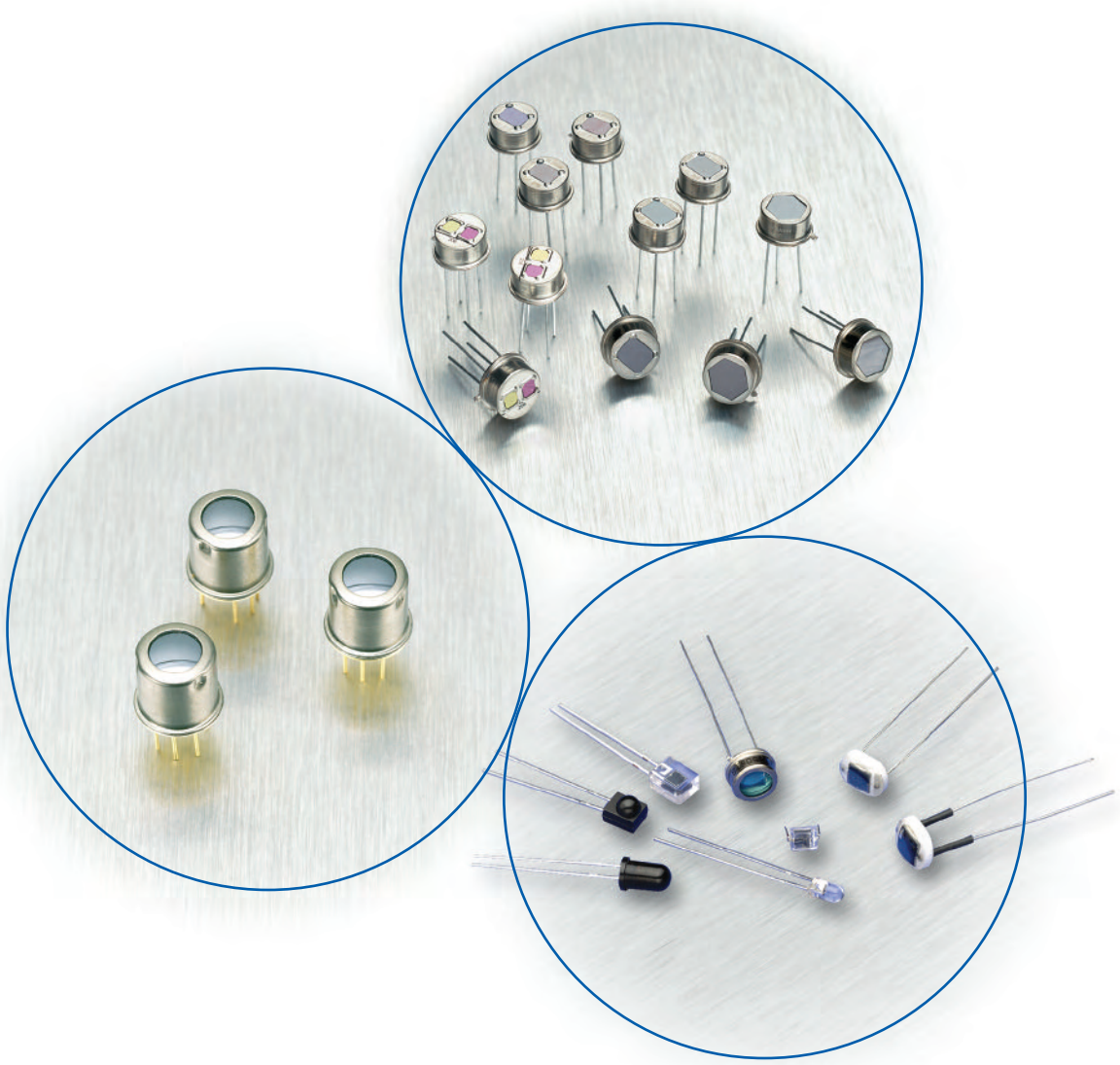
Advanced sensor technologies for today's breakthrough applications.



PerkinElmer®
precisely.

PerkinElmer Optoelectronics provides Sensor, Lighting and Medical Imaging technologies to speed the development of breakthrough applications for customers in industrial, safety & security, consumer, automotive, medical, analytical and defense markets. With development and manufacturing centers around the world, the company is able to leverage and align global resources to serve customers through innovation and operational excellence. With in-house sensor design and vertically integrated manufacturing including low-cost packaging centers, PerkinElmer sells more than 150 million optical sensors each year.

Consistent with PerkinElmer Optoelectronics' policy of continually updating and improving its products, the type designation and data are subject to change, unless otherwise arranged. No obligations are assumed for notice of change of future manufacture of these devices or materials.

table of contents

thermopile detectors

Features

- Available in TO-39 and TO-46 housings
- Available in isothermal housing options
- Integrated signal processing ASIC available (TPMI®)
- Single, dual or quad elements
- 8-element line arrays and 4x4 matrix arrays with various lens optics and integrated ASIC with multiplexer
- Various filters for optical broadband or narrow-band applications
- Excellent repeatability of electro-optical parameters
- Ambient temperature reference (thermistor or high stability Si-spreading resistor) included
- High chip sensitivity of several 10 V/W; DC radiation sensitive
- Extremely low temperature coefficient of sensitivity and resistivity
- Constant response over the infrared spectrum due to patented absorber technology
- The absence of microphonic noise effects
- Low susceptibility to electromagnetic pulses (EMP) due to the low internal resistance (<100 kΩ)
- Rugged construction based on CMOS silicon micromachining technology

Typical Applications

- Remote temperature sensing, hand-held or industrial pyrometers
- Ear or body thermometers
- Temperature control in copiers and printers
- Sensor modules for control of air condition systems (heat management, home, automotive)
- Temperature-sensor modules in home appliances
- Sensor arrays for spatial temperature measurements (imaging applications)
- Presence detection
- Sensors with infrared bandpass filters for gas detection by infrared absorption
- Fire detection
- Industrial drying

Datasheets available upon request.

Description

Thermopile detectors directly sense thermal radiation, providing the perfect device for remotely measuring temperatures without the need for any mechanical chopper. PerkinElmer's proprietary and innovative Si-based micromachining technology guarantees a new generation of components: extreme long-term stability, very low temperature coefficient in sensitivity, and excellent repeatability of electro-optical parameters.
Thermopile sensors allow remote temperature sensing at a low system cost. The sensor does not require cooling, and can reach an accuracy of ±1°C, dependent on the measurement range.
For narrow temperature ranges, as in body temperature measurement, a precision of 0.1°C is possible.

Thermopile Modules with Integrated Signal Processing: TPMI® Series

For convenient use, PerkinElmer offers thermopile sensors with an integrated electronic circuit for the necessary signal condition and ambient temperature compensation – the TPMI®. This very compact and miniature thermopile module is offered as a fully calibrated, ready-to-go sensor. Various temperature ranges and optics are available.

Isothermal Housing

Fast temperature changes and temperature gradients are known to influence the output signal of thermal radiation sensors such as thermopiles and generate a measurement error. Therefore, PerkinElmer has developed a novel housing concept with large thermal mass and thermal conductivity. This sensor provides a stable signal even in demanding industrial, automotive, or medical applications such as ear thermometers, where high accuracy is required while the sensor is exposed to external heat sources.

Single-Element Thermopile Detectors: TPS Series

The different available chip sizes and packaging types, together with the variety in window openings with and without a silicon lens, different filters, enable the adaptation of the PerkinElmer thermopiles to virtually every application where a remote temperature measurement or control is needed.

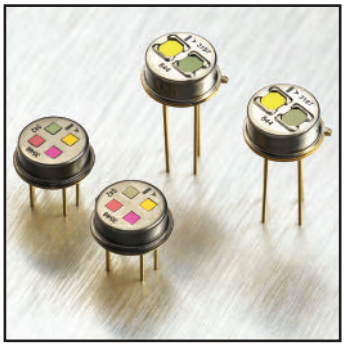
Dual- and Quad-Element Types: TPS 2, TPS 4 Series

PerkinElmer offers thermopile detectors with two or four channels, each of which can be equipped with one of the many available infrared spectral bandpass filters. The main application of multiple channel thermopiles is gas detection through IR absorption. Prominent gases to be detected are CO2, hydrocarbons and CO.

Thermopile Line and Matrix Arrays: TPL, TPA Series

The new TPA- (matrix array) and TPL- (line array) series offer multi-element thermopile arrays combined with an optical lens, amplifier, and interface electronics (multiplexer, ambient temperature sensor) in a compact TO-39-type housing. Array sensors are sold as a modular type, i.e. on a PCB with external data memory. These TPA- and TPL-Modules are precalibrated with the data stored in an EEPROM.

All thermopile detectors are RoHS compliant.



Dual and Quad Element Thermopile Detectors General Data

Tc of sensitivity (absolute value): 0.02%/K
Tc of resistance (absolute value): 0.02%/K
Max. operating temperature: -20 to 100°C
Max. storage temperature: -40 to 100°C
Thermistor BETA: 3964 K
Option for all types: 8-14 µm
Pyrometry filter: G9

Thermopile Sensors in TO-46 (left) (TPS 332, TPS 232) and Isothermal (right) (TPS 23B) Housing

Thermopile TPMI® Modules with Si-Lens Optics

Single Element Thermopile Detectors

Technical Specification

Part Number	Housing	Field of View	DC Sensitivity V/W	Output Voltage at Tamb = 25°C Tobj = 40°C (mV)	Time Constant ms	Active Area mm²	TP Chip Resistance kΩ	Thermistor kΩ
TPS 332	TO-46	100°	35	1.6	25	0.7 x 0.7	75	100
TPS 334	TO-39	60°	35	0.74	25	0.7 x 0.7	75	30
TPS 334 G9	TO-39****	60°	20	0.4	35	0.7 x 0.7	75	30
TPS 334 L5.5	TO-39**	7°	55	0.3	25	0.7 x 0.7	75	30
TPS 336-IRA	TO-39***	15°	35	1.0	25	0.7 x 0.7	75	30
TPS 232	TO-46	110°	36	0.73	16	round, ∅ 0.5	87	100
TPS 23B	Isothermal TO-46	90°	36	0.65	16	round, ∅ 0.5	87	Spreading resistor 1
TPS 535	TO-39	80°	20	1.5	35	1.2 x 1.2	50	30

Test conditions: T = 25°C
Field of view: at 50% intensity points
Noise: r.m.s., 300 K
* 500 K black body
** with 5.5 mm lens
*** with int. reflector
**** with 8...12 µm IR window

Dual and Quad Thermopile Detectors for Optical Gas Detection

Technical Specification

Part Number	Housing	Field of View	DC Sensitivity V/W	Time Constant ms	Active Area mm²	TP Chip Resistance kΩ	Noise nV/√Hz	NEP nW/√Hz	D* cm√Hz/W	Thermistor (25°C) kΩ
TPS 2534	TO-39**	2x90°	42	35	1.2x.1.2	50	29	0.7	$1.8x10^8$	30
TPS 4339	TO-39***	4x60°	75	25	0.7x0.7	75	35	0.5	$1.5x10^8$	100

Test conditions: T = 25°C
Field of view: at 50% intensity points
Noise: r.m.s., 300 K
* 500 K black body
** with 2 channels
*** with 4 channels
Above data are referenced without the bandpass filter. Option for all types: individual bandpass filters for each channel

Line and Matrix Arrays

Technical Specification

Part Number	Housing	Number of Pixels	Field of View	Optics	Output Voltage V (80°C object, 20°C ambient)	Object Temperature	Noise mV/√Hz (.5–20Hz)
TPLM 086 L5.5	TO-39 on PCB	8 element line	41°x6°	f/1 optics, f=5.5 mm	0.95	-20–100°C or -20–200°C	0.4
TPAM 166 L3.9	TO-39 on PCB	4x4 matrix	41°x32°	f/1 optics, f=3.9 mm	0.95	-20–100°C	0.4

Test conditions: T = 25°C
Operating voltage: 5 V
Operating current: 1 mA
Zero signal offset: $V_{DD}/2$
Output resistance: 200 Ω
Power up time: 0.3 s
Sample frequency: 3 kHz
Max. operating temperature: -20–100°CMax.
storage temperature: -40–100°C
Temperature reference slope: 10 mV/K
Temperature reference offset: 0 mV

TPMI® Modules

Technical Specification

Part Number	Housing	Optics	Field of View
a2TPMI 334	TO-39	window opening 2.5 mm	60°
a2TPMI 334 L5.5	TO-39	integrated Si lens, 5.5 mm focal length	7° (D:S = 8:1)
a2TPMI 334 IRA	TO-39	internal mirror	15° (D:S = 4:1)

Technical Specification

Mfr Type	Package	Object Temperature Range	Analog Output	Supply Voltage	Optics	Field of View
A2TPMI334-L5.5 OAA180 / 6264	TO-39, 8.3 mm height (without pins)	-20–180°C	0–5 V	5 V	Si-lens	7°
A2TPMI334-L5.5 OAA060 / 6266	TO-39, 8.3 mm height (without pins)	-20–60°C	0–5 V	5 V	Si-lens	7°
A2TPMI334 OAA060 / 6259	TO-39, 4.2 mm height (without pins)	-20–60°C	0–5 V	5 V	infrared window	60°

For further details please contact us.

pyroelectric infrared detectors

Features

- Low noise, high responsivity
- Excellent common mode balance for Dual Element types
- Available in TO-39, TO-5 housings
- Various filter windows for broad band or narrow band applications
- Single and Dual channel devices
- Dual and Quad-type elements for intrusion applications
- Thermally compensated versions for single element types

Typical Applications

- Intrusion alarm
- Motion detection
- Ceiling mount presence detection
- Gas analysis
- Gas alarm
- Non-contact infrared measurements

Datasheets available upon request.

Pyroelectric Basics

Pyroelectric materials produce a charge shift when they undergo a change in thermal energy. This effect is applied for detectors that show an output signal similar to alternative current with a change of incident infrared radiation. Such pyroelectric detectors are used in all kinds of motion detection. Detectors based on the same principle are applied for gas monitoring based on the spectral absorption method.

Dual Element Types

Dual Element Detectors combine two elements which are connected in reverse polarity to each other to one FET source follower output. Typical applications: intrusion alarm PIR, motion detection for light switches.

Four Element Two Channel Types

Four Element Detectors combine four elements to two FET outputs. The two individual channels allow signal processing to avoid false alarms and provide redundancy. Typical applications: high end intrusion alarms.

Ceiling Mount Detectors

Ceiling Mount Detectors have a special element configuration suitable for ceiling lens designs. They combine two or four elements to one FET output. Different window sizes for cost optimization and optional RF protection is available. Applications: presence detection and alarms.

Single Element Detectors

This range of detectors offer one element with source follower output. Different element sizes are available. Most of the preferred types have built-in thermal compensation. Special IR windows of narrow bandwidth are offered. Applications: non-contact temperature measurements and gas monitors.

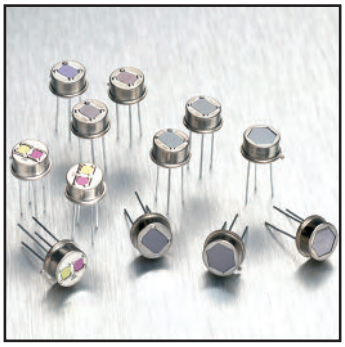
Dual Channel Detectors

These special designs offer two Single Element Detectors in one TO-5 case. Each one is equipped with its individual filter and provides its own output. This is also available in temperature compensated version. Various narrow-band filter windows can be chosen. Application: gas monitor, gas alarms.

DigiPyro™ Family

To enable total digital electronics, PerkinElmer introduces a new family of pyrodetectors with digital output.

All pyroelectric infrared detectors are RoHS compliant.



General Data

Max. operating temperature:
-40 to +85°C
Max. storage temperature:
-40 to +85°C
Operating voltage: 2 to 12 V/47 kΩ
Load resistor
Offset voltage: 0.2 to 1.5 V/47 kΩ
Load resistor

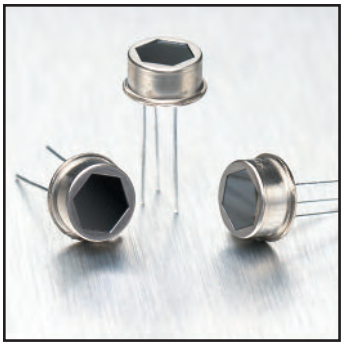


Table Key

Responsivity	100°C Black Body, 1Hz electr.Bandwidth
Noise	1 to 10 Hz Bandwidth
NEP	100°C Black Body, 1Hz electr.Bandwidth, 1Hz
*D**	100°C Black Body, 1Hz electr.Bandwidth, 1Hz

All data refer to 25°C

Dual Element Detectors

Technical Specification

Part Number	Housing	Responsivity V/W typ (1 Hz)	Noise µVpp typ	NEP W√Hz typ	D* cm√Hz/W typ	Field of View Horizontal	Field of View Vertical	Element Size mm²
LHi 944	TO-39	4000	20	7.5×10^{-10}	1.9×10^{7}	110°	110°	2x1/2x1
LHi 958	TO-5	3700	20	8.1×10^{-10}	1.75×10^{7}	110°	110°	2x1/2x1
LHi 968	TO-5	3800	20	8.0×10^{-10}	1.9×10^{7}	100°	100°	2x1/2x1
LHi 874	TO-39	4000	20	7.5×10^{-10}	1.9×10^{7}	90°	95°	2x1/2x1
LHi 878	TO-5	4000	20	7.5×10^{-10}	1.9×10^{7}	90°	95°	2x1/2x1

Four Element Two Channel Detectors

Technical Specification

Part Number	Housing	Responsivity V/W typ (1 Hz)	Noise µVpp typ	NEP W√Hz typ	D* cm√Hz/W typ	Field of View Horizontal	Field of View Vertical	Element Size mm²
LHi 1148	TO-5	4500	30	8.6×10^{-10}	14×10^{7}	108°	67°	0.8x1.2 ea.
LHi 1548	TO-5	6500	30	8.6×10^{-10}	14×10^{7}	108°	67°	0.9532 ea.

Ceiling Mount Application Detectors

Technical Specification

Part Number	Housing	Responsivity V/W typ (1 Hz)	Noise µVpp typ	NEP W√Hz typ	D* cm√Hz/W typ	Field of View X	Field of View Y	Element Size mm²
LHi 906	TO-5	3000	20	7.5×10^{-10}	719×10^{7}	150°	150°	2.66 ea. (round)
LHi 1128	TO-5	8000	40	7.5×10^{-10}	28×10^{7}	156°	144°	1x1 (4 elements)
PYQ 1398	TO-5	8000	40	7.5×10^{-10}	28×10^{7}	103°	103°	1x1 (4 elements)

Single Element Detectors

Technical Specification

Part Number	Housing	Responsivity V/W typ (10 Hz)	Noise $nV_{RMS(10Hz)}$	NEP W√Hz typ	D* cm√Hz/W typ	Field of View X	Field of View Y	Element Size mm²
LHi 807	TO-5	640	600	9.4×10^{-10}	16×10^{7}	135°	120°	1.5x1.5
LHi 807 TC	TO-5	320	300	9.4×10^{-10}	16×10^{7}	135°	120°	1.5x1.5
PYS 4198 TC	TO-5	150	150	10×10^{-10}	18×10^{7}	130°	110°	2x2

These types offer special narrow band windows.

Dual Channel Detectors

Technical Specification

Part Number	Housing	Responsivity V/W typ (10 Hz)	Noise $nV_{RMS(10\ Hz)}$	NEP W√Hz typ	D• cm√Hz/W typ	Field of View X (ea.)	Field of View Y (ea.)	Element Size mm²
LHi 814 G1/G20	TO-5	640	600	9.4×10^{-10}	16×10^{7}	77°	95°	1.5x1.5 (ea.)
LHi 814 G2/G20	TO-5	640	600	9.4×10^{-10}	16×10^{7}	77°	95°	1.5x1.5 (ea.)
PYS 3228 TC	TO-5	320	300	9.4×10^{-10}	16×10^{7}	77°	95°	1.5x1.5 (ea.)

These types offer special narrow band windows in pair, one channel as reference.

gas sensors

Benefits

- No service requirement.
- Digital output, self-monitoring and diagnostic features – enhanced ease of use.
- Long-term stability: The system has a long service life without gradual degradation.
- Contamination proof: no chemical sensitivity to other gases or aerosols, no poisoning effects, temporary or permanent.
- System self-diagnosis: A system failure automatically produces a notification - no degradation goes unnoticed.
- Selectivity: The sensor reacts precisely to the type of gas determined by the absorption region, with negligible response to other gases within the mixture.

Serinus™ CO_2 Sensor (PYM 122-1): Air Quality
Serinus™ CO_2 Sensor (PYM 122-2): Air Safety
Natural Gas Alarm Sensor (PYM 151)

PerkinElmer introduces a number of gas sensors based on a common platform, all based on the principle of non-dispersive infrared radiation absorption (NDIR). A robust thermal IR source and a highly reliable dual channel pyroelectric detector are the core of the sensor cell, which is detemined in size by an absorption chamber. In the event of the specified gas diffusing into the chamber, the signal is reduced accordingly and the included electronics generate a signal output.
Pyroelectric detectors are especially suited for optical IR-based gas detection due to their robustness and low sensitivity to environmental temperature influences. A selective IR window in the detector allows the precise spectral selection of a gas. Appropriate electronics are required for obtaining a user-friendly signal. A microprocessor converts the amplified sensor signal into a gas concentration value. The PerkinElmer gas sensor range is featured with pre-programmed calibration and enables safe long term operation.

The gas sensors include the following versions:

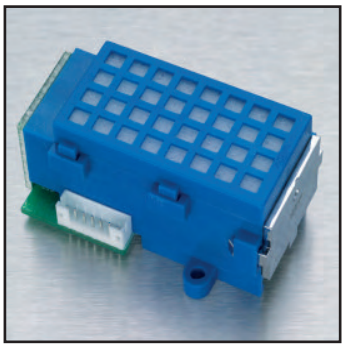
Serinus™ CO_2 Sensor (PYM 122-1): Air Quality
Calibrated to meet the air quality application range of 0 to 5000 ppm CO_2 content. It provides a 16-bit digitally coded output signal and two additional fixed trigger levels as switched outputs (800 ppm / 1500 ppm).

Serinus™ CO_2 Sensor (PYM 122-2): Air Safety
Calibrated to meet the air quality application range of 0 to 10% CO_2 content. It provides a 16-bit digitally coded output signal and two additional fixed trigger levels as switched outputs (2% / 5%).

