

PREMA SEMICONDUCTOR GmbH

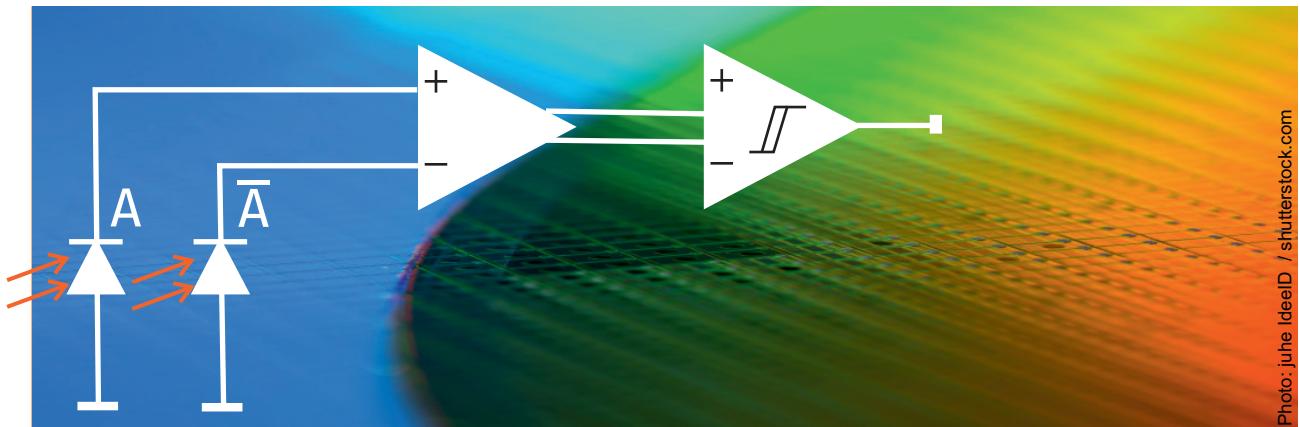
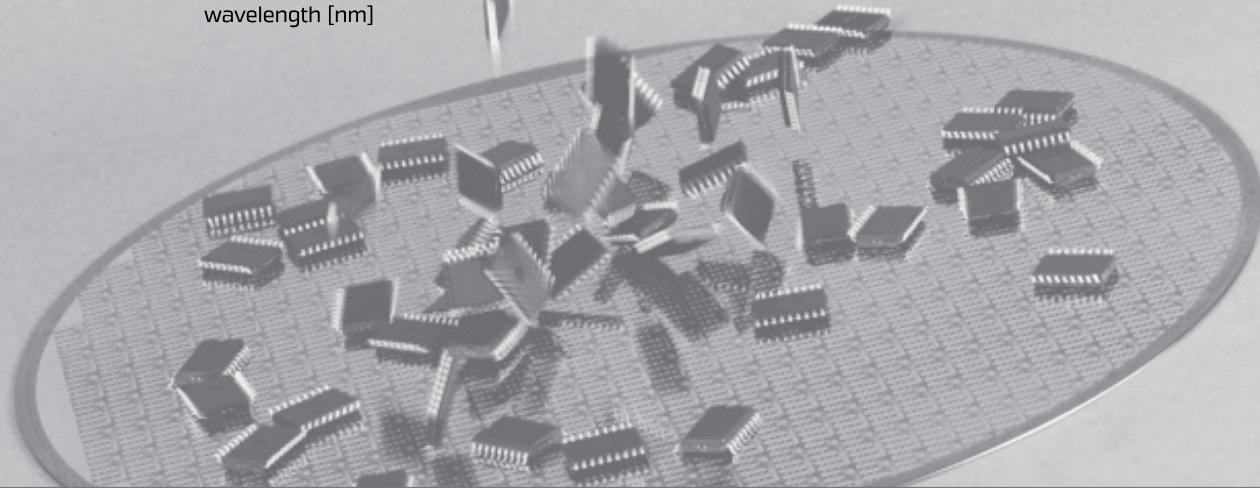
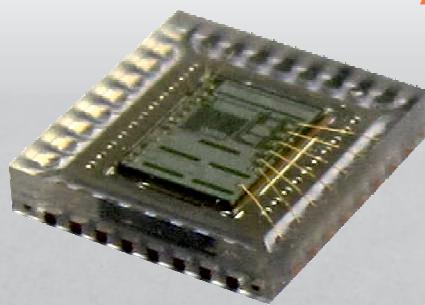
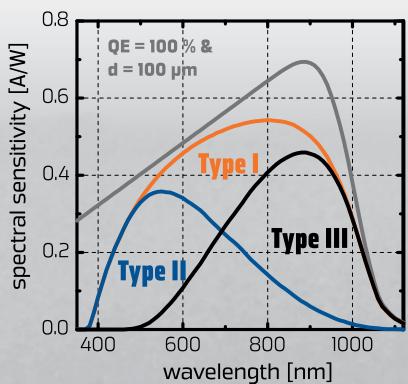


