

Photon Detection Solutions

For Health, Safety and
Security Applications



Photon detection for
tomorrow's cutting-edge
applications.

EXCELITAS
TECHNOLOGIES

Making your World Healthier, Safer & More Secure.

At Excelitas, we're sensing what you need for a healthier, cleaner and safer tomorrow. From Photon Counting Modules to Silicon Detectors, InGaAs Detectors, and Pulsed Laser Diodes, our photon detection technologies are addressing your high-performance and high-volume applications. We have the detection technologies and capabilities to enhance and accelerate your OEM designs. You can depend on our seven world-class design, manufacturing and R&D facilities including: Montreal, Canada; Wiesbaden, Germany; Fremont, USA; Singapore; Manila, Philippines; Shenzhen, China; and Batam, Indonesia. We're sensing what you need.

Our Photon Detection Solutions are contributing to:

Longer, Healthier Lives.

- Luminescence and fluorescence for analytical and clinical diagnostics
- Photon counting, particle sizing
- PET, CT, and MRI scanning

Enhanced Safety and Security.

- X-ray scanning of luggage, cargo and food
- Laser range finding – industrial and consumer
- Smoke detection
- Safety curtains

■ SECTION 1 • MODULES AND OPTICAL RECEIVERS

- SPCMs based on high-performing APDs – for visible and NIR single photon counting
- CPMs and modules for lowest dark noise applications
- CCD cameras – for high speed imaging
- PIN and APD hybrid receivers – for high signal detection

■ SECTION 2 • PHOTODIODE ARRAYS FOR X-RAY SECURITY SCANNING

- Photodiode solutions with scintillators for x-ray scanners

■ SECTION 3 • PHOTODIODES FOR HIGH-PERFORMANCE APPLICATIONS

- Si and InGaAs APDs and PIN photodiodes – for industrial applications and high-volume laser range finding
- Si APD arrays – for beam positioning and spectrometers
- Large-area/UV-enhanced APDs – for molecular imaging, high-energy radiation detection

■ SECTION 4 • PHOTODIODES & -TRANSISTORS FOR HIGH-VOLUME APPLICATIONS

- Smoke detection components
- Ambient light sensors
- Si-photodiodes and-transistors
- Infrared switches

■ SECTION 5 • PULSED LASER DIODES AND INFRARED LEDS (IREDS)

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MODULES & RECEIVERS FOR ANALYTICAL & MOLECULAR APPLICATIONS



Single Photon Counting Modules – SPCM

Applications

- Particle sizing
- Confocal microscopy
- Photon correlation spectroscopy
- Quantum cryptography
- Astronomical observation
- Optical range finding
- Adaptive optics
- Ultra sensitive fluorescence

Features and Benefits

- Peak photon detection efficiency at 650 nm: 65 % typical
- Active area: 180 μm diameter
- Gated output
- Single +5V supply
- FC receptacle option for fiber coupling
- EU RoHS compliant
- Array of 4 channels available

Product Description

SPCM-AQRH is a self-contained module that detects single photons of light over the 400 nm to 1060 nm wavelength range - a range and sensitivity that often outperforms a photomultiplier tube. The SPCM-AQRH uses a unique silicon avalanche photodiode (SLiK®) with a circular active area that achieves a peak photon detection efficiency of more than 65 % at 650 nm over a 180 μm diameter. The photodiode is both thermoelectrically cooled and temperature controlled, ensuring stabilized performance despite ambient temperature changes. Circuit improvements have reduced the overall power consumption.

Count speeds exceeding 20 million counts per second (Mc/s) are achieved by the SPCM-AQRH-1X module (> 30 million counts per second on some models). There is a “dead time” of 35 ns between pulses but other values can be set at the factory.

As each photon is detected, a TTL pulse of 2.5 Volts (minimum) high into a 50 Ohm load and 15 ns wide is output at the rear BNC connector. The module is designed to give a linear performance at a case temperature between 5 ° C and 40 ° C.