Natural Gas Alarm Sensor (PYM 151-1 / PYM 152-1)
Designed for natural gas alarm applications. It fully meets requirements of EN 50194 standard for gas alarm, calibrated to offer a Pre-Alert at 6% LEL and Main Alert at 12% LEL. It provides a 16-bit digitally coded output signal and self-diagnosis.

Serinus™ CO_2 Sensor (PYM 122-1): Air Quality
Serinus™ CO_2 Sensor (PYM 122-2): Air Safety

The perfect range of sensors to cover all applications of sensing CO_2 in air, whether for comfort, energy management, air processing, air safety and cooling refrigerant supervision.



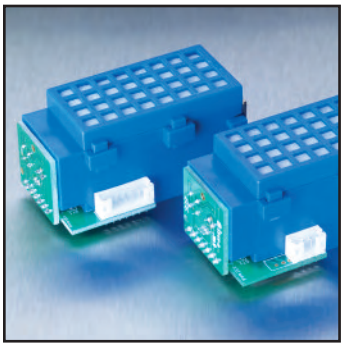
Serinus™ CO_2 Sensor (PYM 122)

Technical Specification

	PYM 122-1 Air Quality	Units	PYM 122-2 Air Safety	Units	Remark
Range	0...5000	ppm	0...10	%	CO_2
Resolution	1	ppm	0.1	%	
Accuracy	50	ppm	0.2	%	+/- 5% of measured value
Reproducibility	10	ppm	0.2	%	+/- 1% of measured value
Pre-Alert Trigger Level S1	800	ppm	2	%	typical
Main Alert Trigger Level S2	1500	ppm	5	%	typical
Outputs S1, S2	30 V/100 mA		30 V/100 mA		open collector max.
Warm-Up Time	120	s	120	s	at 20°C, after 1 hour with power off. max.
Response Time	30	s	30	s	63% change of output upon step concentration change. max.
Long-Term Stability	+/- 50	ppm/yr	+/- 0.2	%/yr	max.
Operating Voltage	5.0+/- 0.5	Volt	5.0+/- 0.5	Volt	DC
Current Consumption	240 150	mA mA	240 150	mA mA	max. Average
Operating Temperature Ranges	-10 to +50	°C	-10 to +50	°C	
Storage Temperature Range	-20 to +60	°C	-20 to +60	°C	
Environmental Humidity	95%	R.H.	95%	R.H.	non condensing max.
Expected Life-Span	10	years	10	years	@ 25°C, 50% r.H. typical

Natural Gas Alarm Sensor (PYM 151-1 / PYM 152-1)

For natural gas alarm applications, providing EN standard required values such as Pre-Alert at 6% LEL and Main Alert at 12% LEL. It is the perfect solution for commercial and industrial gas alarm applications for all available mixtures of natural gas.



Natural Gas Alarm Sensor (PYM 151-1 / PYM 152-1)

Technical Specification

	PYM 151	Units	PYM 152	Units	Remark
Range	0...20	% LEL	0...20	% LEL	Natural Gas
Resolution	1	% LEL	1	% LEL	
Reproducibility	2	% LEL	2	% LEL	+/- 1% of measured value
Pre-Alert Trigger Level S1	6	% LEL	6	% LEL	typical
Main Alert Trigger Level S2	12	% LEL	12	% LEL	typical
Outputs S1, S2	30 V/100 mA		30 V/100 mA		open collector max.
Warm-Up Time	120	s	120	s	at 20°C, after 1 hour with power off. max.
Response Time	30	s	30	s	63% change of output upon step concentration change. max.
Long-Term Stability	+/- 0.5	% LEL/a.	+/- 0.5	% LEL/a.	max.
Operating Voltage	5.0+/- 0.5	Volt	5.0+/- 0.5	Volt	DC
Current Consumption	240 150	mA mA	240 150	mA mA	max. Average
Operating Temperature Ranges	-10 to +50	°C	-10 to +50	°C	
Storage Temperature Range	-20 to +60	°C	-20 to +60	°C	
Environmental Humidity	95%	R.H.	95%	R.H.	non condensing max.
Expected Life-Span	10	years	10	years	@ 25°C, 50% r.H. typical

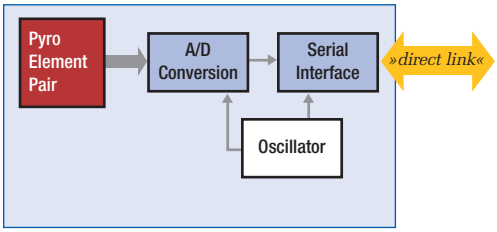
DigiPyro™ digital output pyrodetectors

Key Features and Benefits

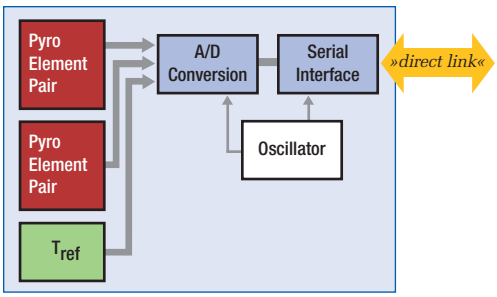
- Digital output sensor
  "direct link" interface
- Infrared window
  5.5...14 µm transmission
- High level electrical performance
  Low EMI sensitivity
  Unique responsivity
  Strong power rejection ratio

Applications

- Intrusion alarm applications
- Motion activated switches



DigiPyro™ PYD 1998



DigiPyro™ PYQ 2898

Dual Element Detector PYD 1998
Triple Channel Quad Element Detector PYQ 2898

PerkinElmer presents the first detector series to dramatically differ from previous generations: the DigiPyro™ technology offers digital signal outputs via a special one wire direct link feature. The electronics include analog-to-digital conversion, on-chip low-power oscillator and the serial interface. As sensing elements, either dual element or quad element configurations are offered.

PYD 1998 Dual Element

Standard dual element configuration in TO-5 housing, offering one output in 15 bit digitized format – *"direct link"* = one wire interface feature.

General Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Units	Remarks
Operating Voltage	V_{DD}	3.0	5	5.5	V	
Supply Current	I_{DD}		30	40	µA	V_{DD} = 5 V
Responsivity		3.3	4		kV/W	
Noise			20	50	μV_{pp}	
Serial Interface Refresh Frequency	t_{REP}		3.70		ms	
ADC Counts of Bits			15		bits	1st bit is "0"
ADC Resolution			14		bits	Max. count = 2^{14}
ADC Sensitivity		6.0	6.5	7.0	µV/count	
ADC Offset		6200	8250	11000	counts	
Internal Clock Frequency	F_{CLK}	60	70	90	kHz	

PYQ 2898 Triple Channel Quad Element

High end version with 2 pairs of elements representing 2 channels and an additional temperature reference channel, quad element configuration in TO-5 housing offering 42 bit *"direct link"* interface.

General Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Units	Remarks
Operating Voltage	V_{DD}	3.0	5.0	5.5	V	
Supply Current	I_{DD}			60	µA (DC)	V_{DD} = 4 V
Responsivity		3.3	4		kV/W	
Noise			20	50	μV_{pp}	
Serial Interface Refresh Frequency	f_{REP}		137		Hz	
ADC Counts of Bits			42		bits	
ADC Resolution			14		bits	Max. count = 2^{14}
ADC Sensitivity		6.1	6.5	7.0	µV/count	
ADC Offset		7000	8192	9200	counts	
Internal Clock Frequency	f_{CLK}	60	70	90	kHz	
Temperature Reference Gain Linearity		 -5	96	 5	counts/K % °C	-10°C to +80°C -40°C to +120°C
Operating Temperature	T_0	-40		85	°C	The electrical parameters may vary from specified values in accordance with their temperature dependence.
Storage Temperature	T_s	-40		85	°C	Avoid storage in humid environments.

Above mentioned are the main characteristical data of this new series. Unless specified differently, all data refer to 25°C environmental temperature. Detailed datasheets and further application notes and application kits are available.

photodiodes

Features

- Low-cost visible and near-IR photodetector
- Excellent linearity in output photocurrent over 7 to 9 decades of light intensity
- Fast response times
- Available in a wide range of packages including epoxy-coated, transfer-molded, cast, and hermetic packages, as well as in chip form or surface mounting technology
- Low noise
- Mechanically rugged, yet compact and lightweight
- Available as duals, quads or as linear arrays
- Usable with almost any visible or near-infrared light source such as solid state laser diodes, LEDs, neon, fluorescent, incandescent bulbs, lasers, flame sources, sunlight, etc.
- Can be designed and tested to meet the requirements of your application

Typical Applications

- Fiber-optic communications
- Instrumentation
- High-speed switching
- Spot position tracking and measurement
- Photometry
- Data transmission
- UV light meters
- Fluorescent light detection
- Laser range finding
- Barcode scanning
- Laser safety scanning
- Distance measurement

Datasheets available upon request.

Description

PerkinElmer Optoelectronics offers a broad array of Silicon and InGaAs PIN and APDs.

InGaAs Avalanche Photodiodes

The high-quality InGaAs avalanche photodiodes (APDs) are packaged in hermetically sealed TO cans and ceramic blocks designed for the 900 to 1700 nm wavelength region.

InGaAs PIN Photodiodes

High-quality Indium Gallium Arsenide photodiodes designed for the 900 to 1700 nm wavelength region, these photodiodes are available in standard sizes ranging from 50 microns to 5 mm in diameter. Packages include ceramic submount, TO packages, and chip form.

Silicon Avalanche Photodiodes

These are reliable, high-quality detectors in hermetically sealed TO packages designed for high-speed and high-gain applications. A “reach-through” structure is utilized which provides very low noise performance at high gains and a full range of active areas.

Silicon PIN Photodiodes

Offered for low- to high-speed applications, these PINs are designed for the 250 nm to 1100 nm range. Standard sizes range from 100 microns to 10 mm in diameter.

Silicon PN Photodiodes

This format includes a variety of high-volume, low-cost silicon photodiodes that meet the demanding requirements of today’s commercial and consumer markets.

Selective Photodiodes

These GaP and GaAlAs-based photodiodes provide high sensitivity and a narrow spectral response without additional filtering.
As SMD components they are ready for automated treatment.

Alternate Source/Second Source Photodiodes

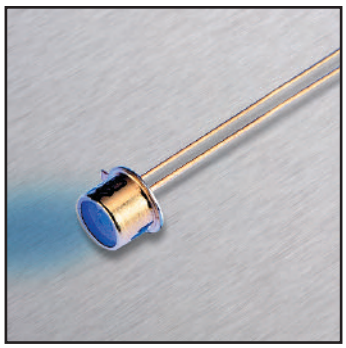
PerkinElmer’s nearest equivalent devices are selected on the basis of general similarity of electro-optical characteristics and mechanical configuration. Interchangeability in any particular application is not guaranteed, suitability should be determined by the customer's own evaluation.

Detector Modules

Preamplifier modules are hybrid devices with a photodiode and a matching amplifier in a compact hermetic TO package. An integral amplifier allows for better ease of use and noise bandwidth performance. 14-pin, DIL, and/or fibered packaged modules are available on a custom basis.

All photodiodes are RoHS compliant.

photodiodes



Indium Gallium Arsenide PIN Photodiodes, Large-Area, and Small-Area Indium Gallium Arsenide APDs

- High responsivity
- Low capacitance for high bandwidths
- Available in various hermetic packages

InGaAs APDs—900 nm to 1700 nm

Technical Specification

Part Number	Standard Package	Photo Sens. Diam. µm	Resp. A/W @1300 nm	Resp. A/W @1550 nm	Dark Curr. Id (nA)	Spect. Noise Curr. Dens. In (pA/√Hz)	Cap. @100 kHz Cd (pF)	Bandwidth GHz into 50 W	NEP @ 1550 nm pW/√Hz	VOP for Gain=10 V
C30645EH	TO window	80	8.4	9.4	10	0.25	1.2	1	0.13	40–70
C30645ECERH	Ceramic	80	8.4	9.4	10	0.25	1	1	0.13	40–70
C30662EH	TO window	200	8.4	9.4	50	1	2.5	0.2	0.15	40–70
C30662ECERH	Ceramic	200	8.4	9.4	50	1	2.5	0.2	0.15	40–70

Test conditions: T = 22°C

InGaAs PIN Large-Area—900 nm to 1700 nm

Technical Specification

Part Number	Standard Package	Photo Sens. Diam. mm	Resp. A/W @850 nm	Resp. A/W @1300 nm	Resp. A/W @1550 nm	Dark Curr. Id (nA)	NEP @ 1300 nm pW/√Hz	Cap. @100 kHz Cd (pF)	Bandwidth MHz into 50 W	Max. Power for .15 dB Linearity (dBm)	Bias Volt for These Specs V
C30619GH	TO-18	0.5	0.2	0.86	0.95	5	<0.1	8	350	>+13	5
C30641GH	TO-18	1	0.2	0.86	0.95	5	<0.1	40	75	>+13	2
C30642GH	TO-5	2	0.2	0.86	0.95	10	0.1	350	20	+11	0
C30665GH	TO-5	3	0.2	0.86	0.95	25	0.2	1000	3	+11	0
C30723GH	TO-8	5	0.2	0.86	0.95	30	0.3	2500	2.5	+11	0

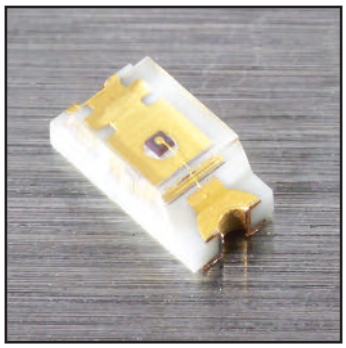
Test conditions: T = 22°C

InGaAs PIN Small-Area—900 nm to 1700 nm

Technical Specification

Part Number	Standard Package	Photo Sens. Diam. µm	Resp. A/W @1300 nm	Resp. A/W @1550 nm	Dark Curr. Id (nA)	Spect. Noise Curr. Dens. In (pA/√Hz)	Cap. @100 kHz Cd (pF)	Bandwidth GHz into 50 Ω	NEP @ 1550 nm pW/√Hz	Bias Volt for These Specs V
	Ceramic	50	0.86	0.95	0.5	<0.02	0.35	>3.5	<0.02	5
C30637ECERH	Ceramic	75	0.86	0.95	0.8	<0.02	0.4	3.5	<0.02	5
C30617ECERH	Ceramic	100	0.86	0.95	1	<0.02	0.55	3.5	<0.02	5
C30617BH	Ball lens	100	0.8	0.9	1	<0.02	0.8	3.5	<0.02	5
C30618ECERH	Ceramic	350	0.86	0.95	2	0.02	4	0.8	0.02	5
C30618GH	TO window	350	0.86	0.95	2	0.02	4	0.8	0.02	5

Test conditions: T = 22°C



Selective Photodiode SR10SPD 470-0.9

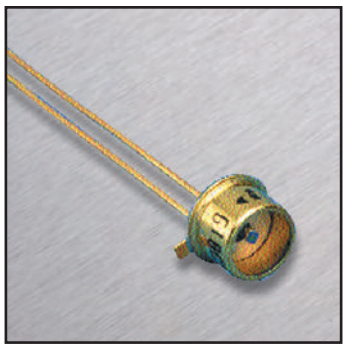
- Surface mounting device
- High sensitivity
- Narrow spectral response without additional filtering

Selective Photodiodes Based on III–V Materials

Technical Specification

Part Number	Package*	Reverse Voltage (V)	Dark Current (nA)	Active Area (mm^2)	Sensitivity (A/W)	Rise/Fall Time tr/tf (us)	Spectral Range @0.5 max. (nm)
SR10SPD 470-0.9	SMD (A3)	10	0.03	0.7	0.18	N/A	425–585
SR10SPD 525-0.9	SMD (A3)	5	0.005	0.73	0.25	N/A	480–560
SR10SPD 660-0.9	SMD (A3)	10	0.04	0.62	0.42	0.027	620–700
SR10SPD 880-0.9	SMD (A3)	5	0.001	0.73	0.25	N/A	820–935

* All packages are listed on our website.



Silicon Avalanche Photodiodes

- Hermetically sealed packages

Si APD—Standard Types–400 nm to 1100 nm

Technical Specification

Part Number	Standard Package	Photo Sens. Diam. mm	Resp. 900 nm A/W	Dark Curr. Id (nA)	Spect. Noise Curr. Dens. In (pA/√Hz)	Cap. @100 kHz: Cd (pF)	Resp. Time tr (ns)	NEP @ 900 nm fW/√Hz	VOP Range V
C30817EH	TO-5	0.8	75	50	0.5	2	2	7	275–425
C30872EH	TO-8	3	45	100	0.5	10	2	11	275–425
C30902EH	TO-18	0.5	77 (@ 830 nm)	15	0.2	1.6	0.5	3 (@ 830 nm)	180–250
C30902SH	TO-18	0.5	128 (@ 830 nm)	15	0.1	1.6	0.5	0.86 (@ 830 nm)	180–250
C30916EH	TO-5	1.5	70	100	0.5	3	2	8	275–425

Test conditions: T = 22°C

Si APD—Arrays Quadrant and Linear–400 nm to 1100 nm

Technical Specification

Part Number	Standard Package	Photo Sens. Diam. mm	Resp. A/W	Dark Curr. Id (nA)	Spect. Noise Curr. Dens. In (pA/√Hz)	Cap. @100 kHz Cd (pF)	Resp. Time tr (ns)	NEP fW/√Hz	VOP Range V
C30927EH-01	TO-8	1.5 total	15 (@1060 nm)	25	0.5	1	3	33 (@1060 nm)	275–425
C30927EH-02	TO-8	1.5 total	62 (@900 nm)	25	0.5	1	3	8 (@900 nm)	275–425
C30927EH-03	TO-8	1.5 total	55 (@830 nm)	25	0.5	1	3	9 (@830 nm)	275–425
C30985EH	Custom	0.3 pitch	31 (@830 nm)	1	0.1	0.5	2	3 (@830 nm)	250–425

Test conditions: T = 22°C

Si APD—Low Cost, High Volume–400 nm to 1000 nm

Technical Specification

Part Number	Standard Package	Photo Sens. Diam. mm	Resp. @900 nm A/W	Dark Curr. Id (nA)	Spect. Noise Curr. Dens. In (pA/√Hz)	Cap. @100 kHz Cd (pF)	Resp. Time tr (ns)	NEP @ 900 nm fW/√Hz	VOP Range V
C30724EH	TO-18	0.5	9 (@ M=15)	25	0.1	1	5	11	120–200
C30724PH	Plastic	0.5	9 (@ M=15)	25	0.1	1	5	11	120–200
C30737EH -500	TO-18	0.5	47 (@ I-800 nm M=100)	20	0.3	2.5	0.3	6.4 (@ 800 nm M=100)	120–200

Test conditions: T = 22°C

Si APD—TE-Cooled

Technical Specification

Part Number	Standard Package	Photo Sens. Diam. mm	Resp. @830 nm A/W	Dark Curr. Id (nA)	Spect. Noise Curr. Dens. In (pA/√Hz)	Cap. @100 kHz Cd (pF)	Resp. Time tr (ns)	NEP @ 830 nm fW/√Hz	ADP VOP Range V
C30902SH-TC	TO-66	0.5	128	2	0.04	1.6	0.5	0.3	160–250
C30902SH-DTC	TO-66	0.5	128	1	0.02	1.6	0.5	0.16	160–250

Test conditions: T = 0°C for -TC and -20°C for -DTC ADP VOP Range: temperature dependent

photodiodes

Silicon Avalanche Photodiodes

- Low cost, high volume

Si APD—NIR-Enhanced–400 nm to 1100 nm

Technical Specification

Part Number	Standard Package	Photo Sens. Diam. mm	Resp. @1060 nm A/W	Dark Curr. Id (nA)	Spect. Noise Curr. Dens. In (pA/√Hz)	Cap. @100 kHz Cd (pF)	Resp. Time tr (ns)	NEP @ 900 nm m=15 fW/√Hz	VOP Range V
C30954EH	TO-5	0.8	36	50	0.5	2	2	14	275–425
C30955EH	TO-5	1.5	34	100	0.5	3	2	15	275–425
C30956EH	TO-8	3	25	100	0.5	10	2	20	275–425

Test conditions: T = 22°C

Si APD—Lightpipe

Technical Specification

Part Number	Standard Package	Photo Sens. Diam. mm	Resp. @830 nm A/W	Dark Curr. Id (nA)	Spect. Noise Curr. Dens. In (pA/√Hz)	Cap. @100 kHz Cd (pF)	Resp. Time tr (ns)	NEP @ 830 nm fW/√Hz	VOP Range V
C30921EH	TO-18	0.5	77	15	0.23	1.6	0.5	3	180–250
C30921SH	TO-18	0.5	128	15	0.11	1.6	0.5	0.86	180–250

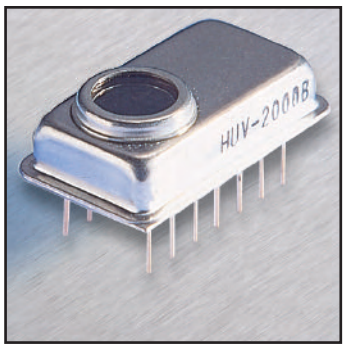
Test conditions: T = 22°C

Si APD—Radiation Detection

Technical Specification

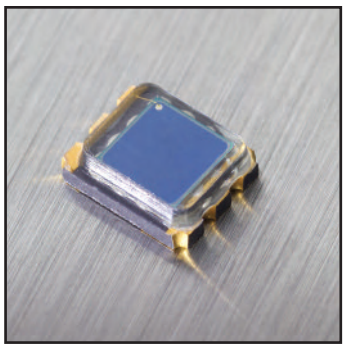
Part Number	Photo Sens. Diam. mm	Resp. A/W	Dark Curr. Id (nA)	Spect. Noise Curr. Dens. In (pA/√Hz)	Cap. @100 kHz Cd (pF)	Resp. Time tr (ns)	NEP @ Peak fW/√Hz	VOP Range V
C30626FH	5x5	22 (@900 nm)	250	0.5	30	5	23 (@900 nm)	275–425
C30703FH	10x10	16 (@530 nm)	10	0.7	120	5	40 (@530 nm)	275–425

Test conditions: T = 22°C



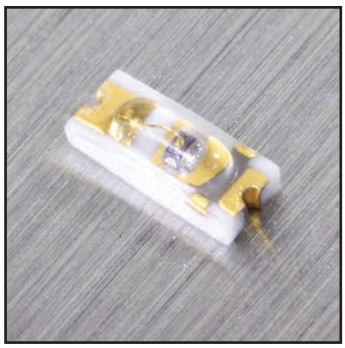
Silicon PIN Photodiodes and Modules

- Broad range of photosensitive areas
- Low operating voltage
- Hermetically sealed packages
- SMD-devices