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Opto ICs and Photodiode Arrays



Quality made in Germany

Opto ICs

Photodiodes and Circuits as One Chip

Photodiodes and analog circuits can be combined in an ideal way in the PREMA process, using high voltage implantation. This brochure gives some examples of photodiodes, passive or combined with high-performance amplifiers, as examples of ICs that PREMA can design and produce for your application.

Key features:

- Low dark current allows use in a wide temperature range.
- Use of different junctions in different depth allows the choice between different spectral sensitivities
- All photodiode types available without any extra layers, compared with basic bipolar or BiCMOS process
- Antireflective coating available as process option

Order your custom opto IC:

- Low tooling costs - few mask layers
- Low design costs - typical photocurrent amplifiers and other analog circuits available as qualified circuit blocks
- Optimized geometries for your application

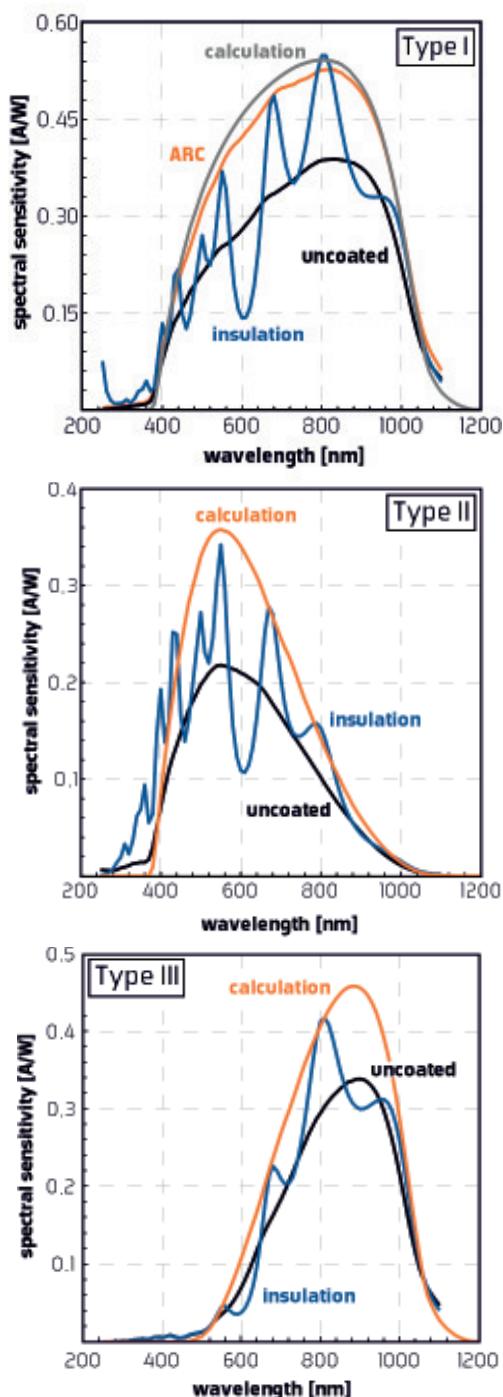
Diagrams on the right: Spectral sensitivities of different types of photodiodes:

Type I = widerange

Type II = biased to visible range

Type III = biased to red and near infrared range

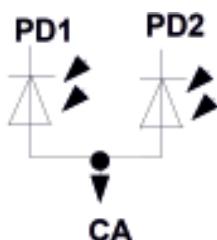
Blue curve gives typical sensitivity without ARC process option.