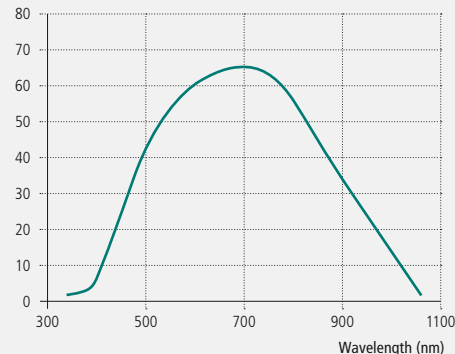
The SPCM is also available in a 4 channel array format, the SPCM-AQ4C. It is a module of 4 APDs with single power supply and 4 individual outputs.

This series of photon counting modules are designed and built to be fully compliant with the European Union Directive 2002/95/EEC - Restriction of the use of certain Hazardous Substances in electrical and electronic equipment (RoHS).

Graph 1

Characteristics SPCM Series

Photon Detection Efficiency (Pd)



Product Table

Single Photon Counting Modules – SPCM

| Part Number | Photo Sensitive Diameter | Maximum Dark Count Rate | Photon Detection Efficiency @ 700 nm | Max. Count Rate before Saturation | Dead Time | Pulse Width |
|---------------------------|--------------------------|-------------------------|--------------------------------------|-----------------------------------|-----------|-------------|
| Unit | mm | c/s | % | c/s | ns | ns |
| SPCM-AQRH-10 | 0.18 | 1500 | 65 % | 25M | 32 | 15 |
| SPCM-AQRH-11 | 0.18 | 1000 | 65 % | 25M | 32 | 15 |
| SPCM-AQRH-12 | 0.18 | 500 | 65 % | 25M | 32 | 15 |
| SPCM-AQRH-13 | 0.18 | 250 | 65 % | 25M | 32 | 15 |
| SPCM-AQRH-14 | 0.18 | 100 | 65 % | 25M | 32 | 15 |
| SPCM-AQRH-15 | 0.18 | 50 | 65 % | 25M | 32 | 15 |
| SPCM-AQRH-16 | 0.18 | 25 | 65 % | 25M | 32 | 15 |
| SPCM-AQ4C | Fibered | 500 | 60 % | >2M / channel | 50 | 30 |
| C30902SH-TC ¹ | 0.475 | 2500 | >5 % | - | - | - |
| C30902SH-DTC ² | 0.475 | 350 | >5 % | - | - | - |