Si PIN – Surface Mounting Device CFD10

- Large radiant sensitivity area



CR50DE

- Solid state ceramic chip
- High thermal conductivity
- Special type (CR50DE-DLF) with daylight filter on request

Si PINs—Window and Lightpipe Packages, Fast Response–400 nm to 1100 nm

Technical Specification

Part Number	Standard Package	Photo Sens. Diam. mm	Resp. @830 nm A/W	Dark Curr. Id nA	Spect. Noise Curr. Dens. In (fA/√Hz)	Cap. @100 kHz Cd (pF)	Resp. Time tr (ns)	NEP @ 830 nm fW/√Hz	Bias Volt for These Specs V
C30971EH	TO-18	0.5	0.5	10	57	1.6	0.5	113	100

Test conditions: T = 22˚C

Si PINs—Large Area, Fast Response–400 nm to 1100 nm

Technical Specification

Part Number	Standard Package	Photo Sens. Diam. mm	Resp. @900 nm A/W	Dark Curr. Id nA	Spect. Noise Curr. Dens. (fA/√Hz)	Cap. @100 kHz Cd (pF)	Resp. Time tr (ns)	NEP @ 900 nm fW/√Hz	Bias Volt for These Specs V
FFD-100H	TO-5	2.5	0.58	2	25	8.5	3.5	44	15
FFD-200H	TO-8	5.1	0.58	4	36	30	5	62	15

Test conditions: T = 22˚C

Si PINs—Quadrant–220 nm to 1100 nm

Technical Specification

Part Number	Standard Package	Photo Sens. Diam. total mm	Resp. @900 nm A/W	Dark Curr. Id nA	Spect. Noise Curr. Dens. In (fA/√Hz)	Cap. @100 kHz Cd (pF)	Resp. Time tr (ns)	NEP @ 900 nm fW/√Hz	Bias Volt for These Specs V
C30845EH	TO-5	8	0.6	7	47	8	6	79	45
YAG-444-4AH	Custom	11.4	0.4 @1.06 µm	40	118	9	25	295	180

Test conditions: T = 22˚C

Si PINs—Standard N-Type–400 nm to 1100 nm

Technical Specification

Part Number	Standard Package	Photo Sens. Diam. mm	Resp. @900 nm A/W	Dark Curr. Id nA	Spect. Noise Curr. Dens. In (fA/√Hz)	Cap. @100 kHz Cd (pF)	Resp. Time tr (ns)	NEP @ 900 nm fW/√Hz	Bias Volt for These Specs V
C30807EH	TO-18	1	0.6	1	18	2.5	3	30	45
C30808EH	TO-5	2.5	0.6	3	31	6	5	52	45
C30822EH	TO-8	5	0.6	5	40	17	7	67	45
C30809EH	TO-8	8	0.6	7	47	35	10	79	45
C30810EH	Custom	11.4	0.6	30	98	70	12	163	45

Test conditions: T = 22˚C

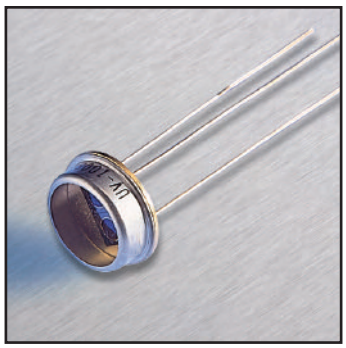
Si PIN-Diodes—Surface Mounting Devices

Technical Specification

Part Number	Package*	Reverse Voltage (V)	Dark Current (nA)	Active Area (mm^2)	Sensitivity (A/W)	Rise/Fall Time tr/tf (us)	Capacitance (pf)
PFD10	SMD (D)	32	5	6.71	0.6	200	25
CR10DE	Ceramic SMD (A1)	50	0.5	0.31	0.5	3	2.5
CR50DE	Ceramic SMD (A2)	50	0.5	0.31	0.5	3	2.5
SR10BP	SMD (A3)	170	10	0.65	N/A	10	10
SR10BP-B	SMD (A3)	170	10	0.65	N/A	10	10

* All packages are listed on our website.

photodiodes



Silicon PINs—UV Enhanced

Si PINs—UV Enhanced, Low Noise–220 nm to 1100 nm

Technical Specification

Part Number	Standard Package	Photo Sens. Diam. mm	Resp. A/W @250 nm	Resp. A/W @900 nm	Shunt Resis. Rd MW	Spect. Noise Curr. Dens.: In (fW/√Hz)	Cap. @100 kHz: Cd (pF)	NEP @ 900 nm fA/√Hz
UV-040BQH	TO-8	1	0.12	0.58	2000	3	25	5
UV-100BQH	TO-8	2.5	0.12	0.58	1000	4	120	7
UV-215BQH	TO-8	5.4	0.12	0.58	250	8	450	25
UV-245BQH	TO-8	4.4x4.7	0.12	0.58	375	7	375	20

Test conditions: T = 22°C

Si PIN Modules—Low Bandwidth–1 kHz to 50 kHz

Technical Specification

Part Number	Standard Package	Photo Sens. Diam. mm	Resp. MV/W @250 nm	Resp. MV/W @900 nm	Spect. Noise Volt. Dens. Vn (µV/√Hz)	NEP @ 900 nm pW/√Hz	Bandwidth kHz into 50 W	Bias Volt for These Specs V
HUV-2000BH	Custom	5.4	24	116	2.5	0.02	2	0
HUV-1100BGH	TO-5	2.5	24	116	20	0.17	20	0

Test conditions: T = 22°C

Si PIN & APD Modules—High Bandwidth–40 MHz to 100 MHz

Technical Specification

Part Number	PIN or APD Used	Standard Package	Photo Sens. Diam. mm	Resp. @900 nm kV/W	Lin.Volt. Out. Swing (V) 50 Ω	Spect. Noise Volt. Dens. Vn (nV/√Hz)	NEP @900 nm pW/√Hz	Bandwidth MHz (3 dB, into 50 Ω)	Photo. Diod. Bias Volt V
C30608EH	C30971 (Si PIN)	P	0.5	32 (@830 nm)	0.7	60	1.8 (@830 nm)	50	12
C30950EH	C30817 (Si APD)	L	0.8	560	0.7	20	0.036	50	275–425
C30919EH (temp. compens.)	C30817 (Si APD)	N	0.8	1000	0.7	25	0.025	40	275–425

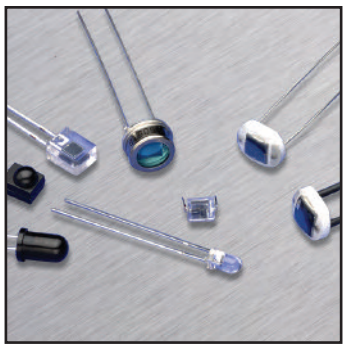
Typical Characteristics @ T = 22°C

Si InGaAs APD Modules—High Bandwidth–50 MHz to 200 MHz

Technical Specification

Part Number	APD Chip	Optimum Resp. λ	Standard Package	Photo Sens. Diam. mm	Resp. @ λ of APD (kv/W)	Lin. Volt. Out Swing (V)	Spect. Noise Volt. Dens. Vn (nV/√Hz)	NEP @ λ fW/√Hz	Bandwidth MHz (-3 dB)	Photo. Diod. Bias Volt V
C30659-900-R5BH	C30902E (Si APD)	900	L	0.5	400	0.7	15	40	200	180–260
C30659-900-R8AH	C30817E (Si APD)	900	L	0.8	3000	0.7	35	12	50	275–435
C30659-1060-R8BH	C30954E (Si APD)	1060	L	0.8	200	0.7	20	100	200	275–425
C30659-1060-3AH	C30956E (Si APD)	1060	L	3	280	0.7	25	90	50	275–425
C30659-1550-R08BH	C30645E (InGaAs APD)	1550	L	0.08	90	0.7	20	220	200	40–70
C30659-1550-R2AH	C30662E (InGaAs APD)	1550	L	0.2	340	0.7	45	130	50	40–70

Typical Characteristics @ T = 22°C, 50 Ω load



Silicon PN Photodiodes

Table Key VTS Series

I_{SC}	Short-Circuit Current H=1000 lux, 2850 K
$TC\ I_{SC}$	I_{SC} Temperature Coefficient H=1000 lux, 2850 K
I_D	Dark Current H=0, V_R=100 mV
$TC\ I_D$	ID Temperature Coefficient H=0, V_R=100 mV
R_{SH}	Shunt Resistance H=0, V_R=10 mV
C_J	Junction Capacitance H=0, V=0 V, 1 MHz
S_R	Sensitivity @ 400 nm
R_E	Responsivity 400 nm, 0.18 A/W
t_R/t_R	Rise/Fall Time @ 1 KΩ load V_R=1 V, 830 nm
V_{OC}	Open-Circuit Voltage H=1000 lux, 2850 K
$TC\ V_{OC}$	V_{OC} Temperature Coefficient H=1000 lux, 2850 K

Table Key VTA Series Arrays

I_L *uniformity*	550 nm, 30 nW/cm^2
S_R	550 nm
C_J	H=0, V_R=0
I_D	H=0, V_R= 10 mV
Active Area	Per Element

Silicon PN—VTS Series (Low Capacitance, Large Area)

Technical Specification

Part Number	I_{SC} mA	TC I_{SC} %/°C	I_D nA	TC I_D %/°C	R_{SH} MΩ	C_J nF	S_R A/W	Re A/(W/cm^2)	t_R/t_F µsec	V_{OC} V	TC V_{OC} mV/°C	Active Area mm^2
VTS__80H	3	0.2	200	+11	0.3	7.5	0.2	0.7	13	0.45	-2.6	392
VTS__81H	1.5	0.2	100	+11	0.6	3.5	0.2	0.34	6.4	0.45	-2.6	187
VTS__82H	0.69	0.2	50	+11	1.2	1.75	0.2	0.16	3.4	0.45	-2.6	93
VTS__83H	0.64	0.2	50	+11	1.2	1.75	0.2	0.15	3.4	0.45	-2.6	85
VTS__84H	0.33	0.2	40	+11	1.5	1	0.2	0.07	1.8	0.45	-2.6	42
VTS__85H	0.16	0.2	20	+11	3	0.5	0.2	0.04	1.2	0.45	-2.6	21
VTS__86H	0.080	0.2	10	+11	6	0.25	0.2	0.02	0.75	0.45	-2.6	10

Electro-optical characteristics @ 25°C

Silicon PN – VTA Series Arrays

Technical Specification

Part Number	Elements	Active Area mm^2	Pitch mm	I_L Uniformity	I_D nA max.	C_J pF	S_R A/W	λ-range nm	λ_p nm
VTA1264H	64	1.4097	2.12	1.5 (max./min.)	0.09	200 max.	0.3 min.	300–1100	925

Electro-optical characteristics @ 25°C

photodiodes

Silicon PN—VTP Series (Fast Response, High Dark Resistance)

Technical Specification

Part Number	I_{SC} µA	TC I_{SC} %/°C	V_{OC} mV	TC V_{OC} mV/°C	I_D nA max.	R_{SH} GΩ	C_J pF	Re A/(W/cm²)	S_R A/W	λ_{range} nm	λ_p nm	V_{BR} V	Package	Active Area mm²
VTP100H	55	0.24	300	-2	30	0.25	50 max.	0.047	0.5	725–1150	925	140	Flat Sidelooker IRT	7.45
VTP100CH	70	0.2	350	-2	30	0.25	50 max.	0.05	0.55	400–1150	925	140	Flat Sidelooker	7.45
VTP1012H	17	0.2	350	-2	7	0.5	6 max.	0.011	0.55	400–1150	925	140	TO-46	1.6
VTP1112H	90	0.2	350	-2	7	0.5	6 max.	0.033	0.55	400–1150	925	140	TO-46 Lensed	1.6
VTP1188SH	200	0.2	330	-2	30	67	180	—	0.55	400–1100	925	—	Lensed Ceramic	11
VTP1220FBH	0.7 min.	0.2	280	-2	10	—	18 max.	—	0.27	400–725	550	140	T1-3/4 flat IRB	1.219
VTP1232H	100 min.	0.2	420 min.	-2	25	—	180 max.	0.076	0.6	400–1100	920	—	T1-3/4	2.326
VTP1232FH	21 min.	0.2	420	-2	25	—	180 max.	—	0.6	400–1100	920	—	T1-3/4 flat	2.326
VTP1332H	75 min.	0.2	420	-2	25	—	180 max.	—	0.55	725–1150	920	—	T1-3/4 IRT	2.326
VTP1332FH	17 min.	0.2	420	-2	25	—	180 max.	—	0.55	725–1150	920	—	T1-3/4 flat IRT	2.326
VTP3310LAH	36	0.2	350	-2	35	10	25 max.	0.015	0.55	400–1150	925	140	T1	0.684
VTP3410LAH	22	0.26	350	-2	35	10	25 max.	0.013	0.55	700–1150	925	140	T1 IRT	0.684
VTP413H	120	0.2	350	-2	30	0.25	50 max.	0.078	0.55	400–1150	925	140	Lensed sidelooker	7.45
VTP4085H	200	0.2	330	-2	100	2	350	—	0.55	400–1100	925	—	Ceramic	21
VTP4085SH	200	0.2	330	-2	50	4	350	—	0.55	400–1100	925	—	Ceramic	21
VTP5050H	70	0.2	350	-2	18	0.25	24 max.	0.05	0.55	400–1150	925	140	TO-5	7.45
VTP6060H	200	0.2	350	-2	35	100	60 max.	0.14	0.55	400–1150	925	140	TO-8	20.6
VTP7110H	9	0.2	350	-2	35	7	25 max.	0.015	0.55	400–1150	925	140	Lateral	0.684
VTP7210H	7	0.26	350	-2	35	7	25 max.	0.015	0.55	700–1150	925	140	Lateral IRT	0.684
VTP7840H	70	0.2	325	-2	20	0.25	40 max.	—	0.55	725–1150	925	1@10 mA	Lensed Sidelooker IRT	5.27
VTP8350H	80	0.2	350	-2	30	100	50 max.	0.06	0.55	400–1150	925	140	Ceramic	7.45
VTP8440H	55	0.2	350	-2	15	0.5	15 max.	0.025	0.55	400–1150	925	140	8 mm Ceramic	5.16
VTP8551H	70	0.2	350	-2	30	0.15	50 max.	0.05	0.55	400–1150	925	140	Mini-DIP	7.45
VTP8651H	55	0.24	300	-2	30	0.15	50 max.	0.045	0.5	725–1150	925	140	Mini-DIP IRT	7.45
VTP8740__TRH	90	0.2	325 min.	-2	20	0.25	50 max.	—	0.6	400–1150	925	33 min.	SMT Clear plastic	5.269
VTP8840__TRH	60	0.5	325 min.	-2	20	0.25	50 max.	—	0.6	725–1150	925	33 min.	SMT IRT	5.269
VTP9412H	17	0.2	350	-2	7	0.4	6 max.	0.011	0.55	400–1150	925	140	6 mm Ceramic	1.6

Electro-optical characteristics @ 25°C

Table Key VTP Series

I_{SC}	Short-Circuit Current H=100 fc, 2850 K
$TC\ I_{SC}$	I_{SC} Temperature Coefficient, 2850 K
V_{OC}	Open-Circuit Voltage H=100 fc, 2850 K
$TC\ V_{OC}$	V_{OC} Temperature Coefficient, 2850 K
I_D	Dark Current H=0, V_R=10, 50, 100 V
R_{SH}	Shunt Resistance H=0, V=10 mV
C_J	Junction Capacitance H=0, V=0, 3, 15 V
R_E	Responsivity 880–940 nm
S_R	Sensitivity @ Peak
λ_{range}	Spectral Application Range
λ_p	Spectral Response @ Peak
V_{BR}	Breakdown Voltage
IRT	Infrared Transmitting
IRB	Infrared Blocking

Silicon PN—VTD Series (Alternate Source/Second Source)

Technical Specification

Part Number	I_{SC} µA	TC I_{SC} %/°C	V_{OC} mV	TC V_{OC} mV/°C	I_D nA max.	C_J pF	t_R/t_F nsec	S_R A/W	λ_{range} nm	λ_p nm	V_{BR} V	Package	Active Area mm²
VTD31AAH	150–225	0.2	350	-2	50	500 max.	—	0.55	400–1150	860	5 min.	Ceramic	16.73
VTD34H	70	0.2	365	-2	30	60	50	0.6	400–1100	900	40 min.	Mini DIP	7.45
VTD34FH	—	—	350	-2	30	60	50	0.6	725–1150	940	40 min.	Mini DIP IRT	7.45
VTD34SMH	70	0.2	365	-2	30	25	50	0.6	400–1100	900	50	SMT	7.45
VTD34FSMH	55	—	350	-2	30	80 max.	50	0.6	725–1150	940	40 min.	SMT IRT	7.45
VTD205H	25	0.2	350	-2.6	30.	72	20	0.6	800–1100	925	50	TO-92 IRT (Round Lens)	7.41
VTD205KH	80	0.2	365	-2.6	30	72	20	0.6	400–1100	925	50	TO-92 (Round Lens)	7.41
VTD206H	25	0.2	350	-2.6	30	72	20	0.6	750–1100	925	50	TO-92 IRT (Flat Lens)	7.41
VTD206KH	80	0.2	365	-2.6	30	72	20	0.6	400–1100	925	50	TO-92 (Flat Lens)	7.41
VTH2090H	800	—	—	—	10	70	15	0.6	400–1100	960	—	Black Ceramic	84.64

Electro-optical characteristics @ 25°C

Table Key VTD Series / VTB Series

I_{SC} Short-Circuit Current 940 nm,
H=0.5 mW/cm² (VTD205, VTD206)
H=5 mW/cm², 2850 K (VTD31AA, VTB Series)
100 Lux, 2850 K (VTD34, VTD205K)
100 Lux, 2856 K (VTD206K)

TC I_{SC} I_{SC} Temperature Coefficient
2850 K (VTD31AA, VTD34, VTD34F, VTB Series)
2856 K (VTD205, VTD205K, VTD206, VTD206K)

V_{OC} Open-Circuit Voltage 940 nm,
H=0.5 mW/cm² (VTD 205, VTD205K, VTD206, VTD206K)
2850 K (VTD31AA, VTD34, VTD34F)

TC V_{OC} V_{OC} Temperature Coefficient
2850 K (VTD31AA, VTD34, VTD34F, VTB Series)
2856 K (VTD205, VTD205K, VTD206, VTD206K)

I_D Dark Current
H=0, V_R=2 V (VTB Series)
H=0, V_R=10 V (VTD34, VTD34F, VTD205, VTD205K, VTD206, VTD206K, VTB100)
H=0, V_R=15 V (VTD31AA)

R_{SH} Shunt Resistance
H=0, V=10 mV (VTB Series)

TC R_{SH} R_{SH} Temperature Coefficient
H=0, V=10 mV (VTB Series)

C_J Junction Capacitance
H=0, V_R=0 V, 1 MHz
(VTD205, VTD205K, VTD206, VTD206K)
@ 1 MHz, V_R=0 V (VTD34, VTD34F)
H=0, V=0 V (VTD31AA, VTB Series)

t_R/t_R Rise/Fall Time
@ RL=50 Ω, V_R=5 V, 850 nm
(VTD205, VTD205K, VTD206, VTD206K)
@ RL=1 kΩ Lead, V_R=10 V, 833 nm
(VTD34, VTD34F)

S_R Sensitivity @ Peak 365 nm (VTB Series)
λ_{range} Spectral Application Range
λ_p Spectral Response @ Peak
V_{BR} Breakdown Voltage

photodiodes

Silicon PN—VTB Series (Blue Enhanced, Ultra High Dark Resistance)

Technical Specification

Part Number	I_{SC} µA	TC I_{SC} %/°C	V_{OC} mV	TC V_{OC} mV/°C	I_D pA max.	R_{SH} G Ω	TC R_{SH} %/°C	C_J nF	S_R A/W	λ_{range} nm	λ_p nm	V_{BR} V	Package	Active Area mm²
VTB100H	65	0.12	490	-2	500	1.4	-8	2 max.	0.1	320–1100	920	40	Flat Sidelooker	7.45
VTB1012H	13	0.12	490	-2	100	0.25	-8	0.31	0.09	320–1100	920	40	TO-46	1.60
VTB1012BH	1.3	0.02	420	-2	100	0.25	-8	0.31	—	330–720	580	40	TO-46 IRB	1.60
VTB1013H	13	0.12	490	-2	20	7	-8	0.31	0.09	320–1100	920	40	TO-46	1.60
VTB1013BH	1.3	0.02	420	-2	20	7	-8	0.31	—	330–720	580	40	TO-46 IRB	1.60
VTB1112H	60	0.12	490	-2	100	0.25	-8	0.31	0.19	320–1100	920	40	TO-46 Lensed	1.60
VTB1112BH	6	0.02	420	-2	100	0.25	-8	0.31	—	330–720	580	40	TO-46 IRB Lensed	1.60
VTB1113H	60	0.12	490	-2	20	7	-8	0.31	0.19	320–1100	920	40	TO-46 Lensed	1.60
VTB1113BH	6	0.02	420	-2	20	7	-8	0.31	—	330–720	580	40	TO-46 IRB Lensed	1.60
VTB4051H	200	0.12	490	-2	250	0.56	-8	3	0.1	320–1100	920	40	Ceramic	14.8
VTB5051H	130	0.12	490	-2	250	0.56	-8	3	0.1	320–1100	920	40	TO-5	14.8
VTB5051BH	13	0.02	420	-2	250	0.56	-8	3	—	330–720	580	40	TO-5 IRB	14.8
VTB5051JH	130	0.12	490	-2	250	0.56	-8	3	0.1	320–1100	920	40	TO-5	14.8
VTB5051UVH	130	0.12	490	-2	250	0.56	-8	3	0.1	200–1100	920	40	TO-5	14.8
VTB5051UVJH	130	0.12	490	-2	250	0.56	-8	3	0.1	200–1100	920	40	TO-5	14.8
VTB6061H	350	0.12	490	-2	2000	0.1	-8	8	0.1	320–1100	920	40	TO-8	37.7
VTB6061BH	35	0.02	420	-2	2000	0.1	-8	8	—	330–720	580	40	TO-8 IRB	37.7
VTB6061CIEH	12	—	—	—	2000	0.1	-8	8	—	475–650	555	—	TO-8	37.7
VTB6061JH	350	0.12	490	-2	2000	0.1	-8	8	0.1	320–1100	920	40	TO-8	37.7
VTB6061UVH	350	0.12	490	-2	2000	0.1	-8	8	0.1	200–1100	920	40	TO-8	37.7
VTB6061UVJH	350	0.12	490	-2	2000	0.1	-8	8	0.1	200–1100	920	40	TO-8	37.7
VTB8341H	60	0.12	490	-2	100	1.4	-8	1	0.1	320–1100	920	40	Ceramic	5.16
VTB8440H	45	0.12	490	-2	2000	0.07	-8	1	0.1	320–1100	920	40	8 mm Ceramic	5.16
VTB8440BH	5	0.02	420	-2	2000	0.07	-8	1	—	330–720	580	40	8 mm Ceramic IRB	5.16
VTB8441H	45	0.12	490	-2	100	1.4	-8	1	0.1	320–1100	920	40	8 mm Ceramic	5.16
VTB8441BH	5	0.02	420	-2	100	1.4	-8	1	—	330–720	580	40	8 mm Ceramic IRB	5.16
VTB9412H	13	0.12	490	-2	100	0.25	-8	0.31	0.09	320–1100	920	40	6 mm Ceramic	1.60
VTB9412BH	1.3	0.02	420	-2	100	0.25	-8	0.31	—	330–720	580	40	6 mm Ceramic IRB	1.60
VTB9413H	13	0.12	490	-2	20	7	-8	0.31	0.09	320–1100	920	40	6 mm Ceramic	1.60
VTB9413BH	1.3	0.02	420	-2	20	7	-8	0.31	—	330–720	580	40	6 mm Ceramic IRB	1.60

phototransistors

Features

- Low-cost visible and near-IR photodetection
- Available with gains from 100 to over 1500
- Moderately fast response times
- Available in a wide range of packages including epoxy-coated, transfer-molded, cast, hermetic packages, chip form and surface mounting technology
- Usable with almost any visible or near-infrared light source such as IREDs, neon, fluorescent, incandescent bulbs, lasers, flame sources, sunlight, etc.
- Same general electrical characteristics as familiar signal transistors

Typical Applications

- Computer/business equipment
  - Write-protect control
  - Margin controls—printers
- Industrial
  - LED light source—light pens
  - Security systems
  - Safety shields
- Consumer
  - Coin counters
  - Lottery card readers
  - Position sensors—joysticks
  - Remote controllers—toys, appliances, audio/visual equipment
  - Games—laser tag
  - Camera shutter control

Principle of Operation

Phototransistors are solid-state light detectors that possess internal gain. They can be used to provide either an analog or digital output signal.

