



Industrial Sensing

**Highly precise
and robust
VCSEL solutions**

High quality VCSEL solutions for sensors in demanding industrial environments

TRUMPF offers innovative VCSEL solutions for industrial applications, from speed to distance to particle or vibration sensing, and many more. Single-mode VCSELs with polarization control are the perfect choice for demanding sensor applications due to their superior optical characteristics.

Gas sensing

760-766 nm for oxygen sensing

For gas detection, the use of narrowband lasers with a single wavelength is ideal. Gas analyzers using VCSEL technology offer a fast-response and accurate measurement, that is highly specific to the gas of interest. This non-contact, in-situ measurement obtains real-time analysis.

Speed / distance sensing

850 nm and 940 nm for precise ToF and SMI measurement

VCSEL being the superior technology, when it comes to short switching times and narrow optical spectrum – makes them the best choice for time-of-flight (ToF) and self-mixing interference (SMI) sensing technology.

Particle sensing

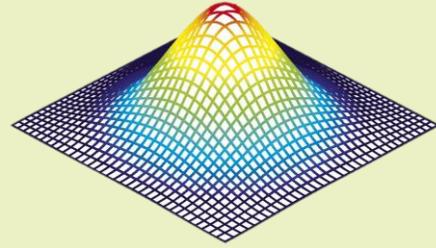
850 nm for air quality sensing

Optical sensors using VCSEL self-mixing interference technology allow real-time air quality measurement. VCSELs are a compact, reliable laser source, that are maintenance free and insensitive to sunlight. High resolution sensors are supported.

Single-mode VCSEL light sources offer excellent and reliable performance over a wide range of conditions

Features:

- Wavelengths:
 - 760 - 766 nm, 850 nm, 940 nm
 - Precise wavelength tunability
 - Narrow 2 nm spectral width
- High frequency modulation up to 100 MHz
- Linearly stable polarization
- Sub-nanosecond single pulses with wide range of duty cycles
- Innovative chip design:
 - Higher-order longitudinal and transversal modes are suppressed
 - Small footprint



In the far field, the intensity distribution of the single-mode VCSEL is perfectly Gaussian shaped. The absolutely symmetrical and Gaussian-shaped beam profile makes the optical design of applications significantly easier.

Wide variety of industrial grade packages

From single component to TO cans to product assembly

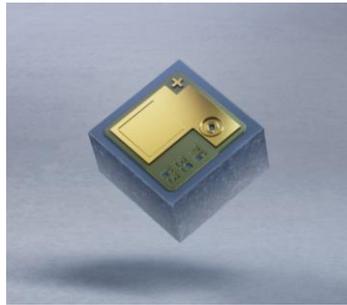
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Components

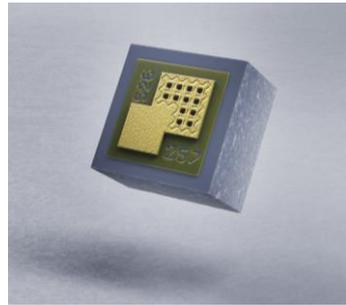
Product variants of single-mode VCSEL



VCSELs in a hermetically sealed housing and temperature control, also available without TEC



Chip die - 2 mW 850 nm VCSEL for high-volume applications and highly integrated sensors



Chip die - 18 mW 940 nm VCSEL array for high-volume time-of-flight proximity sensing in camera auto-focus sensors with short distance linearity



Chip die - two 850 nm VCSELs with single integrated photodiode (ViP) for high-volume self-mixing interferometry sensing applications and integrated speed sensors

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TO cans

The robust solution for demanding environmental conditions

Single-mode VCSELs in a hermetically sealed TO housing allow easy handling of the laser diode and are suitable for operation in demanding ambient conditions. An additional Zener diode protects the laser diode from damage caused by electrostatic discharge (ESD). The VCSELs are also subjected to burn-in to stabilize the lasers.

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Packaging

Further integration and chip assembly

TRUMPF also offers more advanced product integration. Further customization such as integrating driver electronics or special optics is possible. Highly automated systems take over the assembly and integration of VCSEL laser diodes into more complex systems. The VCSELs can thus be handled safely and easily.

For more information visit

<http://www.trumpf.com/s/industrial-sensing>