1. C30902SH-TC (0° C operation), 2. C30902SH-DTC (-20° C operation)

Figure 1

Mechanical Dimensions of the SPCM-AQRH Series

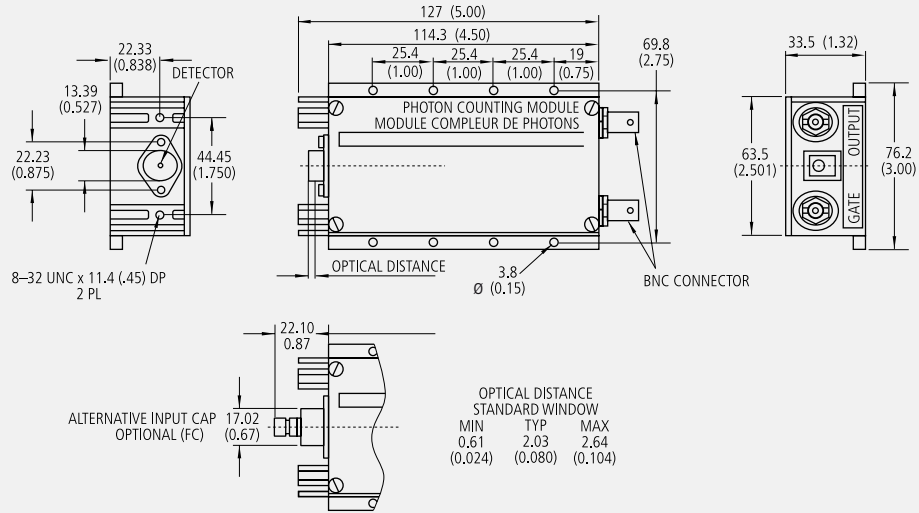


Figure 2

Mechanical Dimensions of the SPCM-AQ4C

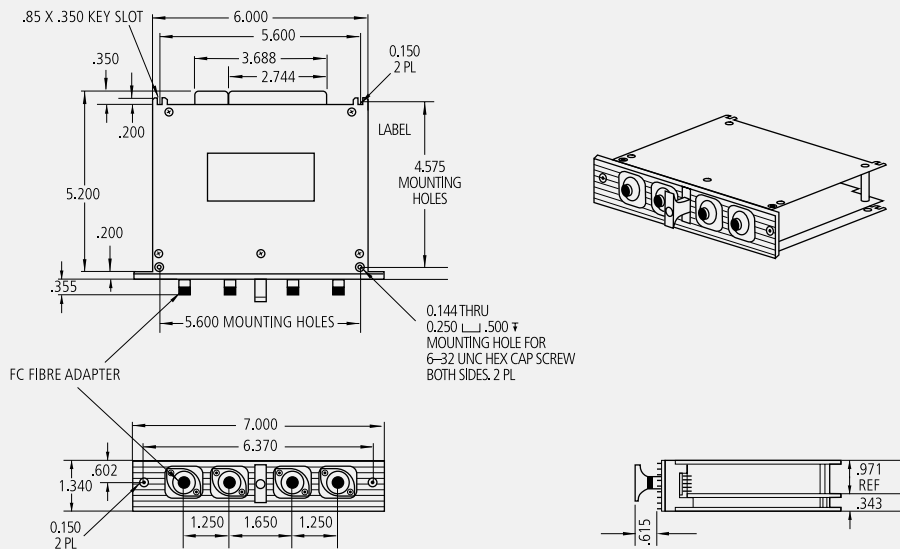
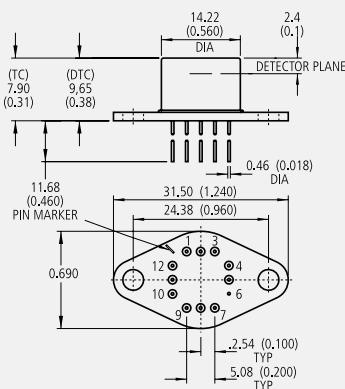


Figure 3

Package Drawing – TO-8 Flange



PHOTOMULTIPLIERS FOR MOLECULAR DETECTION IN ANALYTICAL APPLICATIONS & MEDICAL DIAGNOSTICS

MODULES AND OPTICAL RECEIVERS ■

Channel Photomultipliers
& Modules (CPM)



Channel Photomultipliers & Modules

Applications

- Photon counting
- Luminescence & fluorescence spectroscopy
- Microplate readers
- Clinical diagnostics
- DNA & cell analysis
- Particle measurements
- Industrial spectroscopy
- Nucleic acid amplification (PCR)

Features and Benefits

- Extremely low background noise
- Best low light level detection limits
- High dynamic range & gain
- Low microphonic & magnetic sensitivity
- Compact size & rugged design
- Multiple photocathode and window selections
- Plug and play for shortest design-in and time-to-market
- Customizations and added features available

Product Description

Excelitas' Channel Photomultiplier (CPM) Technology offers a portfolio of ultra-high sensitivity optical detectors designed for extremely low noise, high dynamic range, highest gain and fast response for analytical, scientific and clinical diagnostic applications. A variety of easy-to-use modules with different read-out electronics is available, enabling customers to benefit from the unique performance characteristics of the CPM technology.

Depending on the application requirements, customers can select plug-and-play modules for photon counting, DC applications, photon-counting detection up to gigacount range or any other method of photon detection. Added features like thermoelectric cooling, shuttering and other sorts of customization are available upon request. The CPM modules are ideally suited for use in human and environmental health, supporting the market needs for ever smaller sample sizes and lower detection limits in applications like microplate readers, nucleic acid amplification (PCR), luminescence or fluorescence spectroscopy.