Datasheets available upon request.

Description

Phototransistors are photodiode-amplifier combinations integrated within a single silicon chip. These are combined to overcome the major fault of photodiodes: unity gain. Many applications demand a greater output signal from the photodetector than can be generated by a photodiode alone. While the signal from a photodiode can always be amplified through use of an external op-amp or other circuitry, this approach is often not as practical or as cost-effective as the use of phototransistors. The phototransistor can be viewed as a photodiode whose output photocurrent is fed into the base of a conventional small-signal transistor. While not required for operation of the device as a photodetector, a base connection is often provided, allowing the designer the option of using base current to bias the transistor. The typical gain of a phototransistor can range from 100 to over 1500.

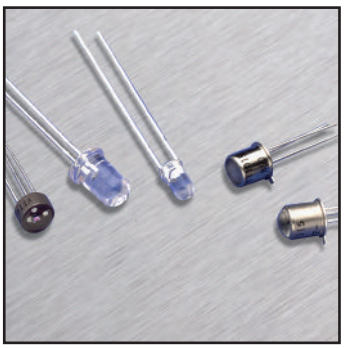
Phototransistors can be used as ambient-light detectors. When used with a controllable light source, typically an IRED, they are often employed as the detector element for optoisolators and transmissive or reflective optical switches.

All phototransistors are RoHS compliant.

Absolute Maximum Ratings

Maximum Temperatures Storage and Operating:	-25°C to 80°C (CR10TE, CR50TE) -40°C to 100°C -40°C to 110°C (VTT1015, VTT1016, VTT1017, VTT1115, VTT1116, and VTT1117) -40°C to 85°C (VTT7222, VTT7223, VTT7225, VTT7122, VTT7123, and VTT7125) -40°C to 70°C (VTT9002, VTT9003, VTT9102, and VTT9103)
Continuous Power Dissipation:	50 mW 100 mW (VTT9002, VTT9003, VTT9102, and VTT9103) 200 mW (CR10TE, CR50TE) 250 mW (VTT1015, VTT1016, VTT1017, VTT1115, VTT1116, and VTT1117)
Derate above 30°C:	0.71 mW/°C 2.5 mW/°C (VTT9002, VTT9003, VTT9102, and VTT9103) 3.12 mW/°C (VTT1015, VTT1016, VTT1017, VTT1115, VTT1116, and VTT1117) 0.91 mW/°C (VTT7122, VTT7123, VTT7125)
Maximum Current:	25 mA 200 mA (VTT1015, VTT1016, VTT1017, VTT1115, VTT1116, and VTT1117)
Lead-Soldering Temperature:	260°C (1.6 mm from case, 5 sec. max.)

phototransistors



NPN Phototransistors

0.25", small area, high speed
0.04", medium area, high sensitivity
0.05", large area, high sensitivity

Table Key

I_C	Light Current
I_{CEO}	Dark Current H=0
$V_{BR(CEO)}$	Collector Breakdown I_C=100 µA, H=0
$V_{BR(ECO)}$	Emitter Breakdown I_E=100 µA, H=0
$V_{CE(SAT)}$	Saturation Voltage I_C=1 mA, H=400 fc
t_R/t_F	Rise/Fall Time I_C=1 mA, R_L=100 Ω

.025" x .025" NPN Phototransistors

Technical Specification

Part Number	Light Current H fc (mW/cm²) V_{CE}=5 V mA min.	Dark Current nA max.	V_{CE} Volts	$V_{BR(CEO)}$ Volts min.	$V_{BR(ECO)}$ Volts min.	$V_{CE(SAT)}$ Volts max.	t_R/t_F µsec, typ.	Angular Response $\theta_{1/2}$
VTT1222WH	1.9 100 (5)	10	20	50	6	0.25	2	±40˚
VTT1223WH	1.5 100 (5)	10	20	40	6	0.25	3	±40˚
VTT1225H	4 100 (5)	100	10	30	5	0.25	1.5	±5˚
VTT1226H	7.5 100 (5)	100	10	30	5	0.25	3	±5˚
VTT1227H	12 100 (5)	100	10	30	5	0.25	4	±5˚
VTT1322WH	0.8 100 (5)	10	20	50	6	0.25	2	±40˚
VTT1323WH	1 100 (5)	10	20	40	6	0.25	3	±40˚
VTT3122EH	1.2 100 (5)	100	20	40	6	0.25	2.5	±8˚
VTT3123EH	4 100 (5)	100	10	30	4	0.25	4	±8˚
VTT3323LAH	2 20 (1)	100	10	30	5	0.25	3	±10˚
VTT3324LAH	4 20 (1)	100	10	30	5	0.25	4	±10˚
VTT3325LAH	6 20 (1)	100	10	30	5	0.25	5	±10˚
VTT3423LAH	1 20 (1)	100	10	30	5	0.25	3	±10˚
VTT3424LAH	2 20 (1)	100	10	30	5	0.25	4	±10˚
VTT3425LAH	3 20 (1)	100	10	30	5	0.25	5	±10˚
VTT7122H	1 100 (5)	100	10	30	5	0.25	2	±36˚
VTT7123H	2 100 (5)	100	10	30	5	0.25	2	±36˚
VTT7125H	4.5 100 (5)	100	10	30	5	0.25	2	±36˚
VTT7222H	0.9 100 (5)	100	10	30	5	0.25	2	±36˚
VTT7223H	1.8 100 (5)	100	10	30	5	0.25	2	±36˚
VTT7225H	4 100 (5)	100	10	30	5	0.25	4	±36˚

Electro-Optical Characteristics @ 25°C

Clear T-1 3/4 (5 mm) Plastic Package

VTT1212 VTT1223W VTT1227
VTT1214 VTT1225
VTT1222W VTT1226

IRT T-1 3/4 (5mm) Plastic Package

VTT1322W VTT1312
VTT1323W VTT1314

Coax Hermetic (with case lead)

VTT3122E VTT3123E

Clear Long T-1 (3 mm) Plastic Package

VTT3323LA VTT3324LA VTT3325LA

IRT Long T-1 (3 mm) Plastic Package

VTT3423LA VTT3424LA VTT3425LA

Molded, Lensed Lateral Package

VTT7122 VTT7123 VTT7125

IRT Molded, Lensed Lateral Package

VTT7222 VTT7223 VTT7225

Clear Epoxy TO-106 Ceramic Package

VTT9002 VTT9003

Epoxy Lensed TO-106 Ceramic Package

VTT9102 VTT9103

.04" x .04" NPN Phototransistors

Technical Specification

Part Number	Light Current H fc (mW/cm²) V_{CE}=5 V mA min.	Dark Current nA max.	V_{CE} Volts	$V_{BR(CEO)}$ Volts min.	$V_{BR(ECO)}$ Volts min.	$V_{CE(SAT)}$ Volts max.	t_R/t_F µsec, typ.	Angular Response $\theta_{1/2}$
VTT1212H	2 20 (1)	100	10	30	5	0.25	4	±10˚
VTT1214H	4 20 (1)	100	10	30	5	0.25	6	±10˚
VTT1312H	1 20 (1)	100	10	30	5	0.25	4	±10˚
VTT1314H	2.4 20 (1)	100	10	30	5	0.25	6	±10˚
VTT9002H	2 100 (5)	100	10	30	6	0.55	4	±50˚
VTT9003H	5 100 (5)	100	10	30	6	0.55	6	±50˚
VTT9102H	6 100 (5)	100	5	30	4	0.55	6	±42˚
VTT9103H	13 100 (5)	100	5	30	4	0.55	10	±42˚

Electro-Optical Characteristics @ 25°C

TO-46 Flat Window Package

VTT1015 VTT1016 VTT1017

TO-46 Lensed Package

VTT1115 VTT1116 VTT1117

Table Key

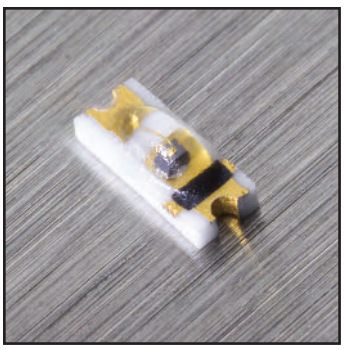
I_C	Light Current
I_{CEO}	Dark Current H=0
$V_{BR(CEO)}$	Collector Breakdown I_C=100 µA, H=0
$V_{BR(ECO)}$	Emitter Breakdown I_E=100 µA, H=0
$V_{CE(SAT)}$	Saturation Voltage I_C=1 mA, H=400 fc
t_R/t_F	Rise/Fall Time I_C=1 mA, R_L=100 Ω

.05" x .05" NPN Phototransistors

Technical Specification

Part Number	Light Current mA min.	Light Current H fc (mW/cm²) V_{CE}=5 V	Dark Current nA max.	Dark Current V_{CE} Volts	$V_{BR(CEO)}$ Volts min.	$V_{BR(ECO)}$ Volts min.	$V_{CE(SAT)}$ Volts max.	t_R/t_F µsec, typ.	Angular Response $\theta_{1/2}$
VTT1015H	0.4	100 (5)	25	20	40	6	0.4	5	±35˚
VTT1016H	1	100 (5)	25	20	30	6	0.4	5	±35˚
VTT1017H	2.5	100 (5)	25	10	20	4	0.4	8	±35˚
VTT1115H	1	20 (1)	100	10	30	6	0.4	5	±15˚
VTT1116H	2	20 (1)	100	10	30	4	0.4	8	±15˚
VTT1117H	4	20 (1)	100	10	30	4	0.4	8	±15˚

Electro-Optical Characteristics @ 25°C



CR10TE

- Surface mounting device
- Solid state ceramic chip
- High thermal conductivity
- Special type (CR10TE-DLF) with daylight filter on request

Technical Specification

Part Number	Package*	Spectral Range	Peak Sensitivity Wavelength (nm)	Vce (V)	P-Current	Dark Current (nA)	Active Area (mm²)	Rise/Fall Time	Orientation
CR10TE	Ceramic SMD (A1)	400–1070	850	40	3	400	0.19	10/10	High Vce
CR50TE	Ceramic SMD (A2)	400–1070	850	40	3	400	0.19	10/10	High Vce

* All packages are listed on our website.

infrared switches

Features

- Contains no mechanical parts to wear out
- Provides non-contact sensing of objects
- Low power consumption, compatible with solid-state electronics
- Low cost
- Capable of sensing any opaque object
- Small size
- Custom mechanical configurations available
- Can be specially selected or built to meet the requirements of your particular application

Typical Applications

- Printers and typewriters
  - Paper sensor
  - Paper-feed detector
  - Imprinting head position detector
- Floppy disk drives
  - Track-zero sensor
  - Index sensor
  - Disk-in sensor
- Vending machines
  - Coin sensor
  - Detection of goods
  - Mechanism position
- Facsimiles
  - Original width detection
  - Initial position detection
  - Final position detection
- Industrial
  - Rotational speed / position detection (encoder)
  - Distance detection
  - Object sensor
- VHS / VHSC / 8 mm VCR
  - Tape start
  - Tape load
  - Tape end
- Copiers
  - Paper-presence detection
  - Toner-density control
  - Paper-carrier detection

Datasheets available upon request.

Description

PerkinElmer Optoelectronics' infrared switches are ideal for non-contact sensing applications. The emitter is generally an IR LED and the detector is either a phototransistor or a photodarlington.

Optoswitches, Optical Hybrids, and Custom Optical Assemblies

Optoswitches, optical hybrids, custom assemblies, photodiodes, phototransistors, IR emitters, and photoconductive cells are commonly used in industrial, commercial, and consumer electronics applications. This product line is one of the broadest in the industry and includes a variety of standard catalog products as well as custom design and manufacturing capabilities. Approximately 75% of the products shipped are custom designed and tested to serve the needs of specific OEM applications.

Reflective Optoswitches

Reflective optical switches combine an infrared-emitting diode (IRED) with an NPN phototransistor or photodarlington in a one-piece, sealed, IR-transmitting plastic case or ceramic SMD-package. Sealed construction improves resistance to moisture and debris. Units are available with PC-board mounting leads (VTR16D1), or 12-inch, #26 AWG flying leads (VTR17D1).

Transmissive Optoswitches

Interrupter-type optical switches combine an infrared-emitting diode (IRED) with an NPN phototransistor. Units are available in two different case styles; a one-piece, sealed, IR-transmitting plastic case (VTL11 and VTL13 series) and an opaque case (VTL23 series). Options also include apertures-over-detector and/or emitter, and either PC-board mount leads or 12-inch, #26 AWG leads (VTL13 only).

All infrared switches are RoHS compliant.

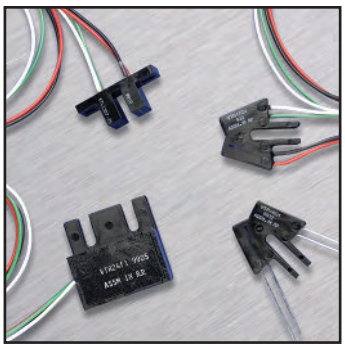
General Characteristics

Parameter	Symbol	Conditions	Input IRED	Output Detector
Reverse Voltage	V_R	I_R=100 µA	2 V min.	
Continuous Forward Current	I_F	Derate 0.73 mA/°C above 30°C	40 mA max.	
Forward Voltage Drop	V_F	I_F=20 mA	1.8 V max.	
Collector Breakdown Voltage	$V_{BR(CEO)}$	I_C=100 µA		30 V min.
Emitter Breakdown Voltage	$V_{BR(ECO)}$	I_C=100 µA I_E=100 µA (VTR)		5 V min. 3 V min. (VTL23DxA) 4.5 V (CRS)
Power Dissipation	P_D	Derate 0.91 mW/°C above 30°C		50 mW max.

(@ 25°C unless otherwise noted)

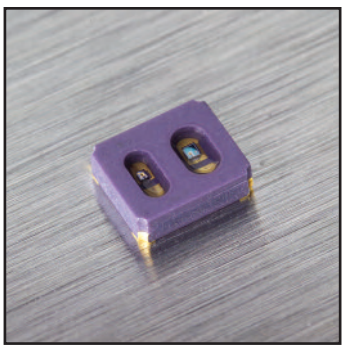
Absolute Maximum Ratings

Maximum Temperatures	-25°C to 85°C (CRS)
Storage and Operating:	-40°C to 85°C
Lead-Soldering Temperature:	260°C (1.6 mm from case, 5 sec. max.)



Infrared Interruptive Switches—Reflective Optoswitches VTR Series

Transmissive Optoswitches VTL11d Series, VTL13D Series, VTL23DxA Series



CRS20

- Surface mounting device
- complete ceramic housing
- High thermal conductivity

VTR Series

Technical Specification

Part Number	Light Current, I_p Test Conditions mA min.	I_F mA	V_{CE} Volts	d inches (mm)	Dark Current Test Conditions µA max.	I_F mA	V_{CE} Volts	Output Element Detector Device
VTR16D1H	0.3	20	5	0.1 (2.5)	0.1	0	5	Phototransistor
VTR17D1H	0.3	20	5	0.1 (2.5)	0.1	0	5	Phototransistor
VTR24F1H	6.0	20	30	2.0 (50.8)	—	—	—	Photodarlington

Specification Notes

The case material is polysulfone and should be cleaned with alcohol or freon TF only. Avoid chlorinated hydrocarbons and solvents such as acetone or toluene, as damage may result.

The light current is measured using a 90% reflective surface at a specified distance.

The dark current is measured with the part totally shielded from ambient light. With 2150 lux (200 fc) from a cool white fluorescent lamp perpendicular to the sensing axis, the detector current will be typically 3 µA. The same illumination concentric to the sensing axis will result in a detector current of 50 µA. Equivalent light from an incandescent lamp will result in significantly greater currents.

With the specified IRED forward current and no reflecting surface, the crosstalk is typically less than 3 µA.

Accommodates most applications.

VTL11D (P.C.B. Mount Leads), 13D (12 inch, #26 AWG Leads) Series

Technical Specification

Part Number	Light Current, I_p Test Cond. mA min.	I_F mA	V_{CE} Volts	Dark Current Test Cond. nA max.	I_F mA	V_{CE} Volts	Saturation Volts Test Cond. Volts max.	I_F mA	I_C mA	Aperture Combination Emitter	Detector
D1H	0.5	20	5	100	0	10	0.4	20	0.25	none	none
D1-20H	0.15	20	5	100	0	10	0.4	20	0.25	0.02" w	none
D3H	2	20	5	100	0	10	0.4	20	1.8	none	none
D3-20H	0.6	20	5	100	0	10	0.4	20	1.8	0.02" w	none
D5-20H	0.15	20	5	100	0	10	0.4	20	0.25	0.02" w	0.01" w
D6-20H	0.075	20	5	100	0	10	0.4	20	0.25	0.02" w	0.005" w
D7H	0.75	20	5	100	0	10	0.4	20	0.25	none	0.02" w
D7-20H	0.225	20	5	100	0	10	0.4	20	0.25	0.02" w	0.02" w

Specification Notes

The dark current is measured with the part totally shielded from ambient light. With 2150 lux (200 fc) from a cool white fluorescent lamp perpendicular to the sensing axis, the detector current will be typically 3 µA. Equivalent light from an incandescent lamp will result in significantly greater currents.

The aperture used for these slotted switches are 0.04" (1.02 mm) high.

The case material is polysulfone and should be cleaned with alcohol or freon TF only. Avoid chlorinated hydrocarbons and solvents such as acetone or toluene, as damage may result.

VTL11D7-20, VTL13D7-20, accommodate most applications. The other parts in this series are available only for specialized, high-volume applications

VTL23DxA (P.C.B. Mount Leads) Series

Technical Specification

Part Number	Light Current, I_p Test Cond. mA min.	I_F mA	V_{CE} Volts	Dark Current Test Cond. nA max.	I_F mA	V_{CE} Volts	Saturation Volts Test Cond. Volts max.	I_F mA	I_C mA	Aperture Combination Emitter	Detector
VTL23D0A21H	0.2	20	10	100	0	10	0.4	20	0.1	0.02" w	0.01" w
VTL23D0A22H	0.2	20	10	100	0	10	0.4	20	0.1	0.02" w	0.02" w
VTL23D1A00H	0.5	20	10	100	0	10	0.4	20	0.4	0.04" w	0.04" w
VTL23D1A22H	0.5	20	10	100	0	10	0.4	20	0.4	0.02" w	0.02" w
VTL23D2A00H	2.5	20	10	100	0	10	0.6	20	1.8	0.04" w	0.04" w
VTL23D3A00H	1.0	10	10	100	0	10	0.4	10	0.8	0.04" w	0.04" w

Specification Notes

The dark current is measured with the part totally shielded from ambient light.

VTL23D2A00 and VTL23D3A00 contains a visible light-blocking dust cover over the apertures.

The plastic case can be damaged by chlorinated hydrocarbons and ketones. Methanol isopropanol alcohols are recommended as cleaning agents.

VTL23D1A22 accommodate most applications. The other parts in this series are available only for specialized, high-volume applications.

Aperture Length is 0.075"

Technical Specification

Part Number	Package*	Collector Emitter Breakdown (V_{CEO})	Emitter Collector Breakdown (V_{ECO})	Dark Current I_{CEO} (nA)	Rise/Fall time tr/tf (ns)	Forward Voltage V_F (V)	Forward Current I_F (mA)	Wavelength (nm)
CRS20	Ceramic SMD (H)	40	4.5	400	10	1.2–1.4	60	950

* All packages are listed on our website.

photocells

Features

- Lowest-cost visible detector
- Available in low-cost plastic-encapsulated packages as well as hermetic packages (TO-46, TO-5, TO-8)
- Responsive to both very low light levels (moonlight) and to very high light levels (direct sunlight)
- Wide dynamic range: resistance changes of several orders of magnitude between "light" and "no light"
- Low noise distortion
- Maximum operating voltages of 50 to 400 Volts are suitable for operation on 120/240 VAC
- Available in center-tap dual-cell configurations as well as specially selected resistance ranges for special applications
- Easy to use in DC or AC circuits
- Usable with almost any visible or near-infrared light source such as LEDS; neon; fluorescent, incandescent bulbs, lasers; flame sources; sunlight; etc.
- Available in a wide range of resistance values

Typical Analog Applications

- Auto-focus for slide projector
- Colorimetric test equipment
- Densitometer
- Electronic scales—dual-cell
- Automated rear-view mirror

Typical Digital Applications

- Automatic headlight dimmer
- Night light control
- Oil burner flame out
- Street light control
- Absence/presence (beam breaker)
- Position sensor

Datasheets available upon request.