Photodiode Arrays

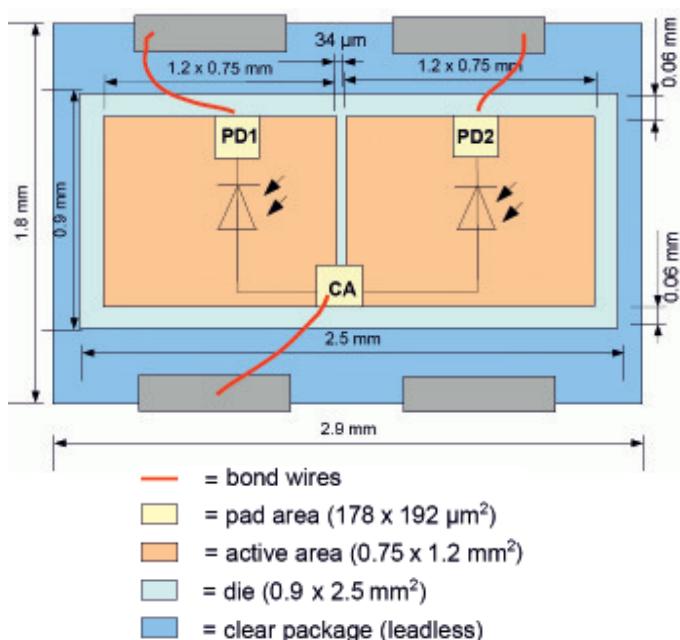
With Customized Geometries of Photodiodes

PREMA can design and produce ICs with photodiodes arranged in the way you need it. Applications are one or two-dimensional position detectors, shutter monitors, range-measurement systems and many more.



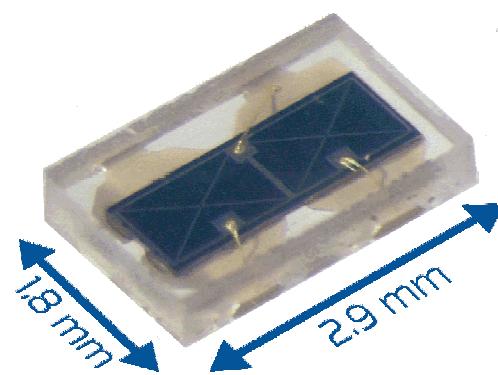
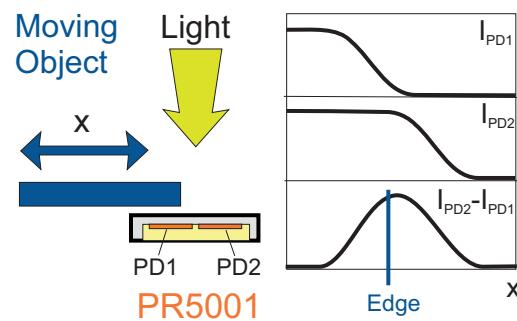
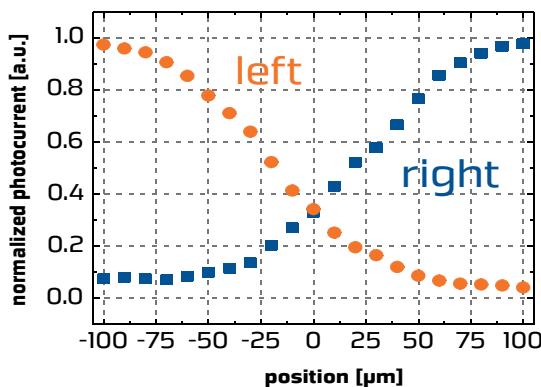
One example of a photodiode array is the dual photodiode PR5001, which PREMA offers as a standard IC.

The PR5001 is a dual-element Si photodiode moulded into a small plastic leadless optical package. The photodiodes offer a very good symmetry, low dark current and high sensitivity.