Product Table

Channel Photomultipliers & Modules

| CPM Tube Model (also as P-Type ^{1,2}) | Spectral Response | Active Diameter (min.) | Remarks, Other Available Types | Dark Current / pA @ 1e5 | Equivalent Noise Input (ENI)/W _{1/2} (Hz) at Peak Resp. Wavel. (typ.) | Peak Wavelength (typ., nm) | Dark Counts for -P Type and MH-P (typ.) |
|---|-------------------|------------------------|--------------------------------|-------------------------|--|----------------------------|---|
| Unit | nm | mm | | Gain (typ.) | | | |
| C911 | | 5 | | 0.1 | 1.0 e ⁻¹⁷ | | 0.1 |
| C1311 | 115-200 | 9 | | 0.2 | 2.0 e ⁻¹⁷ | 140 | 0.4 |
| C1911 | | 15 | | 0.5 | 3.0 e ⁻¹⁷ | | 1 |
| C922 | | 5 | | 0.5 | 1.0 e ⁻¹⁷ | | 1 |
| C1322 | 165-320 | 9 | MgFl window available | 1 | 2.0 e ⁻¹⁷ | 200 | 4 |
| C1922 | | 15 | | 2 | 3.0 e ⁻¹⁷ | | 10 |
| C943 | | 5 | | 2 | 1.0 e ⁻¹⁷ | | 10 |
| C1343 | 185-650 | 9 | | 8 | 2.0 e ⁻¹⁷ | 400 | 40 |
| C1943 | | 15 | | 20 | 3.0 e ⁻¹⁷ | | 100 |
| C984 | | 5 | | 1 | 6.0 e ⁻¹⁸ | | 2 |
| C1384 | 300-670 | 9 | | 4 | 1.0 e ⁻¹⁷ | 350 | 10 |
| C1984 | | 15 | | 10 | 2.0 e ⁻¹⁷ | | 20 |
| C993 | | 5 | | 2 | 1.0 e ⁻¹⁷ | | 5 |
| C1393 | 185-750 | 9 | Quartz, Boro. window available | 8 | 2.0 e ⁻¹⁷ | 450 | 20 |
| C1993 | | 15 | | 20 | 3.0 e ⁻¹⁷ | | 50 |
| C963 | | 5 | | 20 | 4.0 e ⁻¹⁷ | | 100 |
| C1363 | 185-850 | 9 | Quartz window available | 80 | 8.0 e ⁻¹⁷ | 450 | 400 |
| C1963 | | 15 | | 200 | 1.0 e ⁻¹⁶ | | 1000 |
| C973 | | 5 | | 100 | 1.5 e ⁻¹⁶ | | 500 |
| C1373 | 185-900 | 9 | Quartz window available | 400 | 3.0 e ⁻¹⁶ | 500 | 2000 |
| C1973 | | 15 | | 1000 | 5.0 e ⁻¹⁶ | | 5000 |

1. P- types are photon counting suitable CPM or module types. When ordering please add -P : e.g.: C993-P, MH984-P

2. Also order number

Ordering Guide

| Series | Description |
|--------------------|--|
| | All modules are available with optical input aperture of 9 mm (9xx-series), 13 mm (13xx-series) and 19 mm (19xx-series). |
| MH series | Modules with direct anode output (comprising CPM and high voltage supply only) |
| MH P-type | MH modules with CPM tube specially selected for photon-counting applications |
| MD series | Modules for DC measurement, analog output: 0 to 10 Volts |
| MP series | Modules optimized for photon counting, digitized output via TTL interface |
| MPRS series | Modules optimized for photon counting, digitized output via RS232 interface |
| MPC series | Temperature stabilized (TE-cooled) MP modules, customized OEM projects only |
| GPDM series | Highest dynamic range (single photon/s to 1G photon/s range) module with digital output for fluorescence and luminescence measurements and other demanding applications. |