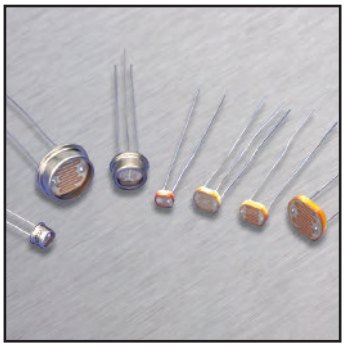
Description

Photocells or Light-Dependent Resistors can provide a very economical and technically superior solution for many applications where the presence or absence of light is sensed (digital operation) or where the intensity of light needs to be measured (analog operation).

Semiconductor light detectors can be divided into two major categories: junction and bulk-effect devices. Junction devices, when operated in the photoconductive mode, utilize the reverse characteristic of a PN junction. Under reverse bias, the PN junction acts as a light-controlled current source. Output is proportional to incident illumination and is relatively independent of applied voltage. Silicon photodiodes are examples of this type of detector.

In contrast, bulk-effect photoconductors have no junction. The bulk resistivity decreases with increasing illumination, allowing more photocurrent to flow. This resistive characteristic gives bulk-effect photoconductors a unique quality: signal current from the detector can be varied over a wide range by adjusting the applied voltage. To clearly make this distinction, PerkinElmer Optoelectronics refers to its bulk-effect photoconductors as photoconductive cells or, simply, photocells.

Photocells are thin-film devices made by depositing a layer of a photoconductive material on a ceramic substrate. Metal contacts are evaporated over the surface of the photoconductor and external electrical connection is made to these contacts. These thin films of photoconductive material have a high sheet resistance. Therefore, the space between the two contacts is made narrow and interdigitated for low cell resistance at moderate light levels.



VT Series

VT Series

Technical Specification

Part Number	Resistance (Ohms) 10 lux 2850 K min.	typ.	max.	2 fc 2850 K typ.	Dark min.	sec.	Material Type	Sensitivity (γ, typ.) LOG (R10/R100) / LOG (100/10)	Max. Volts V, pk	Response Time @ 1fc ms, typ. Rise (1-1/e)	Fall (1/e)
VT20N1	8 k	16 k	24 k	8 k	200 k	5	0	0.8	100	78	8
VT20N2	16 k	34 k	52 k	17 k	500 k	5	0	0.8	100	78	8
VT20N3	36 k	72 k	108 k	36 k	1 M	5	0	0.8	100	78	8
VT20N4	76 k	152 k	230 k	76 k	2 M	5	0	0.8	200	78	8
VT23N1	20 k	40 k	60 k	20 k	500 k	5	3	0.85	100	35	5
VT23N2	42 k	86 k	130 k	43 k	1 M	5	3	0.85	100	35	5
VT23N3	90 k	180 k	270 k	90 k	2 M	5	3	0.85	100	35	5
VT30N1	6 k	12 k	18 k	6 k	200 k	5	0	0.75	100	78	8
VT30N2	12 k	24 k	36 k	12 k	500 k	5	0	0.8	200	78	8
VT30N3	24 k	48 k	72 k	24 k	1 M	5	0	0.8	200	78	8
VT30N4	50 k	100 k	150 k	50 k	2 M	5	0	0.8	300	78	8
VT30CT	10 k	20 k	30 k	10 k	500 k	5	0	0.8	200	78	8
VT33N1	20 k	40 k	60 k	20 k	500 k	5	3	0.9	100	35	5
VT33N2	40 k	80 k	120 k	40 k	1 M	5	3	0.9	200	35	5
VT33N3	80 k	160 k	240 k	80 k	2 M	5	3	0.9	200	35	5
VT33CT	60 k	120 k	180 k	60 k	1 M	5	3	0.9	200	35	5

VT Series

Technical Specification

Part Number	Resistance (Ohms) 10 lux 2850 K min.	typ.	max.	2 fc 2850 K typ.	Dark min.	sec.	Material Type	Sensitivity (γ, typ.) LOG (R10/R100) / LOG (100/10)	Max. Volts V, pk	Response Time @ 1fc ms, typ. Rise (1-1/e)	Fall (1/e)
VT43N1	4 k	8 k	12 k	—	300 k	30	3	0.9	250	90	18
VT43N2	8 k	16 k	24 k	—	300 k	30	3	0.9	250	90	18
VT43N3	16 k	32 k	48 k	—	500 k	30	3	0.9	400	90	18
VT43N4	33 k	66 k	100 k	—	500 k	30	3	0.9	400	90	18
VT50N1	4 k	8 k	12 k	4 k	200 k	5	0	0.75	200	78	8
VT50N2	8 k	16 k	24 k	8 k	500 k	5	0	0.75	200	78	8
VT50N3	16 k	32 k	48 k	16 k	1 M	5	0	0.8	300	78	8
VT53N1	16 k	32 k	48 k	16 k	1 M	5	3	0.85	200	35	5
VT53N2	32 k	76 k	96 k	38 k	2 M	5	3	0.85	200	35	5
VT53N3	66 k	132 k	200 k	66 k	3 M	5	3	0.85	300	35	5

Specification Notes

Photocells categorized into groups by resistance. All groups must be purchased together and PerkinElmer maintains the right to determine the product mix among these groups.

Dimensions controlled at base of package.

Photocells are tested at either 1 fc or 10 lux. 2 fc. typical values shown in the tables are for reference only.

Cells are light-adapted at 30–50 fc.

The photocell “grid” pattern can vary from that shown. PerkinElmer reserves the right to change mix grid patterns on any standard product.

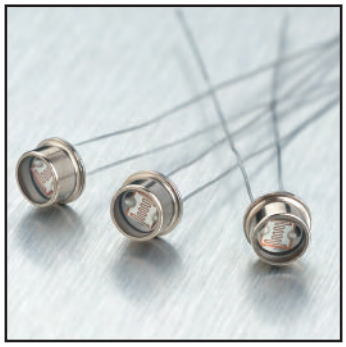
The resistance for any standard cell is controlled at only one light level. If the resistance at other light levels is a concern, please contact us.

VT Series

Technical Specification

Part Number	Resistance (Ohms) 10 lux 2850 K min.	typ.	max.	2 fc 2850 K typ.	Dark min.	sec.	Material Type	Sensitivity (γ, typ.) LOG (R10/R100) / LOG (100/10)	Max. Volts V, pk	Response Time @ 1fc ms, typ. Rise (1-1/e)	Fall (1/e)
VT80N1	4 k	8 k	12 k	4 k	100 k	5	0	0.8	100	78	8
VT80N2	8 k	16 k	24 k	8 k	500 k	5	0	0.8	200	78	8
VT83N1	6 k	12 k	18 k	6 k	100 k	5	3	0.95	100	35	5
VT83N2	12 k	28 k	36 k	14 k	500 k	5	3	0.95	200	35	5
VT83N3	24 k	48 k	72 k	24k	1 M	5	3	0.95	200	35	5
VT83N4	50 k	100 k	150 k	50 k	2 M	5	3	0.95	200	35	5
VT83CT	30 k	60 k	90 k	30 k	1 M	5	3	0.90	100	35	5
VT90N1	6 k	12 k	18 k	6 k	200 k	5	0	0.8	100	78	8
VT90N2	12 k	24 k	36 k	12 k	500 k	5	0	0.8	100	78	8
VT90N3	25 k	50 k	75 k	25 k	1 M	5	0	0.85	100	78	8
VT90N4	50 k	100 k	150 k	50 k	2 M	5	0	0.9	100	78	8
VT93N1	12 k	24 k	36 k	12 k	300 k	5	3	0.9	100	35	5
VT93N2	24 k	48 k	72 k	24 k	500 k	5	3	0.9	100	35	5
VT93N3	50 k	100 k	150 k	50 k	500 k	5	3	0.9	100	35	5
VT93N4	100 k	200 k	300 k	100 k	500 k	5	3	0.9	100	35	5

photocells



A10 Series

A10 Series

Technical Specification

Part Number	Typical Electro-Optical Characteristics R10 range kΩ	R100 typ. kΩ	R01 min. MΩ	R05 min. MΩ	$\gamma_{10/100}$ typ.	λ_{peak} nm	Limit Values Top range °C	Tst range °C	TC 10 lux %/°k	ton typ. msec	toff typ. msec	Vmax. V	Pmax. mW
A106009	4–11	2	0.04	0.12	0.65	600	-20–+70	-20–+80	0.4	50	40	100	90
A106011	9–20	3.5	0.06	0.18	0.65	600	-20–+70	-20–+80	0.3	60	40	150	90
A106012	16–33	5	0.18	0.5	0.7	600	-20–+70	-20–+80	0.35	50	35	150	90
A106013	27–94	8	0.5	1.5	0.8	600	-20–+70	-20–+80	0.4	35	30	150	90
A106014	77–340	15	1.5	5	0.9	600	-20–+70	-20–+80	0.5	25	20	150	90
A106031	60–130	23	0.4	1.2	0.65	600	-20–+70	-20–+80	0.3	60	40	300	90
A106032	120–210	35	1	3	0.7	600	-20–+70	-20–+80	0.35	50	35	300	90
A106033	200–580	50	3	9	0.8	600	-20–+70	-20–+80	0.4	35	30	300	90
A106034	500–1200	100	5	15	0.9	600	-20–+70	-20–+80	0.5	25	20	300	90
A105009	4–11	2	0.04	0.12	0.65	530	-20–+70	-20–+80	0.3	70	50	100	90
A105011	9–22	4	0.05	0.15	0.6	530	-20–+70	-20–+80	0.2	70	50	150	90
A105013	36–88	12	0.4	1.2	0.7	530	-20–+70	-20–+80	0.3	50	30	150	90

All readings taken at standard light A (2854 K color temperature) after 2 hours of preillumination at 500 lux.

A90 Series

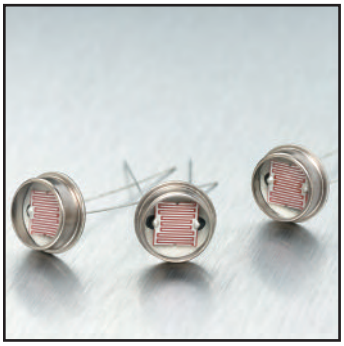
Technical Specification

Part Number	Typical Electro-Optical Characteristics R10 range kΩ	R100 typ. kΩ	R01 min. MΩ	R05 min. MΩ	$\gamma_{10/100}$ typ.	λ_{peak} nm	Limit Values Top range °C	Tst range °C	TC 10 lux %/°k	ton typ. msec	toff typ. msec	Vmax. V	Pmax. mW
A906009	4–11	2	0.04	0.12	0.65	600	-20–+70	-20–+80	0.4	50	40	100	90
A906011	9–20	3.5	0.06	0.18	0.65	600	-20–+70	-20–+80	0.3	60	40	150	90
A906012	16–33	5	0.18	0.5	0.7	600	-20–+70	-20–+80	0.35	50	35	150	90
A906013	27–94	8	0.5	1.5	0.8	600	-20–+70	-20–+80	0.4	35	30	150	90
A906014	77–340	15	1.5	5	0.9	600	-20–+70	-20–+80	0.5	25	20	150	90
A906031	60–130	23	0.4	1.2	0.65	600	-20–+70	-20–+80	0.3	60	40	300	90
A906032	120–210	35	1	3	0.7	600	-20–+70	-20–+80	0.35	50	35	300	90
A906033	200–580	50	3	9	0.8	600	-20–+70	-20–+80	0.4	35	30	300	90
A906034	500–1200	100	5	15	0.9	600	-20–+70	-20–+80	0.5	25	20	300	90
A905012	18–44	7	0.15	0.45	0.65	530	-20–+70	-20–+80	0.2	60	40	150	90
A905013	36–88	12	0.4	1.2	0.7	530	-20–+70	-20–+80	0.3	50	30	150	90
A905014	70–200	20	1	3	0.75	530	-20–+70	-20–+80	0.3	40	30	150	90
A995011	9–22	4	0.05	0.15	0.6	530	-20–+70	-20–+80	0.2	70	50	150	90
A995012	18–44	7	0.15	0.45	0.65	530	-20–+70	-20–+80	0.2	60	40	150	90
A995013	36–88	12	0.4	1.2	0.7	530	-20–+70	-20–+80	0.3	50	30	150	90
A995014	70–200	20	1	3	0.75	530	-20–+70	-20–+80	0.3	40	30	150	90

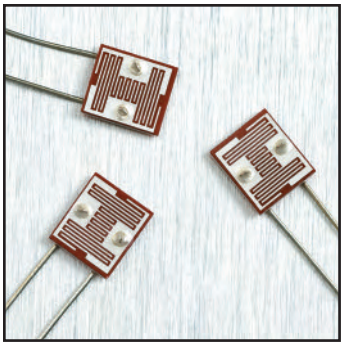
All readings taken at standard light A (2854 K color temperature) after 2 hours of preillumination at 500 lux.

Table Key

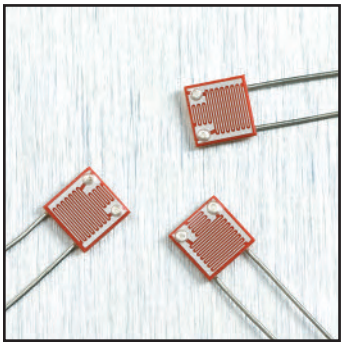
R 10	Resistance at E=10 lux light intensity
R 100	Resistance at E=100 lux light intensity
R_{01}	Dark Resistance after 1 sec (E=0)
R_{05}	Dark Resistance after 5 sec (E=0)
$\gamma_{10/100}$	Sensitivity log (R10/R100)/log (100 lux/10 lux)
λ_{peak}	Peak Spectral Sensitivity
Top	Operating Temperature
Tst	Storage Temperature
TC	Thermal Coefficient
t_{on}	Rise Time to 63% of final I (R_{10})
t_{off}	Decay Time to 37% of initial I (R_{10})
Vmax	Maximum Operating Voltage at E=0 lux
Pmax	Power Dissipation at 25°C Ambient Temperature



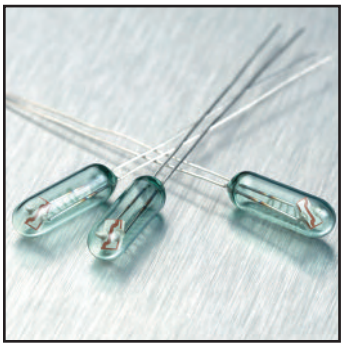
B90 Series



D99 Series



M99 Series



U11 Series

B90 Series

Technical Specification

Part Number	Typical Electro-Optical Characteristics R10 range kΩ	R100 typ. kΩ	R01 min. MΩ	R05 min. MΩ	$\gamma_{10/100}$ typ.	λ_{peak} nm	Limit Values Top range °C	Tst range °C	TC 10 lux %/°k	ton typ. msec	toff typ. msec	Vmax. V	Pmax. mW
B906032	5–13	2	0.1	0.3	0.7	600	-20–+70	-20–+80	0.3	50	35	300	200
B906033	11–40	5	0.2	0.6	0.8	600	-20–+70	-20–+80	0.4	35	25	300	200

All readings taken at standard light A (2854 K color temperature) after 2 hours of preillumination at 500 lux.

D99 Series

Technical Specification

Part Number	Typical Electro-Optical Characteristics R10 range kΩ	R100 typ. kΩ	R01 min. MΩ	R05 min. MΩ	$\gamma_{10/100}$ typ.	λ_{peak} nm	Limit Values Top range °C	Tst range °C	TC 10 lux %/°k	ton typ. msec	toff typ. msec	Vmax. V	Pmax. mW
D996011	1.5–3	0.6	0.01	0.03	0.6	600	-20–+70	-20–+80	0.3	60	35	150	200
D996012	2.8–6	0.8	0.03	0.09	0.7	600	-20–+70	-20–+80	0.35	50	30	150	200
D996013	4.5–13	1.5	0.1	0.3	0.8	600	-20–+70	-20–+80	0.4	35	25	150	200
D996022	8–15	2.5	0.09	0.27	0.7	600	-20–+70	-20–+80	0.35	50	30	150	200
D996023	12–35	4	0.5	1.5	0.8	600	-20–+70	-20–+80	0.4	35	25	150	200

All readings taken at standard light A (2854 K color temperature) after 2 hours of preillumination at 500 lux.

M99 Series

Technical Specification

Part Number	Typical Electro-Optical Characteristics R10 range kΩ	R100 typ. kΩ	R01 min. MΩ	R05 min. MΩ	$\gamma_{10/100}$ typ.	λ_{peak} nm	Limit Values Top range °C	Tst range °C	TC 10 lux %/°k	ton typ. msec	toff typ. msec	Vmax. V	Pmax. mW
M996011a	1.5–5	0.7	0.05	0.15	0.7	600	-20–+70	-20–+80	0.3	50	30	100	200
M996011b	0.8–2	0.4	0.05	0.15	0.65	600	-20–+70	-20–+80	0.3	40	30	100	200

All readings taken at standard light A (2854 K color temperature) after 2 hours of preillumination at 500 lux.

U11 Series

Technical Specification

Part Number	Typical Electro-Optical Characteristics R10 kΩ	R100 typ. kΩ	R01 min. mΩ	R05 min. mΩ	$\gamma_{10/10}$ min.	λ_{peak} nm	Limit Values top *range* °C	tst range °C	TC 10 lux %/°K	ton typ. msec	toff typ. msec	Vmax V	Pmax mW
U116012	20–50	8	0.12	0.36	0.7	550	-20–+70	-20–+80	0.3	50	40	150	50
U116013	35–220	15	0.4	1.2	0.85	550	-20–+70	-20–+80	0.35	40	30	150	50
U116014	150–1000	35	1	3	0.95	550	-20–+70	-20–+80	0.4	30	25	150	50
U116032	100–320	40	1	3	0.7	550	-20–+70	-20–+80	0.3	40	30	400	50
U116033	250–1100	75	2	6	0.85	550	-20–+70	-20–+80	0.35	30	25	400	50

All readings taken at standard light A (2854 K color temperature) after 2 hours of preillumination at 500 lux.

analog optical isolators

Features

- High input-to-output voltage isolation
- True resistance element output
- Single- or dual-element outputs available
- Low cost
- Suitable for AC or DC use
- Wide range of input-to-output characteristics
- Low drive current
- Low "on" resistance, high "off " resistance
- Complete solid-state construction

Typical Applications

- DC isolators
- Feedback elements in automatic gain control circuits
- Audio limiting and compression
- Noiseless switching
- Logic interfacing
- Remote gain control for amplifiers
- Photochoppers
- Noiseless potentiometers

Principle of Operation

Analog Optical Isolators are used in many different types of circuits and applications.

Available Related Products

VTL5C series
LT3011 series
LT9900 series

Datasheets available upon request.

Description

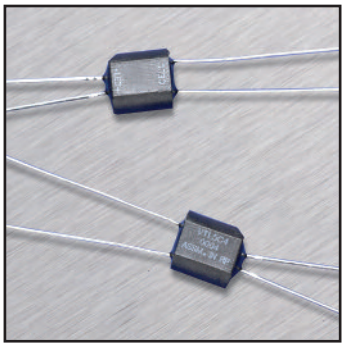
PerkinElmer Optoelectronics has been a leading manufacturer of analog optical isolators (AOI) for over twenty years and makes a broad range of standard parts under its trademark VACTROL®.

There are many kinds of optical isolators, but the most common is the LED/phototransistor type. Other familiar types use output elements such as light-sensitive SCRs, Triacs, FETs and ICs. The major application for these silicon-based devices is to provide electrical isolation of digital lines connected between different pieces of equipment. The principle of operation is very simple. When an input current is applied to the LED, the output phototransistor turns on. The only connection between the LED and phototransistor is through light—not electricity—thus the term optical isolator. These optical isolators are primarily digital in nature with fast response times for interfacing with logic gates. Rise and fall times of a few microseconds, faster for some isolators, are typical.

The AOI also uses an optical link between input and output. The input element is an LED and the output element is always a photoconductive cell or, simply a photocell. Together, the coupled pair act as an electrically variable potentiometer. Since the output element of the AOI is a resistor, the voltage applied to this output resistor may be DC and/or AC and the magnitude may be as low as zero or as high as the maximum voltage rating. Because the input will control the magnitude of a complex waveform in a proportional manner, this type of isolator is an analog-control element. AOIs may be used in the ON-OFF mode but the fastest response time is only in the millisecond range. A level-sensitive Schmitt trigger is required between the AOI and logic gates when used in digital circuits.

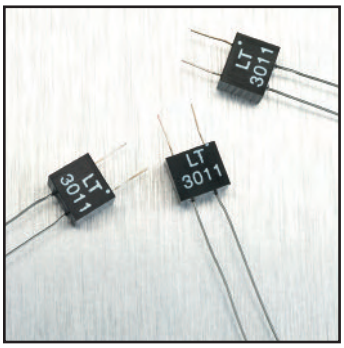
Absolute Maximum Ratings @ 25°

Maximum Temperatures	
Storage and Operating:	–40°C to 75°C
Cell Power:	175 mW
Derate Above 30°C:	3.9 mW/°C
LED Current:	40 mA
Derate Above 30°C:	0.9 mA/°C
LED Reverse Breakdown Voltage:	3.0 V
LED Forward Voltage Drop @ 20 mA:	2.0 V (1.65 V Typ.) VTL5C8 = 2.8 V (2.2 V typ.) VTL5C9 = 2.8 V (2.2 V typ.) VTL5C10 = 2.8 V (2.2 V typ.)
Minimum Isolation Voltage @ 70% Rel. Humidity:	2500 VRMS
Output Cell Capacitance:	5.0 pF
Input/Output Coupling Capacitance:	0.5 pF



Analog Optical Isolators—VTL5C Series

PerkinElmer Optoelectronics' line of AOIs consists of a light-tight package which houses a light source and one or more photoconductive cells. Through control of the input current or voltage applied to the AOI, the output resistance can be varied. The output resistance can be made to switch between an "on" and "off" state or made to track the input signal in an analog manner. Because a small change in input signal can cause a large change in output resistance, AOIs have been found to provide a very economical and technically superior solution for many applications.