Geometry of PR5001 photodiodes within the QFN-4L package

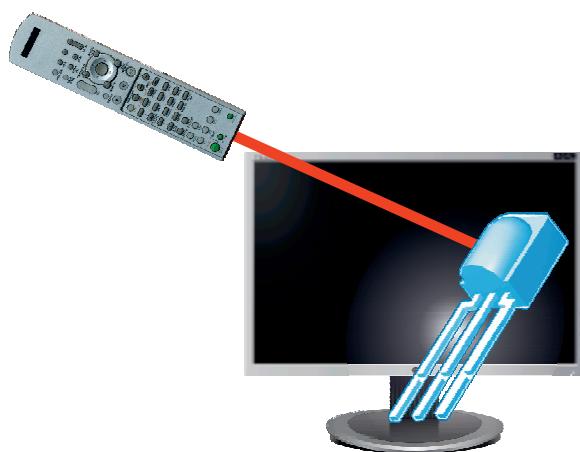
PR5001 is sensitive at wavelengths in the range between 500 and 1000 nm. Its good spatial resolution makes it ideal for applications such as edge detectors.



Infrared Receivers

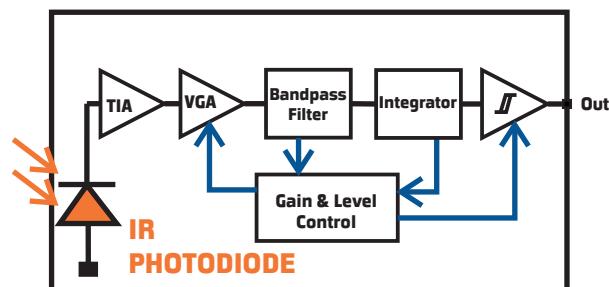
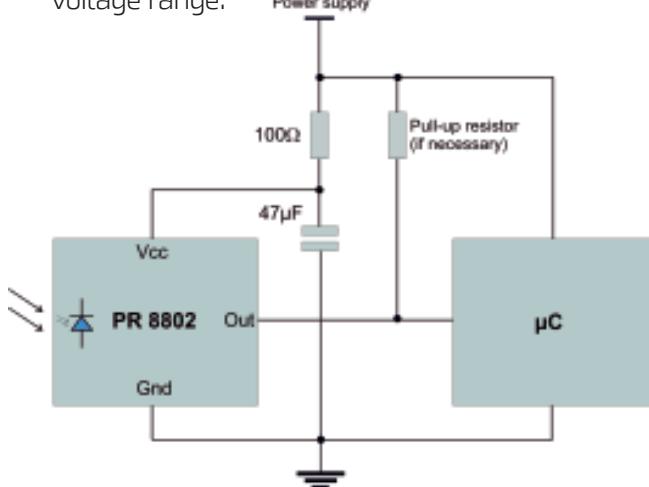
IR Photodiode and Filter Circuit on the same Chip

An infrared receiver for remote control and data transmission applications is an example of a photodiode combined with analog signal processing on one chip.

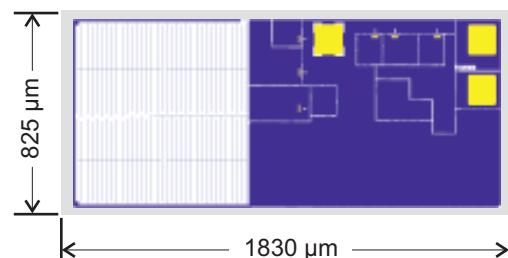


It is a fully integrated IR receiver for remote control systems, containing the infrared photodiode, variable gain amplifier, bandpass filter, integrator and digital output stage. The monolithically integrated photodiode allows a very easy assembly with only three bond wires. Because of its small size it is well suited for SMD packaging. An internal voltage regulator assures constant performance data over the full supply voltage range.

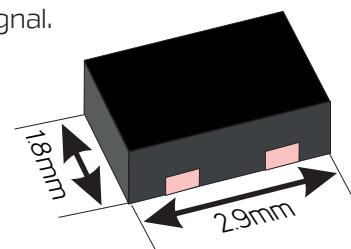
Power supply



Block diagram of infrared receiver IC, including photodiode, transimpedance amplifier, variable gain amplifier with gain and level control circuit, bandpass filter, integrator and comparator with output driver.



A photodiode with 0.5 mm^2 and the analog circuit are combined in one layout. No bonding connection is required between photodiode and chip, also avoiding an antenna effect at the highly sensitive photodiode signal.