General Specification

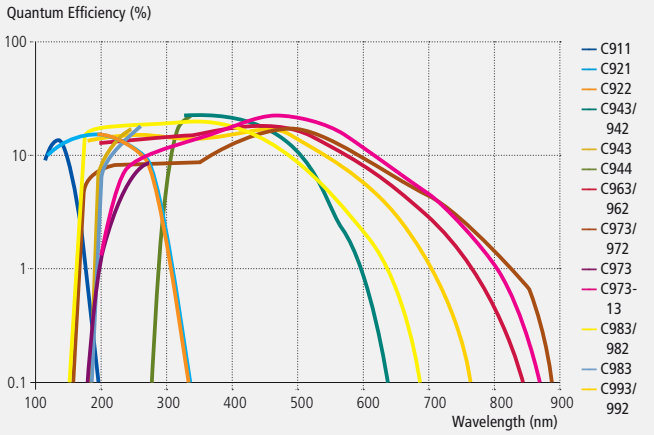
| Parameter | Remarks/ Conditions | Symbol | CPM (tube) | MH-Module MH-P-Type | MD | MP MPC | MPRS | GPDM | Unit |
|--|---|--------------------|--------------------------------|------------------------|----------------------|----------------------|----------------------|----------------------|-------------|
| Window materials | MgF2, quartz, UV glass, borosilicate | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| Photocathode materials | CsI, CsTe, low noise bialkali, bialkali, yellow enhanced, multialkali, extended red multialkali | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| Max. input current | Module input current | I_{DD} | | 200 | 250 | 250 ² | 250 | 300 | mA |
| Bias current (typ.) | CPM input current | I_{bias} | 40 | | | | | | μA |
| Supply voltage/ Input voltage | Modules include CPM high voltage supply | V_{DD} | 2000 V (typ.) 2600 V (max.) | +5 to +5.5 (max.) | +5 to +5.5 (max.) | +5 to +5.5 (max.) | +5 to +5.5 (max.) | +5 to +5.5 (max.) | Volts dc |
| Current amplification | 6e6 (typ.), 1e8 (max.) | | ✓ | ✓ | ✓ | ✓ | ✓ | (see note 3) | |
| Max. anode current | Output current (max. 30sec.) | I_{anode} | 10 | 10 | | | | | μA |
| Linear anode current | Max. (DC linearity limit) 10% of bias current ¹ | I_{lin} | ✓ | ✓ | | | | | |
| Linear count rate (typ.) | (see note 1) | CPS _{lin} | | | | 20 | 10 | 1000 | Mcps |
| Response time | Output pulse rise time | t_{resp} | 3 | 3 | | 3 | | | ns |
| Transit time | | t_t | 17 | 17 | | | | | ns |
| Transit time spread | Timing resolution/jitter | t_{ts} | 2 | 2 | | | | | ns |
| Output pulse width (FWHM) | Typical value | PW | 6 | 6 | | 20 | | | ns |
| Over-illumination protection | Active gate control | | | | ✓ | ✓ | ✓ | ✓ | |
| Output impedance | Termination for fast output pulse | | 50 | 50 | | 50 | | Digital | Ohms |
| Active gate control | TTL-pulse, active high | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| GATE voltage | TTL-level: low to high/high to low | V_{gate} | | 100/300 | 100/300 | 0.02/0.02 | | 100/300 | μs |
| Operating temperature | +5 to +40° C (other temperatures on request) | t_{op} | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| Storage temperature | -20 to +50° C | t_{store} | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| Weight | max. 350g/420g/450g (modules 9xx-series/13xx-series/19xx-series) | | | | | | | | |
| Output | | | Anode signal | Anode sig. | 0–10V | TTL | RS232 | USB/SPI | |

1. For long term operation: max. average output count rate of < 100 Kcps (anode current of < 100 nA) is recommended
 2. Cooling input power: 9VDC/3.5A Fan input power: 24VDC/100mA