LT Series

Table Key LT Series

R1mA	Output Resistance at If=1 mA
R20mA	Output Resistance at If=20 mA
R01	Dark Resistance after 1 sec (If=0)
R05	Dark Resistance after 5 sec (If=0)
Top	Operating Temperature Range
Tst	Storage Temperature Range
Vi	Input/Output Insulation Voltage
TC	Module Thermal Coefficient
Ton	Rise Time to 63% of final R_{20}
Toff	Decay Time to 37% of initial R_{20}
Cs	Output Capacity
Vmax	Operating Voltage at If=0
Pmax	Output Power Dissipation at 25°C

VTL Series

Technical Specification

Part Number	Material Type	On Resistance Input Current	On Resistance Dark Adapted typ.	Off Resistance @ 10 sec. min.	Slope	Dynamic Range	Cell Voltage	Response Time Turn-on to 63% Final R_{ON} typ.	Response Time Turn-off (Decay) to 100Ω max.
VTL5C1	1	1 mA 10 mA 40 mA	20 kΩ 600 Ω 200 Ω	50 MΩ	15	100 db	100 V	2.5 ms	35 ms
VTL5C2	0	1 mA 10 mA 40 mA	5.5 kΩ 800 Ω 200 Ω	1 MΩ	24	69 db	200 V	3.5 ms	500 ms
VTL5C2/2	0	5 mA 40 mA	2.5 kΩ 700 Ω	1 MΩ	20	65 db	50 V	7 ms	150 ms
VTL5C3	3	1 mA 10 mA 40 mA	30 kΩ 5 kΩ 1.5 kΩ	10 MΩ	20	75 db	250 V	2.5 ms	35 ms
VTL5C3/2	3	1 mA 40 mA	55 kΩ 2 kΩ	10 MΩ	19	71 db	100 V	3 ms	50 ms
VTL5C4	4	1 mA 10 mA 40 mA	1.2 kΩ 125 Ω 75 Ω	400 kΩ	18.7	72 db	50 V	6 ms	1.5 sec
VTL5C4/2	4	1 mA 10 mA	1.5 kΩ 150 Ω	400 kΩ	8.3	68 db	30 V	6 ms	1.5 sec
VTL5C6	0	1 mA 10 mA 40 mA	75 kΩ 10 kΩ 2 kΩ	100 MΩ	16.7	88 db	250 V	3.5 ms	50 ms (1 MΩ)
VTL5C7	7	0.4 mA 2 mA	5 kΩ 1.1 kΩ	1 MΩ	5.7	75 db	50 V	6 ms	1 sec. (100 kΩ)
VTL5C8	0	1 mA 4 mA 16 mA	4.8 kΩ 1.8 kΩ 1 kΩ	10 MΩ	8	80 db	500 V	4 ms	60 ms
VTL5C9	1	2 mA	630 Ω	50 MΩ	7.3	112 db	100 V	4 ms	50 ms
VTL5C10	4	1 mA	400 Ω	400 kΩ	3.8	75 db	50 V	1 ms	1.5 sec

Specification Notes

LED Current: Since the input has a substantially constant voltage drop, a current-limiting resistance is required.

ON Resistance: Dark adapted resistance measured after 24 or more hours of no input.

OFF Resistance: Measured 10 sec. after removal of the input. The ultimate resistance is many times greater than the value at 10 sec.

Response Time: Ascent measured to 63% of final conductance from the application of 40 mA input. The conductance rise time to a specified value is increased at reduced input drive while the conductance decay time to a specified value is decreased.

Typical matching and tracking from 0.4 to 40 mA is 25%.

Measured 5 sec. after removal of the input. The ultimate resistance is many times greater than the value at 5 sec.

VTL5C9 response times are based on a 2 mA input. VTL5C10 response times are based on a 10 mA input for ascent time and a 1 mA input for decay time.

LT Series

Technical Specification

Part Number	Typical Electro-Optical Characteristics R1mA kΩ	R20mA typ. kΩ	R_{01} min. MΩ	R_{05} min. MΩ	t_{op} range °C	t_{st} range °C	Limit Values V_i min. V	TC 10 lux %/°K	t_{on} msec	t_{off} typ. msec	C_s max. pF	V_{max} V	P_{max} mW
LT3011-2	—	1	3	9	-20–+60	-20–+80	2500	2	10	10	2	50	50
LT3011	—	0.32	0.1	0.3	-20–+70	-20–+70	2500	0.4	50	40	2	100	75
LT9909	0.7–1.2	0.35	0.06	0.18	-20–+70	-20–+70	1000	0.4	40	40	1	50	50
LT9910	1.2–2.5	0.7	0.06	0.18	-20–+70	-20–+70	1000	0.4	40	40	1	50	50
LT9911	2–5	1.5	0.1	0.3	-20–+70	-20–+70	1000	0.4	50	40	1	100	50
LT9912	4.5–9	2	0.2	0.6	-20–+70	-20–+70	1000	0.4	40	30	1	100	50
LT9913	8–16	3.5	0.5	1.5	-20–+70	-20–+70	1000	0.4	35	30	1	100	50
LT9914	14–25	6	0.7	2.1	-20–+70	-20–+70	1000	0.4	35	30	1	100	50

All readings taken at standard light A (2854 K color temperature) after 2 hours of preillumination at 500 lux.

Input/Output Coupling Capacity: 1 pF max.

Reverse Voltage: 4 V max.

Diode Forward Current: 25 mA max. DC

channel photomultipliers

CPM Features

- Ultra-high anode sensitivity up to 10^7 A/W
- Extremely low dark current, typically 3 pA @ 10^6 gain
- Very low equivalent noise input (down to 10^{-17} W)
- High stability in dark current ("no bursts")
- High gain exceeding 10^8
- Compact dimensions
- High dynamic range
- Wide spectral response through multiple window materials
- High resolution
- Fast response time
- High immunity to magnetic fields
- Rugged design

Module Features

- High dynamic range
- No cooling required
- Very high stability in noise level
- Adjustable gain
- Active quenching circuit for high light protection
- Gateable CPM input
- Optical fiber read-out possible
- 5 volts operating voltage
- Monitor voltage output

Typical Applications

- Photon detection and counting
- Fluorescence and luminescence measurements
- Analytical and clinical instrumentation
- Particle sizing (molecular imaging)

Available Related Products

CPM:

1/3" C900 series
1/2" C1300 series
3/4" C1900 series

CPM modules:

MD series
MP series
MH series
MP 96X-2, MP 97X-2
MP-RS232 series

High voltage power supply:

CHV 30N
CHV 30P

Datasheets available upon request.

Description

PerkinElmer Optoelectronics' Channel Photomultiplier (CPM) is an ultra-high sensitivity optical detector capable of replacing conventional photomultipliers (PMTs). This device uses a proprietary detector principle to produce ultra-high gain and dynamic range, extremely low noise, and fast response within a compact form factor. These detectors are available as components or in complete modules designed for DC operation and photon counting. All modules are gateable by an external TTL pulse for time-resolved measurements.

Modules

- MD Series DC-Module—contains the CPM, a high-voltage power supply, an amplifier with I/U conversion, and an active quenching circuit for high light protection.
- MP Series Photon Counting Module—The Photon Counting Head MP series contains the Channel Photomultiplier, a high-voltage power supply, a discrimination amplifier and a pulse shaper for fast output pulses.
- MH Series Channel Photomultiplier Head Module—The Channel Photomultiplier module MH series is designed for both photon counting and DC operating modes. It contains an adjustable high-voltage supply and a Channel Photomultiplier.
- MP 96X-2, MP 97X-2 Single Photon Counting Module—These modules are specially designed for particle sizing measurement with 530 nm and 632 nm laser excitation light. Based on the standard multialkali photocathode, the sensitive diameter is reduced to 2 mm in order to achieve an excellent low dark- count performance.

Power Supply

- CHV 30N—A self-contained high-voltage supply specially designed for the Channel Photomultipliers CPM C900, C1300 and C1900. It provides the matching voltages for the cathode, channel entrance, and channel end.
- CHV 30P—The equivalent power supply for positive high voltage, suitable for photon counting and pulse mode applications.

All given values are nominal/typical at 20˚C ambient temperature; specifications are subject to change without notice.

Principle of Operation

The CPM converts a very low light level into photoelectrons through a semitransparent photocathode deposited on the inner surface of the entrance window. On their way from the cathode to the anode, the photoelectrons pass through a narrow semiconductive channel. Each time the electrons hit the inner surface of the curved channel, multiple secondary electrons are emitted. This effect occurs multiple times along the path, leading to an avalanche effect with a gain exceeding 10^8. The curved shape of the glass tube improves the multiplication effect.

Please ask for our RoHS compliant products.

Channel Photomultipliers—CPM Format 1/3"

CPM—1/3" C 900 Series

Technical Specification

Spectral Response /nm	Model	@140 nm A/W	@200 nm A/W	@400 nm A/W	@560 nm A/W	ENI (W)	Dark Current pA	Model	Dark Counts per Second (cps)
115–200	C911	$6x10^5$				$1x10^{-17}$	2	C911P	0.1
115–200	C921		$1x10^6$			$1x10^{-17}$	10	C921P	1
165–320	C922		$1x10^6$			$1x10^{-17}$	10	C922P	1
165–650	C942			$3x10^6$		$1x10^{-17}$	80	C942P	10
185–650	C943			$3x10^6$		$1x10^{-17}$	80	C943P	10
300–650	C944			$3x10^6$		$1x10^{-17}$	80	C944P	10
165–850	C962				$2x10^6$	$4x10^{-17}$	1000	C962P	100
185–850	C963				$2x10^6$	$4x10^{-17}$	1000	C963P	100
165–900	C972				$2x10^6$	$1.5x10^{-16}$	5000	C972P	500
185–900	C973				$2x10^6$	$1.5x10^{-16}$	5000	C973P	500
165–650	C982			$3x10^6$		$6x10^{-18}$	25	C982P	3
185–650	C983			$3x10^6$		$6x10^{-18}$	25	C983P	3
300–650	C984			$3x10^6$		$6x10^{-18}$	25	C984P	3
165–750	C992			$3x10^6$	$2x10^6$	$1x10^{-17}$	50	C992P	5
185–750	C993			$3x10^6$	$2x10^6$	$1x10^{-17}$	50	C993P	5

Useful Area: Min. 5 mm diameter
Window Material: MgF_2, Quartz or UV Glass
Electron Multiplication: Channel Electron Multiplier
Supply Voltage (V): 2400 (Max. 3000)
Current Amplification: $5x10^7$
Bias Current (µA): 50
Anode Current: Max. 10 µA (Max. 30 sec.)
Single Photo Electron gain: $3x10^6$
Ambient Temperature (°C): Max. 50
Photocathode Material: CsI, CsTe, Low-noise Bialkali, Bialkali, Low-noise Multialk., Multialk. Extended Red Multialk, yellow enhanced.
Linear Anode Current: Max. (DC linearity limit) 10% of Bias Current
Response Time Rise Time (ns): 3
Pulse Width/FWHM (ns): 6
Peak to Valley: 10:1

Channel Photomultipliers—CPM Formats 1/2"and 3/4"

CPM—1/2" C 1300 Series

Technical Specification

Spectral Response /nm	Model	@140 nm A/W	@200 nm A/W	@400 nm A/W	@560 nm A/W	ENI (W)	Dark Current pA	Model	Dark Counts per Second (cps)
115–200	C1311	$6x10^5$				$2x10^{-17}$	8	C1311P	0.4
115–320	C1321		$1x10^6$			$2x10^{-17}$	40	C1321P	4
165–320	C1322		$1x10^6$			$2x10^{-17}$	40	C1322P	4
165–650	C1342			$3x10^6$		$2x10^{-17}$	320	C1342P	40
185–650	C1343			$3x10^6$		$2x10^{-17}$	320	C1343P	40
300–650	C1344			$3x10^6$		$2x10^{-17}$	320	C1344P	40
165–850	C1362				$2x10^6$	$8x10^{-17}$	4000	C1362P	400
185–850	C1363				$2x10^6$	$8x10^{-17}$	4000	C1363P	400
165–900	C1372				$2x10^6$	$3x10^{-16}$	20000	C1372P	2000
185–900	C1373				$2x10^6$	$3x10^{-16}$	20000	C1373P	2000
165–650	C1382			$3x10^6$		$1x10^{-17}$	100	C1382P	10
185–650	C1383			$3x10^6$		$1x10^{-17}$	100	C1383P	10
300–650	C1384			$3x10^6$		$1x10^{-17}$	100	C1384P	10
165–750	C1392			$3x10^6$	$2x10^6$	$2x10^{-17}$	200	C1392P	20
185–750	C1393			$3x10^6$	$2x10^6$	$2x10^{-17}$	200	C1393P	20

Useful Area: Min. 9 mm diameter
Window Material: MgF_2, Quartz, UV Glass or Borosil.
Supply Voltage (V): 2400 (Max. 3000)
Current Amplification: $5x10^7$
Bias Current (µA): 50
Response Time Rise Time (ns): 3
Pulse Width/FWHM (ns): 6
Peak to Valley: 10:1
Photocathode Material: CsI, CsTe, Low-noise Bialkali, Bialkali, Low-noise, Multialk., Multialk. Extended Red Multialk, yellow enhanced.
Linear Anode Current: Max. (DC linearity limit) 10% of Bias Current
Anode Current: Max. 10 µA (Max. 30 sec.)
Single Photoelectron gain: $3x10^6$
Ambient Temperature (°C): Max. 50

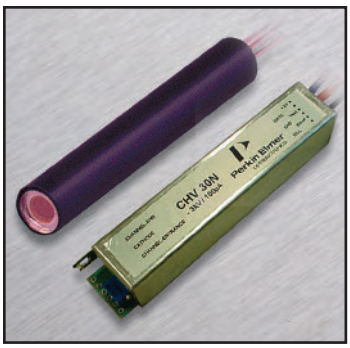
channel photomultipliers

CPM—3/4" C 1900 Series

Technical Specification

Spectral Response /nm	Model	@140 nm A/W	@200 nm AW	@400 nm A/W	@560 nm A/W	ENI (W)	Dark Current pA	Model	Dark Counts per Second (cps)
115–200	C1911	$6x10^5$				$3x10^{-17}$	20	C1911P	1
115–320	C1921		$1x10^6$			$3x10^{-17}$	100	C1921P	10
165–320	C1922		$1x10^6$			$3x10^{-17}$	100	C1922P	10
165–650	C1942			$3x10^6$		$3x10^{-17}$	800	C1942P	100
185–650	C1943			$3x10^6$		$3x10^{-17}$	800	C1943P	100
300–650	C1944			$3x10^6$		$3x10^{-17}$	800	C1944P	100
165–850	C1962				$2x10^6$	$1x10^{-16}$	10000	C1962P	1000
185–850	C1963				$2x10^6$	$1x10^{-16}$	10000	C1963P	1000
165–900	C1972				$2x10^6$	$5x10^{-16}$	50000	C1972P	5000
185–900	C1973				$2x10^6$	$5x10^{-16}$	50000	C1973P	5000
165–650	C1982			$3x10^6$		$2x10^{-17}$	250	C1982P	25
185–650	C1983			$3x10^6$		$2x10^{-17}$	250	C1983P	25
300–650	C1984			$3x10^6$		$2x10^{-17}$	250	C1984P	25
165–750	C1992			$3x10^6$	$2x10^6$	$3x10^{-17}$	500	C1992P	50
185–750	C1993			$3x10^6$	$2x10^6$	$3x10^{-17}$	500	C1993P	50

Useful Area: Min. 15 mm diameter
Window Material: MgF_2, Quartz, UV Glass or Borosil.
Electron Multiplication: Channel Electron Multiplier
Supply Voltage (V): 2400 (Max. 3000)
Current Amplification: $5x10^7$
Bias Current (µA): 50
Anode Current: Max. 10 µA (Max. 30 sec.)
Single Photoelectron gain: $3x10^6$
Ambient Temperature (°C): Max. 50
Photocathode Material: CsI, CsTe, Low-noise Bialkali, Bialkali, Low-noise Multialk., Multialk. Extended Red Multialk, yellow enhanced.
Linear Anode Current: Max. (DC linearity limit) 10% of Bias Current
Response Time Rise Time (ns): 3
Pulse Width/FWHM (ns): 6
Peak to Valley: 10:1



Power Supply CHV30N (CHV30P) and a CPM of the C9xx series

Power Supply—CHV30N

Technical Specification

Part Number	Voltage Channel Entrance	Voltage Cathode	Output Current	Long Term Stability typ.	Output Ripple typ.	Supply Voltage
CHV30N	-2900 V max.	-3000 V max.	100 µA max.	< 1E-5	< 50 mV_{pp}	5 V

Test conditions: T = 20°C
Voltage channel entrance: V_{SET}=0–2.9 V
Voltage cathode: V_{gate}=low or open
Long-term stability @ V_{SET}: <<1 E-5
Weight: 45 g
Operating temperature: 0–50°C
Storage temperature: -20–60°C

Power Supply—CHV30P

Technical Specification

Part Number	Voltage Anode	Voltage Cathode typ.	Voltage Channel Entrance typ.	Output Current	Long Term Stability typ.	Output Ripple typ.	Supply Voltage
CHV30P	+3000 V max.	0 V	90 V	100 µA max.	< 1E-5	< 30 mV_{pp}	5 V

Test conditions: T = 20°C
Voltage Anode: @ V_{SET}=0–3 V
Voltage cathode: 190 V—when gated
Voltage channel entrance: @ V_A ≥1400 V
Long-term stability @ V_{SET}: <<1 E-5
Weight: 45 g
Operating temperature: 0–50°C
Storage temperature: -20–60°C

CPM Module—1/3" 900 Series

Technical Specification

Spectral Response /nm	Model	ENI (W)	Dark Current/Offset Voltage @1x10^6 Gain & 1 V/20 nA	Model	Dark Counts per Second (cps)	Model	Dark Current pA @5x10^7 Gain	Model	ENI (W)	Dark Counts per Second (cps)
165–650	MD 942	1x10^{-17}	3 pA/150 µV	MP 942	10	MH 942	80	MH 942P	1x10^{-17}	10
185–650	MD 943	1x10^{-17}	3 pA/150 µV	MP 943	10	MH 943	80	MH 943P	1x10^{-17}	10
165–850	MD 962	4x10^{-17}	30 pA/1.5 mV	MP 962 MP 962-2	100 40	MH 962	1000	MH 962P	4x10^{-17}	100
185–850	MD 963	4x10^{-17}	30 pA/1.5 mV	MP 963 MP 963-2	100 40	MH 963	1000	MH 963P	4x10^{-17}	100
165–900	MD 972	1.5x10^{-16}	200 pA/10 mV	MP 972 MP 972-2	500 160	MH 972	5000	MH 972P	1.5x10^{-16}	400
185–900	MD 973	1.5x10^{-16}	200 pA/10 mV	MP 973 MP 973-2	500 160	MH 973	5000	MH 973P	1.5x10^{-16}	400
165–650	MD 982	6x10^{-18}	1 pA/50 µV	MP 982	3	MH 982	25	MH 982P	6x10^{-18}	3
185–650	MD 983	6x10^{-18}	1 pA/50 µV	MP 983	3	MH 983	25	MH 983P	6x10^{-18}	3
300–650	MD 984	6x10^{-18}	1 pA/50 µV	MP 984	3	MH 984	25	MH 984P	6x10^{-18}	3
165–750	MD 992	1x10^{-17}	2 pA/100 µV	MP 992	5	MH 992	50	MH 992P	1x10^{-17}	5
185–750	MD 993	1x10^{-17}	2 pA/100 µV	MP 993	5	MH 993	50	MH 993P	1x10^{-17}	5

Photocathode Diameter: 5 mm (MP 9xx-2 types: 2 mm)
Window Material: Quartz or UV Glass
Additional models on request

Photocathode Material: Low-noise Bialkali, Bialkali, Low-noise Multialk., Multialk. Extended Red Multialk, yellow enhanced.
Quantum Efficiency: 20% typical (Ext. Red MA: 10% typical)

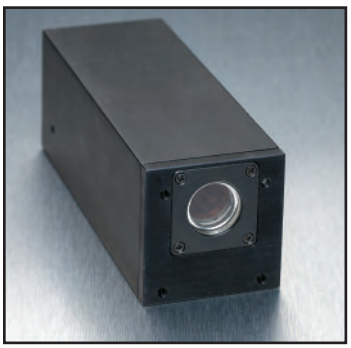
CPM Module—1/2" 1300 Series

Technical Specification

Spectral Response /nm	Model	ENI (W)	Dark Current/Offset Voltage @1x10^6 Gain & 1 V/20 nA	Model	Dark Counts per Second (cps)	Model	Dark Current pA @5x10^7 Gain	Model	ENI (W)	Dark Counts per Second (cps)
165–650	MD1342	2x10^{-17}	12 pA/600 µV	MP1342	40	MH1342	320	MH1342P	2x10^{-17}	40
185–650	MD1343	2x10^{-17}	12 pA/600 µV	MP1343	40	MH1343	320	MH1343P	2x10^{-17}	40
165–850	MD1362	8x10^{-17}	120 pA/6 mV	MP1362	400	MH1362	4000	MH1362P	8x10^{-17}	400
185–850	MD1363	8x10^{-17}	120 pA/6 mV	MP1363	400	MH1363	4000	MH1363P	8x10^{-17}	400
165–900	MD1372	3x10^{-16}	800 pA/40 mV	MP1372	2000	MH1372	20000	MH1372P	3x10^{-16}	2000
185–900	MD1373	3x10^{-16}	800 pA/40 mV	MP1373	2000	MH1373	20000	MH1373P	3x10^{-16}	2000
165–650	MD1382	1x10^{-17}	4 pA/200 µV	MP1382	10	MH1382	100	MH1382P	1x10^{-17}	10
185–650	MD1383	1x10^{-17}	4 pA/200 µV	MP1383	10	MH1383	100	MH1383P	1x10^{-17}	10
300–650	MD1384	1x10^{-17}	4 pA/200 µV	MP1384	10	MH1384	100	MH1384P	1x10^{-17}	10
165–750	MD1392	2x10^{-17}	8 pA/400 µV	MP1392	20	MH1392	200	MH1392P	2x10^{-17}	20
185–750	MD1393	2x10^{-17}	8 pA/400 µV	MP1393	20	MH1393	200	MH1393P	2x10^{-17}	20

Photocathode Diameter: Min. 9 mm
Window Material: Quartz or UV Glass
Additional models on request

Photocathode Material: Low-noise Bialkali, Bialkali, Low-noise Multialk., Multialk. Extended Red Multialk, yellow enhanced.
Quantum Efficiency: 20% typical (Ext. Red MA: 10% typical)



CPM Modules—3/4" 1900 Series

CPM Module—3/4" 1900 Series

Technical Specification

Spectral Response /nm	Model	ENI (W)	Dark Current/Offset Voltage @1x10^6 Gain & 1 V/20 nA	Model	Dark Counts per Second (cps)	Model	Dark Current pA @5x10^7 Gain	Model	ENI (W)	Dark Counts per Second (cps)
165–650	MD1942	3x10^{-17}	30 pA/1.5 mV	MP1942	100	MH1942	800	MH1942P	3x10^{-17}	100
185–650	MD1943	3x10^{-17}	30 pA/1.5 mV	MP1943	100	MH1943	800	MH1943P	3x10^{-17}	100
165–850	MD1962	1x10^{-16}	300 pA/15 mV	MP1962	1000	MH1962	10000	MH1962P	1x10^{-16}	1000
185–850	MD1963	1x10^{-16}	300 pA/15 mV	MP1963	1000	MH1963	10000	MH1963P	1x10^{-16}	1000
165–900	MD1972	5x10^{-16}	2 nA/100 mV	MP1972	5000	MH1972	50000	MH1972P	5x10^{-16}	5000
185–900	MD1973	5x10^{-16}	2 nA/100 mV	MP1973	5000	MH1973	50000	MH1973P	5x10^{-16}	5000
165–650	MD1982	2x10^{-17}	10 pA/500 µV	MP1982	25	MH1982	250	MH1982P	2x10^{-17}	25
185–650	MD1983	2x10^{-17}	10 pA/500 µV	MP1983	25	MH1983	250	MH1983P	2x10^{-17}	25
300–650	MD1984	2x10^{-17}	10 pA/500 µV	MP1984	25	MH1984	250	MH1984P	2x10^{-17}	25
165–750	MD1992	3x10^{-17}	16 pA/800 µV	MP1992	50	MH1992	500	MH1992P	3x10^{-17}	50
185–750	MD1993	3x10^{-17}	16 pA/800 µV	MP1993	50	MH1993	500	MH1993P	3x10^{-17}	50

Photocathode Diameter: Min. 15 mm
Window Material: Quartz or UV Glass
Additional models on request

Photocathode Material: Low-noise Bialkali, Bialkali, Low-noise Multialk., Multialk. Extended Red Multialk, yellow enhanced.
Quantum Efficiency: 20% typical (Ext. Red MA: 10% typical)

photon counting modules

Features

- Peak photon-detection efficiency @ 650 nm: 65% typical
- Active area: SPCM-AQR-1X: 180 µm
- User friendly
- Gated input
- Single +5 V supply

Typical Applications

- Particle sizing
- Ultra-sensitive fluorescence
- Photon-correlation spectroscopy
- LIDAR
- Optical range finding
- Adaptive optics
- Astronomical observation

Datasheets available upon request.