It is possible to assemble the die into an infrared-transparent, optically opaque DFN package, making it the smallest infrared receiver available.

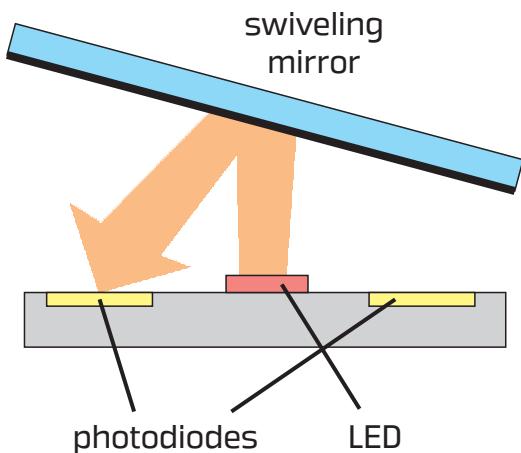
Differential Photodetectors

4-Quadrant Photodiode with Transimpedance Amp

Unique applications require unique photosensor solutions. Under one roof, PREMA Semiconductor can design and produce ICs optimized for your application.

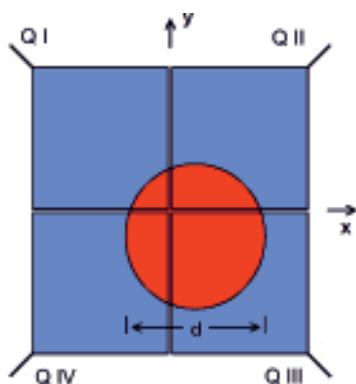
Project example 1:

The deflection of a swiveling mirror above a surface should be detected by measuring the difference of light intensity reflected to the corners of a 3 mm x 3 mm surface. In the centre of the chip an LED is mounted.



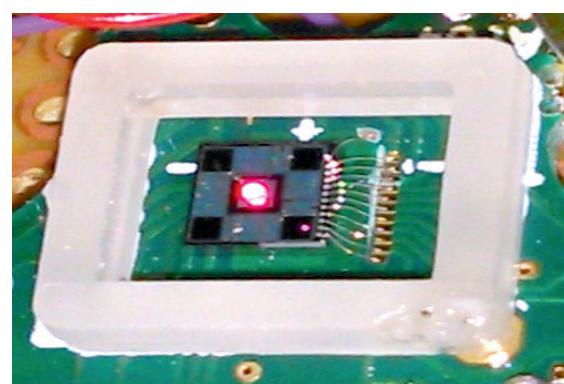
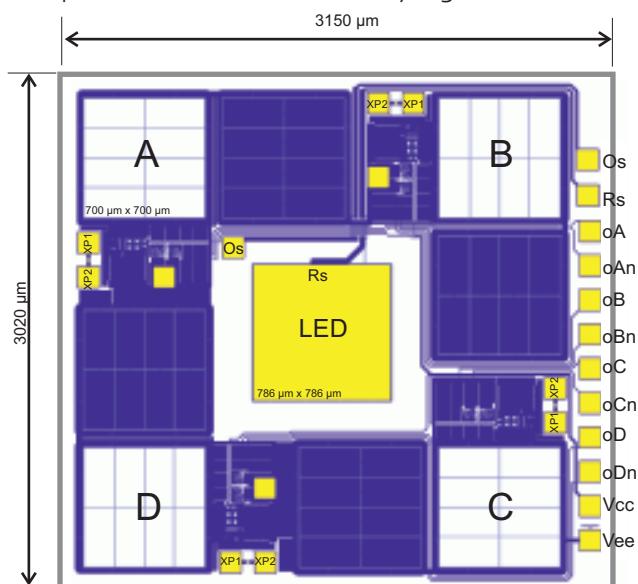
Project example 2:

For alignment of a laser beam the distribution of the light on the four quadrants should be evaluated. In this case the photodiodes cover the whole area to the centre of the chip.



The chip consists of four photodiodes with four transimpedance amplifiers, two fully differential amplifiers and output buffers. It can detect vibrations of the mirror up to 1 MHz.