3. Gain setting depending on operating mode – see separate datasheet

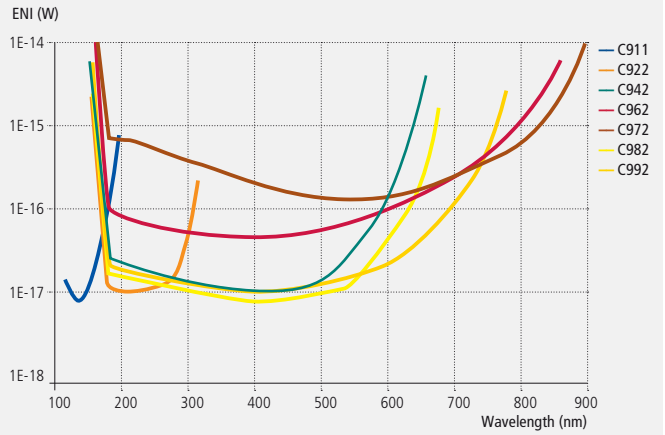
Graph 1

Spectral Response



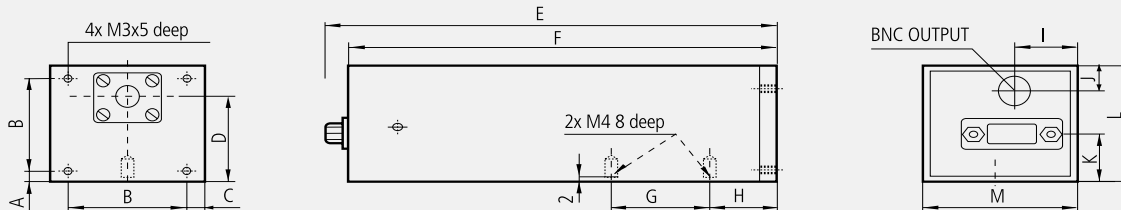
Graph 2

Equivalent Noise Input



Housing / Package Drawings

| Dimensions (mm) Module Type | A | B | C | D | E | F | G | H | I | J | K | L | M |
|--------------------------------|-----|----|-----|----|-----|-----|----|----|------|----|------|----|----|
| 9xx | 4.5 | 36 | 4.5 | 33 | 127 | 120 | 30 | 20 | 19.5 | 10 | 18 | 45 | 45 |
| 13xx | 4.5 | 36 | 7 | 33 | 132 | 125 | 30 | 20 | 19 | 10 | 22.1 | 50 | 50 |
| 19xx | 4.5 | 36 | 7 | 33 | 137 | 130 | 30 | 20 | 19 | 10 | 22.1 | 50 | 50 |



PHOTOMULTIPLIERS FOR MOLECULAR DETECTION IN ANALYTICAL APPLICATIONS & MEDICAL DIAGNOSTICS

MODULES AND OPTICAL RECEIVERS ■

Gigahertz Photon
Detection Module



Gigahertz Photon Detection Module

Applications

- Multimodal analytical measurements
- Luminescence spectroscopy
- Time-resolved fluorescence
- High through-put screening
- DNA & cell analysis
- Microplate reading

Features and Benefits

- Extremely low background noise
- Highest dynamic range
- High gain
- 4 different operating modes
- Variable Interface options
- Best suited for multimodal analytical applications

Product Description

The new CPM Gigahertz Photon Detection Module (GPDM) provides the capability of ultra low-light-level detection in DC mode operation. Using DC mode operation with single-photon-sensitivity makes the GPDM module superior to traditional counting circuits with their performance limitation at high-light-levels. The fully equipped module includes the Channel Photomultiplier, the high voltage supply, analog current amplifier, A to D conversion and a microcontroller with USB/SPI interface allowing the optimal adaptation to a wide range of applications. Additional features like the synchronization I/O offer the possibility to synchronize the measurement with other devices in the application like flash lamp trigger etc. Utilizing the generic noise advantage of the CPM technology together with highest dynamic range electronics the GPDM represents a real innovation in photon detection, well suited to increase overall OEM system performance.