Description

PerkinElmer Optoelectronics provides photon counting modules based on both APDs and innovative Channel Photomultipliers.

APD Based Single Photon Counting Modules

The Single Photon Counting Module (SPCM) is a self-contained photon counter which covers the wavelength range from 400 nm to 1100 nm, with photon detection efficiencies exceeding 60% at 650 nm. It has an integral 2-stage TE cooler, cooler controller, amplifier, discriminator and TTL output driver. It also contains a high-voltage DC-to-DC converter and is powered from a single 5 V source. The module utilizes a patented active-quench circuit which allows it to count over 30 million photons per second. The photosensitive area is 180 µ, and units are available with dark-count rates less than 25 counts / second.

SPCM-AQ4C Single Photon Counting Array

The SPCM-AQ4C is a 4-channel photon counting card capable of detecting single photons of light over a wavelength range from 400 nm to 1100 nm. Each channel is independent from the others. The SPCM-AQ4C utilizes a unique silicon avalanche photodiode (SliK™) with a circular active area whose peak photon-detection efficiency exceeds 60% at 650 nm. Each photodiode is both thermoelectrically cooled and temperature controlled, ensuring stabilized performance despite changes in the ambient temperature.

All standard Single Photon Counting Modules are RoHS compliant.

Single Photon Counting Module – SPCM

SPCM-AQ4C Single Photon Counting Array

SPCM-AQR-1X Series

Technical Specification

Parameter	Typical	Parameter	Typical
Supply current	0.5 Amps	Supply voltage	5 V
Power cable total resistance	0.2 Ω	Case operating temperature	5–40°C
Active area (diameter) @ min. Pd	175 µm		
Photon detection efficiency (Pd) @ 400 nm 650 nm 830 nm 1060 nm	 5% 65% 45% 2%	Output pulse width	31ns
Pd variation at constant case temperature (2 h @ 25°C)	±1–±3%	Pd variation 5°C to 40°C case temperature	±4–±10%
Dark count (cps) = SPCM-AQR-10 SPCM-AQR-11 SPCM-AQR-12 SPCM-AQR-13	 1000–1500 500–1000 250–500 100–250	Dark count (cps) = SPCM-AQR-14 SPCM-AQR-15 SPCM-AQR-16	 50–100 50 max. 25 max.
Average dark count variation at constant case temperature (6 hrs @ 25°C) SPCM-AQR-10/11/12/13 SPCM-AQR-14/15/16	 ±10% max. ±1σ max.	Average dark count variation at 5°C to 40°C case temperature SPCM-AQR-10/11/12/13 SPCM-AQR-14/15/16	 ±20% max. ±2σ max.
Single-photon timing resolution	500 ps	Dead time (Count rates below 5 Mc/s)	30 ns
Output count rate before saturation	30 Mc/s	Afterpulsing probability	0.5%
Linearity correction factor @1 Mc/s @5 Mc/s @10 Mc/s @20 Mc/s @25 Mc/s	 1.02 1.19 1.48 2.82 4.91	Gating turn on/off (50 Ω output) Disable = TTL Low Enable = TTL High	 26 ns 52 ns
Settling time following power up (1% stability) @ 1 meg counts/sec and 25°C	15 S	Threshold setting required on counter for digital output pulse (terminate in 50 Ω)	1 V
Gate threshold voltage: (@ V_{supply} = 5 V) Low level (sink current >90 mA)	 0 V–0.4 V	Gate threshold voltage: (@ V_{supply} = 5 V) High level (sink current >30 mA)	 3.5–5.25 V

Test Conditions: T=22°C

SPCM-AQ4C

Technical Specification

Parameter	Typical	Parameter	Typical
Supply currents: @+2 V @+5 V @+30 V	 1 Amp 0.2 Amps 0.01 Amps	Maximum power consumption: @+2 V @+5 V @+30 V	Counts/Second 6 Watts max. 5 Watts max. 1.2 Watts max.
Supply voltage	 1.95 V–2.05 V 4.75 V–5.25 V 29 V–31 V	Photon detection efficiency (per channel) @400 nm @650 nm @830 nm	 2.5% 60% 45%
Operating temperature (heatsink)	5°C–40°C	Dark count (per channel)	500 counts/sec.
Average dark count variation per channel @ constant heatsink temp.	±10%	Average dark count variation per channel @ 5° to 40°C heatsink temp.	±20%
Timing resolution	500 ps	Dead time	50 ns
Output pulse width	25 ns	Maximum count rate*	4 Mc/s
Continuous	1.5 Mc/s	Afterpulsing probability	0.3%
Gate threshold voltage: (@ V_{supply} = 5 V) Low level (sink current >90 mA)	 0 V–0.4 V	Gate threshold voltage: (@ V_{supply} = 5 V) High level (source current >30 mA)	 3.5 V–5.25 V

Test Conditions: T=22°C *500 ms duration, 25% duty cycle

infrared emitting diodes

Features 880 nm
- Nine standard packages in hermetic and low-cost epoxy
- End- and side-radiating packages
- Graded output
- High efficiency GaAIAs, 880 nm LPE process delivers twice the power of conventional GaAs 940 nm emitters

Features 940 nm
- Three standard packages in hermetic and low-cost epoxy
- End-radiating packages
- High power GaAs, 940 nm LPE process

Features 770 nm, 870 nm, 950 nm
- Multiple SMD-packages on ceramic substrate
- High thermal conductivity
- Superior light uniformity
- Wide viewing angle
- End-to-end and side-to-side stackable

Typical Applications
- Computer/business equipment
  - Write-protect control
  - Margin controls—printers
- Industrial
  - LED light source—light pens
  - Security systems
  - Safety shields
- Consumer
  - Coin counters
  - Lottery card readers
  - Position sensors—joysticks
  - Remote controllers—toys, appliances, audio/visual equipment
  - Games—laser tag
  - Camera shutter control

Principle of Operation
Because they emit at wavelengths which provide a close match to the peak spectral response of silicon photodetectors, both GaAs and GaAIAs IREDs are often used with phototransistors.

Datasheets available upon request.

Description
Light Emitting Diodes (LEDs) are solid-state P-N junction devices that emit light when forward biased. An IRED is an Infrared Emitting Diode, a term specifically applied to PerkinElmer IR emitters. Unlike incandescent lamps, which emit light over a very broad range of wavelengths, LEDs emit light over such a narrow bandwidth that they appear to be emitting a single "color". Their small size, long operating lifetimes, low power consumption, compatibility with solid-state drive circuitry, and relatively low cost make LEDs the preferred light source in many applications.

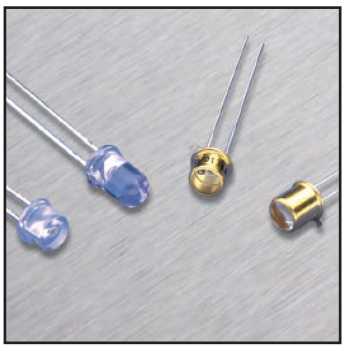
LEDs are made from a wide range of semiconductor materials. The emitted peak wavelength depends on the semiconductor material chosen and how it is processed. LEDs can be made that emit in the visible or near-infrared part of the spectrum.

The P-N junction is formed by doping one region of the material with donor atoms and the adjacent region with acceptor atoms. Like all P-N junction devices, LEDs exhibit the familiar diode current-voltage characteristics. LEDs emit light only when they are biased in the forward direction. Under forward-biased conditions, carriers are given enough energy to overcome the potential barrier existing at the junction. After crossing the junction, these carriers will recombine. A percentage of the carriers will recombine by a radiative process in which the hole-electron recombination energy is released as a photon of light. The remaining carriers recombine by a non-radiative process and give up their energy in the form of heat. The amount of light generated, or power output of the LED, varies almost linearly with forward current. Doubling the forward current approximately doubles the power output.

880 nm IREDs
This series of infrared emitting diodes (IREDs) consists of three standard chips in nine different packages that provide a broad range of mounting, lens and power-output options.

940 nm IREDs
This series of infrared emitting diodes (IREDs) consists of two standard chips in three different packages.

All infrared emitting diodes are RoHS compliant.



Infrared Emitting Diodes—
VTE Formats 880 nm and 940 nm

GaAlAs Infrared Emitting Diodes
TO-46 Flat Window Package
VTE1063
TO-46 Lensed Package
VTE1163
T- 1 3/4 (5 mm) Plastic Package
VTE1261 VTE1281F VTE1291-2
VTE1262 VTE1281W-1 VTE1291W-1
VTE1281-1 VTE1281W-2 VTE1291W-2
VTE1281-2 VTE1291-1
T- 1 3/4 (5 mm) Bullet Package
VTE1285 VTE1295
Coax Hermetic (with case lead)
VTE3175L VTE3176L
Long T-1 (3 mm) Plastic Package
VTE3372LA VTE3374LA
Molded Lateral Package
VTE7172 VTE7173
GaAs Infrared Emitting Diodes
TO-46 Flat Window Package
VTE1013
TO-46 Lensed Package
VTE1113
Long T-1 Plastic Package
VTE3322LA VTE3324LA

VTE 880 nm Series

Technical Specification

Part Number	Irradiance E_e mW/cm² min.	Irradiance E_e mW/cm² typ.	Output Irradiance Distance mm	Output Cond. Diameter mm	Radiant Intensity I_e mW/sr min.	Total Power P_O mW typ.	Test Current I_{FT} mA Pulsed	Forward Drop V_F @ I_{FT} volts typ.	Forward Drop V_F @ I_{FT} volts max.	Half Power Beam Angle $\theta_{1/2}$ typ.
VTE1063H	3.8	5	36	6.4	49	80	1000	2.8	3.5	±35˚
VTE1163H	22	28	36	6.4	285	110	1000	2.8	3.5	±10˚
VTE1261H	3	3.9	36	6.4	39	20	100	1.5	2	±10˚
VTE1262H	4	5.2	36	6.4	52	25	100	1.5	2	±10˚
VTE1281-1H	2.5	3.3	36	6.4	32	20	100	1.5	2	±10˚
VTE1281-2H	5	6.5	36	6.4	65	25	100	1.5	2	±10˚
VTE1281FH	0.16	0.21	36	6.4	2.1	20	100	1.5	2	±45˚
VTE1281W-1H	1.2	1.6	36	6.4	16	20	100	1.5	2	±25˚
VTE1281W-2H	2.5	3.3	36	6.4	32	25	100	1.5	2	±25˚
VTE1285H	3	5.5	36	6.4	39	20	100	1.5	2	±8˚
VTE1291-1H	2.5	3.3	36	6.4	32	20	100	1.5	2	±12˚
VTE1291-2H	5	6.5	36	6.4	65	25	100	1.5	2	±12˚
VTE1291W-1H	1.2	1.6	36	6.4	16	20	100	1.5	2	±25˚
VTE1291W-2H	2.5	3.3	36	6.4	32	25	100	1.5	2	±25˚
VTE1295H	3	5.5	36	6.4	39	20	100	1.5	2	±8˚
VTE3175LH	0.65	—	13.6	5.1	1.2	—	20	1.3	1.8	±10˚
VTE3176LH	1.65	—	13.6	5.1	3.1	—	20	1.3	1.8	±10˚
VTE3372LAH	2	2.6	10.16	2.1	2	3	20	1.3	1.8	±10˚
VTE3374LAH	4	5.2	10.16	2.1	4.1	5	20	1.3	1.8	±10˚
VTE7172H	0.4	0.6	16.7	4.6	1.1	2.5	20	1.3	1.8	±25˚
VTE7173H	0.6	0.8	16.7	4.6	1.7	5	20	1.3	1.8	±25˚

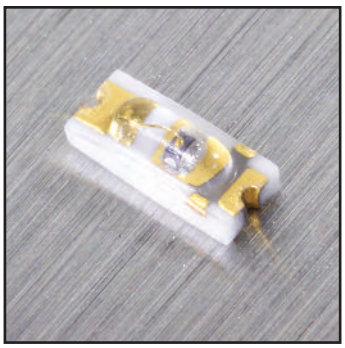
Electro-Optical Characteristics @ 25°C

VTE 940 nm Series

Technical Specification

Part Number	Irradiance E_e mW/cm² min.	Irradiance E_e mW/cm² typ.	Output Irradiance Distance mm	Output Cond. Diameter mm	Radiant Intensity I_e mW/sr min.	Total Power P_O mW typ.	Test Current I_{FT} mA Pulsed	Forward Drop V_F @ I_{FT} volts typ.	Forward Drop V_F @ I_{FT} volts max.	Half Power Beam Angle $\theta_{1/2}$ typ.
VTE1013H	2.1	2.7	36	6.4	27	30	1000	1.9	2.5	±35˚
VTE1113H	12	15	36	6.4	156	30	1000	1.9	2.5	±10˚
VTE3322LAH	1	1.3	10.16	2.1	1	1.5	20	1.25	1.6	±10˚
VTE3324LAH	2	2.6	10.16	2.1	2	2.5	20	1.25	1.6	±10˚

Electro-Optical Characteristics @ 25°C



Technical Specification

Part Number	Package*	Peak Wave-length	Radiant Flux ϕ_e 50 mA	Radiant Flux ϕ_e 20 mA	Rise/Fall Time tr/tf (ns)	Forward Voltage V_F 50 mA	Forward Voltage V_F 20 mA	Forward Current I_F	Orientation
CR10IRD	Ceramic SMD (A1)	770	6.3	2.4	40/30	1.75	1.6	75	Anode
CR10IRDA	Ceramic SMD (A1)	870	20	8.2	30/15	1.5	1.4	75	Anode
CR10IRH	Ceramic SMD (A1)	870	10.6	4.5	1500/800	N/A	1.35	75	Anode
CR10IRK	Ceramic SMD (A1)	950	11.4	4.4	500/500	1.35	1.2	80	Anode
CR50IRD	Ceramic SMD (A2)	770	6.3	2.4	40/30	1.75	1.6	75	Anode
CR50IRDA	Ceramic SMD (A2)	870	20	8.2	30/15	1.5	1.4	75	Cathode
CR50IRH	Ceramic SMD (A2)	870	10.6	4.5	1500/800	N/A	1.35	75	Anode
CR50IRK	Ceramic SMD (A2)	950	11.4	4.4	500/500	1.35	1.2	80	Cathode

* All packages are listed on our website.

CR50IRDA
- Surface mounting device

laser diodes

Typical Applications

- Laser range finding
- LIDAR
- High speed switching
- Laser scanning
- Fiber optic instrumentation
- YAG laser simulation

Datasheets available upon request.

Description

Pulsed Laser Diodes

These devices range in wavelength from 850 nm to 1550 nm and are produced using Molecular Beam Epitaxy (MBE) and MOCVD growth techniques. Fiber optic pigtailed devices employ an advanced fibre alignment process yielding highly stable fiber to laser diode positioning. Alternative packages and fiber optic core diameters may be supplied on a custom basis.

Multiple Epi-Cavity Lasers

In order to multiply the power output of our laser diodes while not increasing the drive current, we offer epitactically stacked devices which contain a series of 2 to 3 active laser diode layers. This way the double or triple power output (compared to single devices) is generated within a height of 10 µm. The width of the optically active area on the laser crystal is variable, standard types have 75 and 225 µm.

High Energy Laser Diodes—Quasi CW Lasers

These devices have been designed specifically to meet the demanding requirements of laser initiated ordnance (LIO) applications. Product offerings include a 9.0 mm TO-style package and an 8 pin miniDIL pigtailed package equipped with a rear facet monitor photodiode and 100/140 Ìm optical fiber. The 980 nm laser chip employs advanced epitaxial materials and processing techniques, providing reliable high optical power output capability and significant power retention at elevated temperatures. Alternate package outlines and fiber optic core diameters may be considered on a custom basis.

Please ask for our RoHS compliant products.

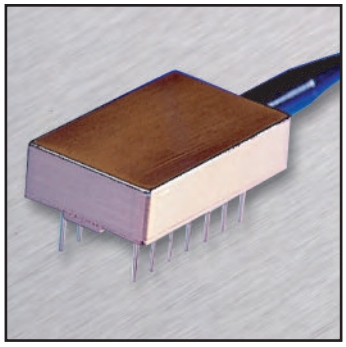
Laser Diode S-Package

Multiple Quantum Well Types–850 nm

Technical Specification

Part Number	Preferred Package	Peak Output Power P_{ko} (W)	Peak Forward Current I_F (A)	Pulse Width t_w (ns)	Maximum Duty Factor DF (%)	Beam Diverg. Q¨xQ^ (deg.) FWHM	Number of Diode Elements
PFAS1S03H	TO-52	5.5	7	50	0.025	12x30	1
PFAS1S09H	TO-52	17	20	50	0.025	12x30	1
PFAS1S12H	TO-52	26	30	50	0.025	12x30	1
PFAS1S16H	TO-52	34	40	50	0.025	12x30	1
PFAS2S09H	TO-52	34	20	50	0.025	12x30	2
PFAS2S12H	TO-52	52	30	50	0.025	12x30	2
PFAS3S12H	TO-52	78	30	50	0.025	12x30	3

Test conditions: T = 22°C



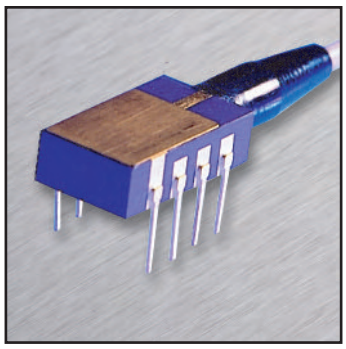
Laser Diode O-Package

Multiple Quantum Well Types–905 nm–PGA Series

Technical Specification

Part Number	Preferred Package	Peak Output Power P_{ko} (W)	Peak Forward Current I_F (A)	Pulse Width t_w (ns)	Maximum Duty Factor DF (%)	Beam Diverg. Q¨xQ^ (deg.)	Number of Diode Elements
PGAS1S03H	TO-52	5.5	7	150	0.1	10x25	1
PGAS1S06H	TO-52	12	15	150	0.1	10x25	1
PGAS1S09H	TO-52	18	22	150	0.1	10x25	1
PGAS1S12H	TO-52	24	30	150	0.1	10x25	1
PGAS1S16H	TO-52	33	40	150	0.1	10x25	1
PGAS1S24H	TO-52	49	60	150	0.1	10x25	1
PGAS3S06H	TO-52	34	15	150	0.1	10x30	3
PGAS3S09H	TO-52	50	22	150	0.1	10x30	3
PGAS3S12H	TO-52	67	30	150	0.1	10x30	3
PGAS4S12H	TO-52	90	30	150	0.1	10x30	4
PGAS4S16H	TO-52	120	40	150	0.1	10x30	4

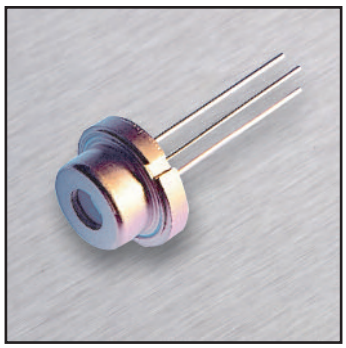
Test conditions: T = 22°C



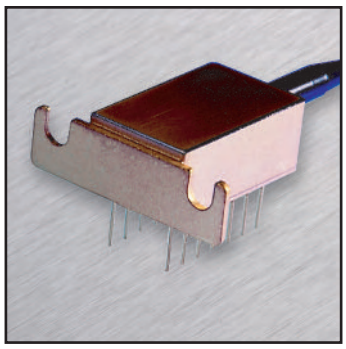
Laser Diode AA-Package

laser diodes

Laser Diode W-Package



Laser Diode R-Package



Laser Diode M-Package

Multiple Quantum Well Types–905 nm–PGEW Series

Technical Specification

Part Number	Standard Package	Peak Output Power P_{ko} (W)	Peak Forward Current I_F (A)	Pulse Width t_w (ns)	Maximum Duty Factor DF (%)	Beam Diverg. Q˝xQ^ (deg.)	Number of Diode Elements
PGEW1S03H	TO-52 plastic	4.5	7	30	0.0075	10x25	1
PGEW1S09H	TO-52 plastic	15	25	30	0.0075	10x25	1
PGEW2S09H	TO-52 plastic	30	25	30	0.0075	10x30	2
PGEW3S09H	TO-52 plastic	45	25	30	0.0075	10x30	3

Test conditions: T = 22°C

Double Heterostructure Types–1550 nm

Technical Specification

Part Number	Standard Package	Peak Output Power P_{ko} (W)	Peak Forward Current I_F (A)	Pulse Width t_w (ns)	Maximum Duty Factor DF (%)	Beam Diverg. Q˝xQ^ (deg.) FWHM	Number of Diode Elements
PVGR1S06H	CD9.0CAP	4	20	200	0.05	20x40	1
PVGS1S06H	TO-52	4	20	200	0.05	20x40	1
PVGR2S06H	CD9.0CAP	8	20	100	0.025	20x40	2
PVGS2S06H	TO-52	8	20	100	0.025	20x40	2
PVGR4S12H	CD9.0CAP	50	75	50	.025	20x40	4

Test conditions: T = 22°C

Laser Diode F-Package

Please ask for additional package options.