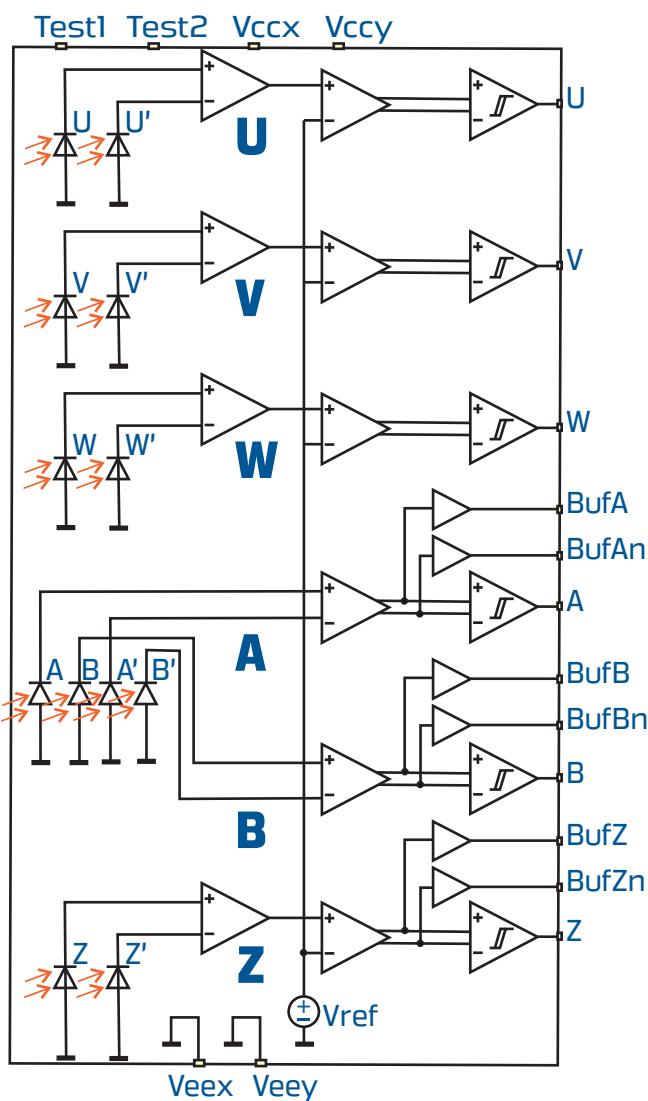
The LED current can be controlled as to produce a constant intensity signal.



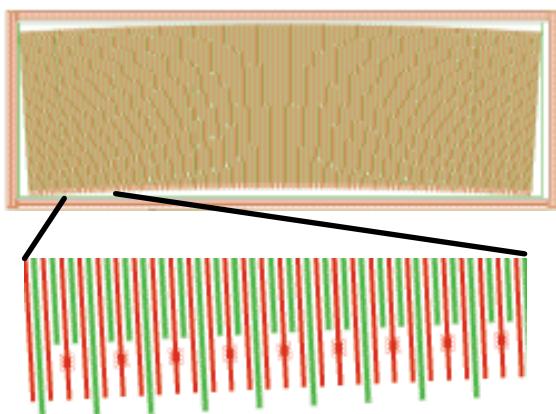
Optical Encoders

Fine-Pitch Photosensors with Signal Processing

Optical encoders measure rotations or translations, such as in robots, pumps, machine tools or printers. Sensor ICs for optical encoders require a high spatial resolution and a good channel separation for photodiodes, as well as high-performance analog circuits for signal processing.

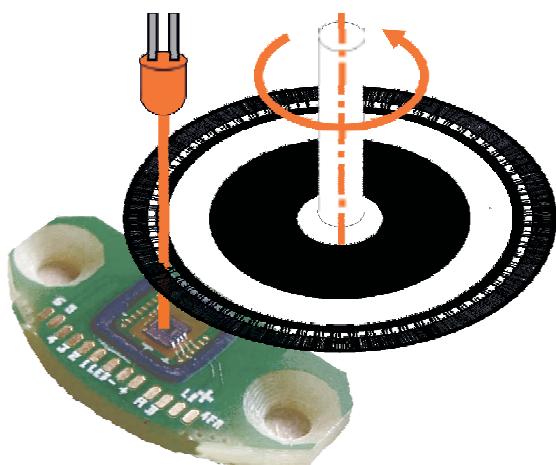


Block diagram of photodiodes, trans-impedance amplifiers, comparators and buffers, as used in a 6-channel optical encoder.