Technical Specification

Gigahertz Photon Detection Module

| Parameter | Condition | Min | Typ | Max | Units |
|------------------------------------|--|-----|------------------|------|--------------------------------|
| Supply voltage | - | 5.0 | 5.3 ⁵ | 5.6 | VDC |
| Supply current | - | - | 300 | - | mA |
| Detection range¹ | Real counting mode | 1 | - | 1e4 | Counts per second ⁴ |
| | Straight output mode | 1 | - | 5e7 | Counts per second ⁴ |
| | Fast switching mode | 1 | - | 1e9 | Counts per second ⁴ |
| | HV reduction mode | 3e5 | - | 1e10 | Counts per second ⁴ |
| Switching dead time | w/o offset calibration | - | 1 | - | ms |
| In fast switching mode | Including offset calibration | - | 20 | - | ms |
| QE² | λ_{peak} | - | 20 % | - | Photoelectrons/ photons |
| CPM gain³ | - | 1E3 | adjustable | - | - |
| Sample time | Continuous data output | 200 | - | 5000 | ms |
| | (under development) | 1 | - | 5000 | ms |
| Acquisition time | Width of measurement | 3 | - | 200 | μ s |
| | Window for flash sequence measurements | - | - | - | - |
| Interface | USB 2.0 | - | 2 | - | Mbit/second |
| | SPI (under development) | - | - | - | - |

1. See below performance characteristics

2. CPM characteristics can be matched to the application's requirements – see spectral response curve

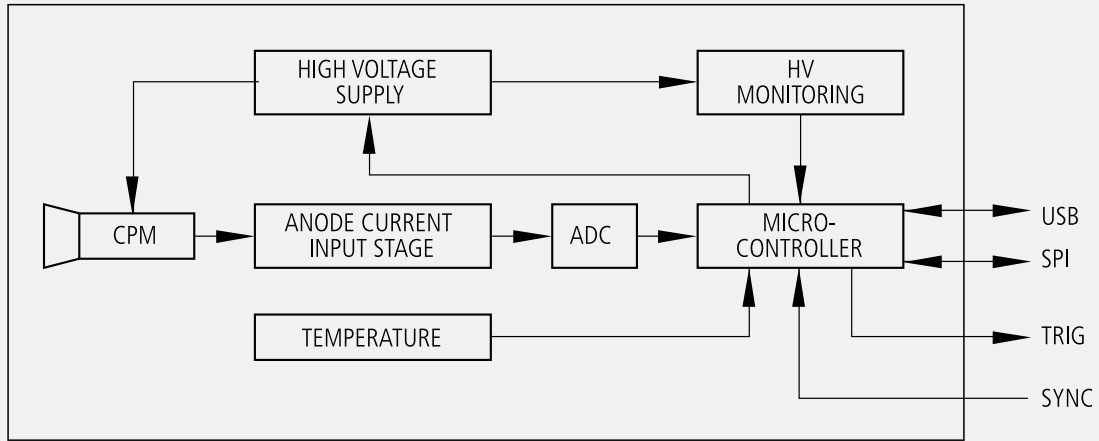
3. Gain pre-set to optimal single photons sensitivity

4. Actual output information is RLU (Relative Light Unit) – counts per second is the μ C calculated value based on RLU

5. Recommended for best performance

Figure 1

Block Diagram Gigahertz Photon Detection Module

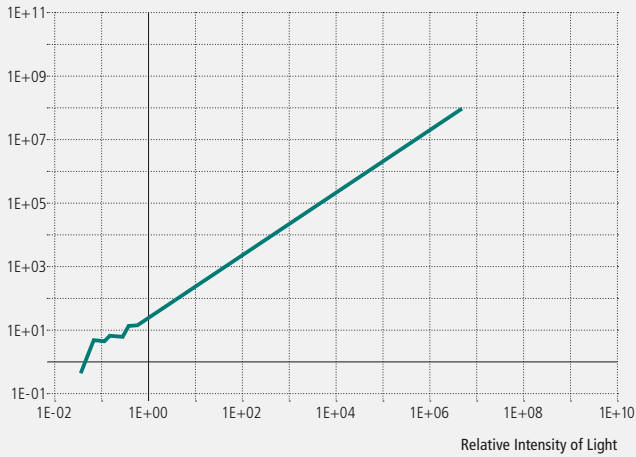


Graph 1

Straight Output Mode

Measurement Bandwidth Straight Output Mode at 1 S/s

Data Readout, Pulses per second (Cps)