Quantum Well Types–980 nm

Technical Specification

Part Number	Standard Package	Peak Output Power P_{ko} (W)	Peak Forward Current I_F (A)	Pulse Width t_w (ms)	Maximum Duty Factor DF (%)	Beam Diverg. Q˝xQ^ (deg.) FWHM	Fibre Optic Core/Clad Diam. (µm)
C86118EH	CD9.0CAP	1.5	2	10	10	10x35	—
C86155E-10	miniDIL	1.2	2	10	10	—	100/140
C86159E-09	miniDIL	2	4	10	10	—	200/240

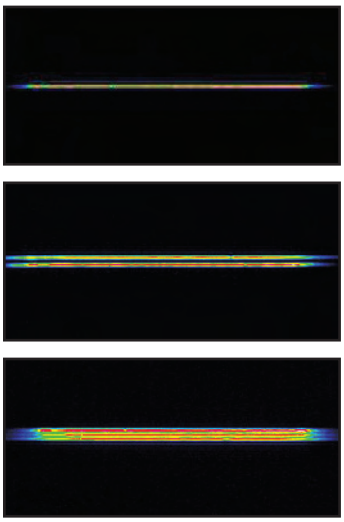
Test conditions: T = 22°C

Double Heterostructure and Quantum Well Types–850 nm and 1064 nm

Technical Specification

Part Number	Standard Package	Centre Wavelength l_0 (nm)	Peak Output Power P_{ko} (W)	Peak Forward Current I_F (A)	Pulse Width t_w (ns)	Maximum Duty Factor DF (%)	Beam Diverg. Q˝xQ^ (deg.) FWHM	Fibre Optic Core/Clad Diam. (µm)
C86153E-12	14 pin DIL	850	1.0	5	200	0.1	—	62.5/125
C86119EH	10/32 COAX	1064	2	4	200	0.1	10x40	—
C86120E-10	14 pin DIL	1064	0.4	4	200	0.1	—	100/140

Test conditions: T = 22°C



Comparison of the Optical Near Field of Laser Diodes with One, Two or Three Epitaxial Layers

The near-field height of single, dual, and triple epitaxial cavity lasers is 1, 7, and 10 µm, respectively, with a width of 225 µm each. Multiple epitaxial cavity lasers with smaller widths (for example, 75 µm for coupling into multimode fibers) are also available.

Multiple Epi-Cavity Lasers 905 nm, TO-52

Technical Specification

Laser diode	Maximum Duty Factor DF (%)	Emitter Size (µm²)	Beam Diverg. Q˝xQ^ (deg.) FWHM	Output Power (W)	Pulse Width t_w (ns)	Max Peak Current (A)	Number of Cavities
DPGAS1S03H	0.1	75x10	10x25	15	100	10	2
TPGAS1S03H	0.1	75x10	10x25	23	100	10	3
DPGAS1S09H	0.1	225x10	10x25	48	100	30	2
TPGAS1S09H	0.1	225x10	10x25	75	100	30	3
TPGAS2S09H	0.1	225x175	10x30	142	100	30	2x3
TPGAS3S09H	0.1	225x325	10x30	200	100	30	3x3

DPGA and TPGA laser diodes are based on the PGA type. Response time is below 1 ns.

Multiple Epi-Cavity Lasers 905 nm, Plastic, TPGEW series

Technical Specification

Laser diode	Maximum Duty Factor DF (%)	Peak Output Power P_{ko} (W)	Peak Forward Current I_F (A)	Pulse Width t_w (ns)	Number of Cavities
DPGEW1S09H	0.1	50	30	100	2
TPGEW1S09H	0.1	75	30	100	3

line scan imagers

Features
- 2500:1 dynamic range
- Ultra-low image lag
- Electronic exposure control
- Antiblooming control
- Square pixels with 100% fill factor
- Extended spectral range – 200–1000 nm

Typical Applications
- High-speed document reading
- Web inspection
- Mail sorting
- Production measurement
- Position sensing
- Spectroscopy

Principle of Operation
Line scan sensors are ideal for imaging objects in motion on webs or conveyors.

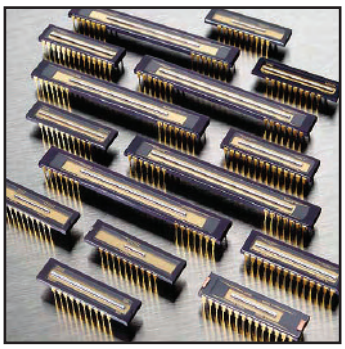
Datasheets available upon request.

Description
Line scan sensors are ideal for imaging objects in motion on webs or conveyors. Applications range from inspection of lead frames and labels to scanning mail and parcels.

P-Series Linear Photodiode Array Imagers
In P-series linear imagers, PerkinElmer has combined the best features of high-sensitivity photodiode array detection and high-speed, charge-coupled scanning to offer an uncompromising solution to the increasing demands of advanced imaging applications. These high-performance imagers feature low noise, high sensitivity, impressive charge-storage capacity, and lag-free dynamic imaging in a convenient 1-output architecture. The 14 µm square contiguous pixels in these imagers reproduce images with minimum information loss and artifact generation, while their unique photodiode structure provides excellent blue response extending below 200 nm in the ultraviolet.

The two-phase CCD readout registers require only modest clocking voltages, yet achieve excellent charge-transfer efficiency. Additional electrodes provide independent control of exposure and antiblooming. Finally, high-sensitivity readout amplifiers provide a large-output signal to relax the noise requirements on the camera electronics that follow. These versatile imagers are available in array lengths of 512 to 4096 elements with either low-cost glass or UV-enhanced fused silica windows. PerkinElmer Optoelectronics also maintains capabilities to manufacture line scan imagers up to 8192 pixels combined with 4 outputs and 7 or 14µm pixels with existing designs. Contact PerkinElmer for more information.

All line scan imagers are RoHS compliant.



Line Scan Imagers—P Series

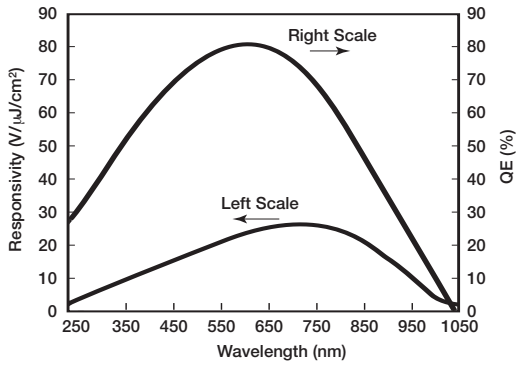
P Series

Technical Specification

Part Number	Pixel Count Elements	Pixel Size µm	Number of Outputs	Spectral Response Range nm	Pixel Data Rate MHz	Dynamic Range	Horizontal Clocking typ.
RL0512P	512	14x14	1	200–1000	40	2500:1	2 ø @ 5 V
RL1024P	1024	14x14	1	200–1000	40	2500:1	2 ø @ 5 V
RL2048P	2048	14x14	1	200–1000	40	2500:1	2 ø @ 5 V
HL2048P	2048	14	2	200–1000	80	2500:1	2 ø @ 5 V
HL4096P	4096	14	2	200–1000	80	2500:1	2 ø @ 5 V

Operating Temperature: 0°C min. to +55°C max.
Storage Temperature: -25°C min. to +85°C max.
Lag: <1%
Saturation Voltage: 600 mV

Spectral Sensitivity Curve



cmos photodiode arrays

Features

- 2.5 mm photodiode aperture
- Extremely low dark leakage current
- Low power dissipation
- Clock-controlled sequential readout at rates up to 1 MHz
- Single-supply operation with HCMOS-compatible inputs
- Single shift register design
- Wide dynamic range
- Differential video output for clock noise cancellation
- High saturation charge 10 pC (25 µm) or 20 pC (50 µm)
- Antiblooming function for low crosstalk
- Line Reset Mode for simultaneous reset of all photodiodes
- Wide spectral response: 300 to 1000 nm
- Polished fused silica window
- On-chip diodes (two) for temperature monitoring

Typical Applications

- Spectroscopy
- Colorimetry

Datasheets available upon request.

Description

For nearly thirty years, PerkinElmer Optoelectronics has been a leader in the development of sensors for spectroscopy. In spectroscopy and other instrumentation applications, large pixels, very high charge storage capacity, low readout noise and dark current, and direct access to the charge packet are all critical to delivering the high dynamic range and linear response demanded. The CMOS photodiode array architecture meets all of these needs in a way no other sensor technology can match.

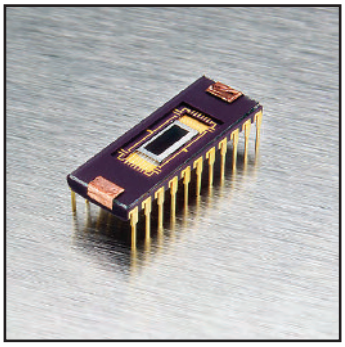
L-Series Visible Range Spectroscopy Arrays

PerkinElmer Optoelectronics' L-series CMOS linear photodiode arrays offer a high-quality, low-cost solution for spectroscopy and colorimetry applications in the 300–1000 nm range. The L-Series family's combination of high sensitivity, low dark current, low switching noise and high saturation charge provides excellent dynamic range and great flexibility in setting integration time.

L-series sensors consist of a linear array of silicon photodiodes, each connected to a MOS switch for readout controlled by an integrated shift register scanning circuit. Under external clock control, the shift register sequentially enables each of the switches, directing the charge on the associated photodiode to an output line. A dummy output provides clock noise cancellation. L-series devices are mounted in ceramic side-brazed, 22-pin, dual-inline packages with ground and polished fused silica windows and are pin-compatible with earlier PerkinElmer SB- and TB-series sensors.

L-series models are available with pixel spacings of 25 µm and 50 µm and lengths from 128 to 1024 pixels. All models feature a 2500 µm pixel aperture to simplify alignment in spectroscopic instruments.

All CMOS photodiode arrays are RoHS compliant.



L-Series Linear CMOS Spectroscopy Sensor— 25 or 50 µm Pitch, 2.5 mm Aperture

- 128, 256, 512 or 1024 photodiode elements with 25 µm center-to-center spacing
- 128, 256, or 512 photodiode elements with 50 µm center-to-center spacing

L Series

Technical Specification

Part Number	Video Capacitance @ 5 V bias pF	Video Capacitance @ 2.5 V bias pF	Sensitivity C/J/cm²	Saturation Exposure nJ/cm²	Saturation Charge pC	Dynamic Range	Dark Current typ. pA
RL1201	—	6.7	$2x10^{-4}$	50	10	70,000	0.2
RL1202	—	10.2	$2x10^{-4}$	50	10	70,000	0.2
RL1205	—	15.4	$2x10^{-4}$	50	10	70,000	0.2
RL1210	—	28.7	$2x10^{-4}$	50	10	70,000	0.2
RL1501	9.1	—	$4x10^{-4}$	50	20	100,000	0.4
RL1502	14	—	$4x10^{-4}$	50	20	100,000	0.4
RL1505	25	—	$4x10^{-4}$	50	20	100,000	0.4

Sensitivity Exposure/
Saturation Charge: Measured at 2.5 V video line bias
average 600-700 nm, includes 8% window loss

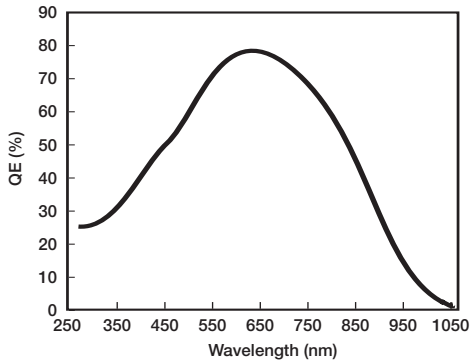
Dark Current: Maximum dark current ≤1.5 x average dark current

Spectral Response Peak: 650 nm, Range: 300–1000 nm typ.

Operating Temperature: 0°C min. to 55°C max.
Storage Temperature: -78°C min. to +85°C max.

Center-to-center spacing: RL12XX, 25 µm
RL15XX, 50 µm

Quantum Efficiency



SmartBlue™

Features

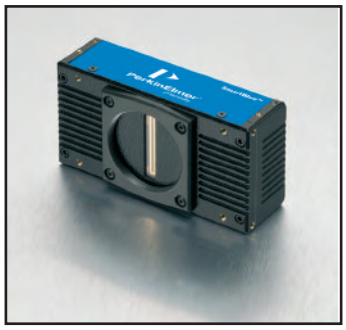
- High Speed, up to 80 MHz data rate.
- 14 µm square pixels in 512, 1024, 2048 or 4096 element resolutions.
- Small size 101.6 x 57.2 x 38.1 mm
- 8/10/12- bit output format
- High line rates up to 68 kHz
- 66 db Dynamic Range
- High Sensitivity Pinned Photo Diode CCD Sensor
- CameraLink™ base output
- User Controlled Smart Pixel Correction
- Antiblooming control
- Single 12 VD.C. power supply
- Electronic exposure control
- Adjustable gain levels
- Real time status LEDs
- CE mark certified

Typical Applications

- High speed inspection
- Postal / parcel sorting
- Web inspection
- Surface inspection
- OCR / barcode reading

The new SmartBlue™ digital linescan cameras incorporate the latest in photodiode array technology based on the industry standard Reticon® devices with state of the art electronics and a robust industrial camera housing. The linescan photodiode array is a Pinned Photodiode Charge Couple Device which allows for high sensitivity, fast readout, while maintaining high dynamic range, and low image lag.
The new SmartBlue™ cameras are cost effective high performance digital linescan cameras, and feature a CameraLink™ digital interface. These cameras feature geometrically precise photodiode CCD image sensor with 14 um square pixels with resolutions of 512, 1024, 2048 and 4096 pixels. This “next generation” array can achieve data rates up to 80 MHz with superior noise immunity, precise linearity, and high CTE.
The SmartBlue™ digital cameras are designed for high line rate applications with low to moderate light conditions and where small size, and low cost are required.

All SmartBlue™ cameras are RoHS compliant.



SmartBlue 512, 1024, 2048

SmartBlue 4096

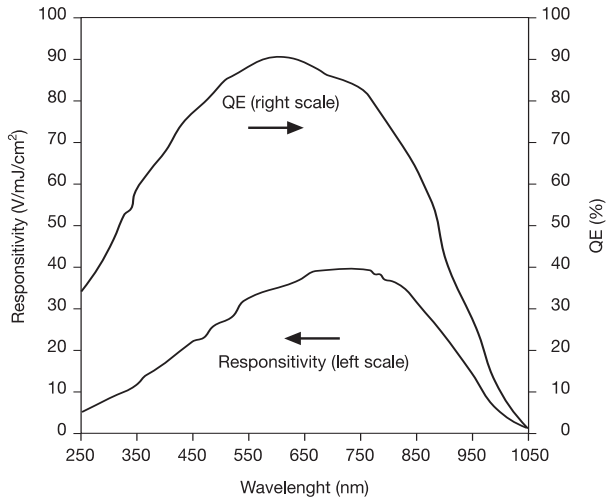
General Characteristics		
Pixel Size	14x14	µm
Number of Pixels	512, 1024, 2048, 4096	
Window Material	Glass / Fused Silica	
Spectral Range	200–1100	nm
Data Rate	40 x 1 or 40 x 2	MHz
Output Format	8 / 10 / 12	bits
Data Interface	CameraLink™, Base	
Control Interface	CameraLink™ serial	
Input Supply	12 +/-10%	V.D.C
Dynamic Range	66	dB

Principle of Operation

The two-point Flat Field pixel correction circuits give the user the flexibility of correcting video data to compensate for non-uniformities in lighting, lens, or CCD sensor variations. Adjustable gain and offset controls allow users to compensate for variations in illumination found in the "real-world" applications. The robust design in conjunction with PerkinElmer's ultra modern manufacturing techniques allows the SmartBlue™ camera to deliver consistent, reliable performance while the rugged industrial design metal housing provides the maximum protection in a variety of harsh environments and factory floor conditions.

SmartBlue™ cameras transform light imaged during an exposure period into a digital video signal. Antiblooming structures within the CCD sensor ensure superior performance over a wide range of lighting conditions. User defined control is possible for line rate, exposure time, video gain and offset. SmartBlue™ cameras have an internal self diagnostics with real time status LEDs in addition to a test pattern mode to allow the user to quickly debug and isolate potential problems within an imaging system. In the self diagnostic test pattern mode, an internal pattern generator will output data via the CameraLink™ interface while the status LEDs will indicate operation of the camera communication control signals. The SmartBlue™ linescan cameras may be interfaced to any CameraLink™ compatible frame grabber card, allowing for a tested, 'plug and play' imaging solution. Typical high performance linescan applications include lumber processing, document scanning, dimensional gauging, biomedical imaging, bar code scanning, and many more industrial and scientific measurement applications.

Spectral Sensitivity Curve (1x Gain)



Technical Specification

Part Number	Resolution	Window	Max. Line Rate (kHz)
SB5440CLG-011	512	Glass	68
SB5440CLG-011	512	F Silica	68
SB1440CLG-011	1024	Glass	36.4
SB1440CLG-011	1024	F Silica	36.4
SB2480CLG-011	2048	Glass	37.3
SB2480CLG-011	2048	F Silica	37.3
SB4480CLG-011	4096	Glass	19.1
SB4480CLG-011	4096	F Silica	19.1

cooled ccd sensors

Features

- 363,000 picture elements (pixels) in a 1100x330 configuration
- 24 µm square pixels
- 2-phase buried channel process
- On-chip amplifier for low noise and high-speed readout
- Dynamic range greater than 25,000:1
- On-chip temperature sensor
- Two-stage TE cooler integrated into the package
- Hermetically sealed
- 100% fill factor
- 10 MHz data rate

Typical Applications

- Spectroscopy
- Fluorescence microscopy
- Luminescence
- Protein quantification

General Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Units
Format			1100x330		
Pixel Size			24x24		µm
Imaging Area			26.4x7.92		mm
Dynamic Range	DR		25,000:1		
Full Well Charge	Q_{SAT}	250	300		Ke-
Saturation Voltage	V_{SAT}	1000	1200		mV
Dark Current MPP	DL		1	3	pA/cm2
Photo Response Non Uniformity	PRNU		5	10	±%
Dark Signal Uniformity	DSNU		2	5	±%
Charge Transfer Efficiency	CTE	>0.9999	>0.99995		
Output Amplifier Gain			4		µV/e-
Operating Frequency	fclock			10	MHz
Read Noise			10		e-

Dynamic Range: Full well/read noise, MPP mode
Full Well Charge: RLoad = 5.1 kΩ, MPP mode
Dark Current MPP: MPP mode at -15˚C
Read Noise: Measured at 500 kHz at -15˚C

tdi imagers

PT1109AAQ-711 Features

- 1024 pixel x 96 stage
- Unidirectional operation
- 20 MHz data rate
- High dynamic range (>5000:1)
- Line rates to 19 kHz
- Quantum efficiency of 42% at 700 nm
- 13 µm x 13 µm pixel size
- >0.99995 horizontal, >0.9999 vertical CTE at maximum saturation exposure

Typical Applications

- Semiconductor inspection
- Wafer inspection
- Sorting applications

Datasheets available upon request.

Technical Specification

	PT1109AAQ-711
Pixel Count*	1024 active elements
Extra Stages*	8
Pixel Size	13x13 µm
Number of Directions	1
Integration Stages**	96
Extra Stages**	1
Number of Outputs	1
Pixel Rate	20 MHz
Line Output Rate (max.)	18.1 kHz
Pixel Fill Factor	100%
Net Quantum Efficiency	>42% at 700 nm
Power Dissipation	—
Well Capacity	400,000 electrons per pixel
RMS Noise	—
Dynamic Range	>5000:1
CTE @ Q_{sat}	>0.99995 (horizontal) >0.9999 (vertical)
Photo Response Non-Uniformity (PRNU)	+/-10%
Spectral Response	400–1000 nm
Dark Current	—
Sensitivity	3.5 µV/electron
Operating Temperature	0 to 55˚C
Package Type	32 pin ceramic

Operating Temperature: 0˚C min. to 50˚C max.
* In readout direction
** In TDI direction

Optoelectronics Headquarters:
PerkinElmer Optoelectronics, 44370 Christy Street, Fremont, CA 94538-3180, USA
P: (+1) 510-979-6500, (+1) 800-775-6786 (toll-free), **F:** (+1) 510-687-1140, opto@perkinelmer.com

North America Customer Support Hub, 22001 Dumberry Road, Vaudreuil-Dorion, Québec, Canada J7V 8P7
P: (+1) 450-424-3300, (+1) 866-574-6786 (toll-free), **F:** (+1) 450-424-3345, opto@perkinelmer.com

European Headquarters, Wenzel-Jaksch-Str. 31, 65199 Wiesbaden, Germany
P: (+49) 611-492-247, **F:** (+49) 611-492-170, opto.Europe@perkinelmer.com

Asia Headquarters, 47 Ayer Rajah Crescent #06–12, Singapore 139947
P: (+65) 6775-2022, (+65) 67704-366, **F:** (+65) 6775-1008, opto.Asia@perkinelmer.com

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