Example of interleaved photodiodes with angular structure for A/B channel of an optical encoder.

Minimum pitch in this example is 14 μm .

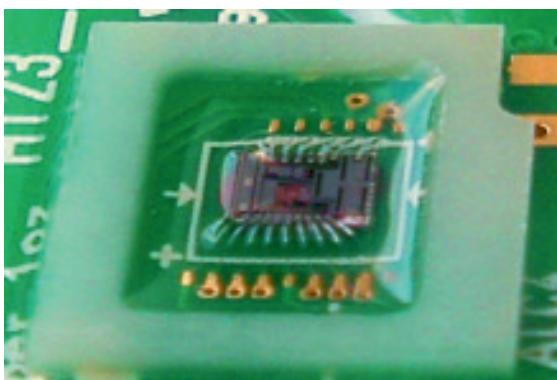


Principle application with sensor chip on PCB, rotating coding disk and LED in an optical rotary encoder.

Package Solutions for Opto ICs

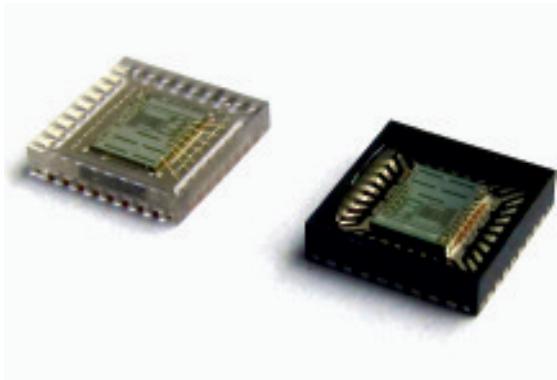
Opto ICs are part of a sensor system and must be packaged according to the field of application. PREMA offers package solutions for different requirements.

Chip-on-Board Assembly



Chip-on-board assembly with transparent globtop allows individual solutions at low tooling costs.

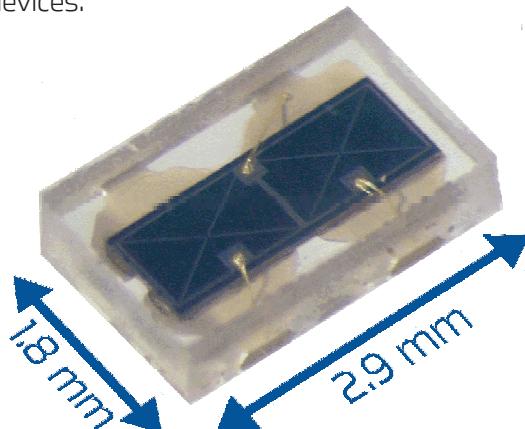
Optical QFN Packages



QFN packages with transparent mold compound (shown left) can be qualified to ambient temperatures up to 85°C. Open cavity QFN packages with transparent silicone filler (right) allow ambient temperatures above 125°C.

Tiny Optical DFN Packages

A tiny 4-lead QFN package is a perfect choice for many photodiode and opto IC circuits, such as ICs for photo-interrupters, photocurrent amplifiers, or position sensing devices.



QFN package with encoder IC on PCB

Unique Fabrication Process



PREMA Semiconductor GmbH has more than 30 years of experience in designing and manufacturing analog and mixed-signal circuits. With our in-house wafer processing facilities, we offer turnkey services from design, prototypes, test, to series production

in high volumes. It gives us the flexibility to react quickly on special demands, re-designing the circuit according to your requirements and producing wafers with modified circuits.

PREMA is a mid-sized, independent company. Our location in the Frankfurt area is perfectly suited for close cooperations with international customers.

In cooperation with reliable partners for chip-on-board, PCB and mechanical assembly we can offer complete solutions on PCB or module level.

We provide custom semiconductor products at affordable design and tooling costs that give your products and edge over your competitors and protect you against product copies.

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