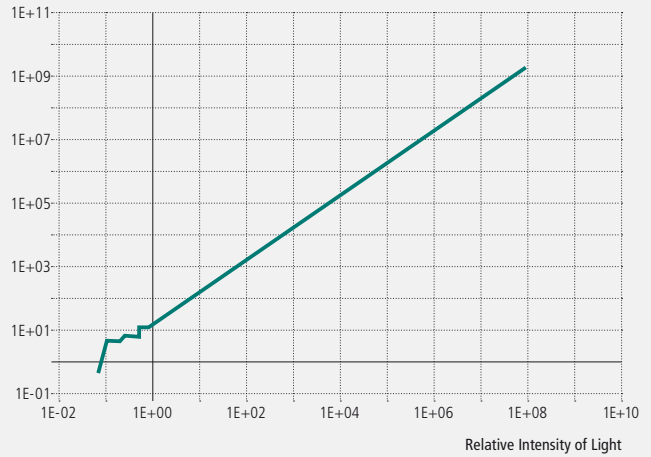


Graph 2

Fast Switching Mode

Measurement Bandwidth Extended Range/
Fast Switching Mode at 1 S/s

Data Readout, Pulses per second (Cps)

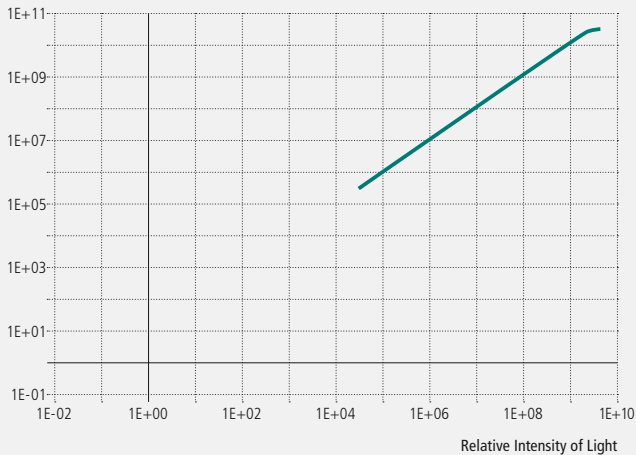


Graph 3

High Voltage Reduction Mode

Measurement Bandwidth Extended Range/
HV Reduction Mode at 1 S/s

Data Readout conv. to Pulses per second (Cps)

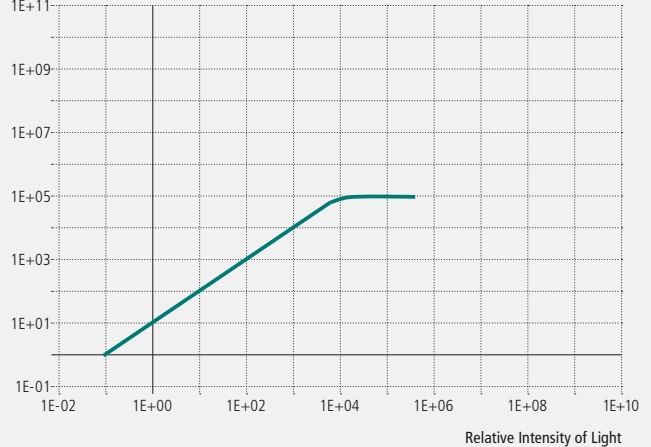


Graph 4

Real Counting Mode

Measurement Bandwidth Real Counting Mode at 1 S/s

Data Readout, Pulses per second (Cps)



HIGH SPEED HIGH SENSITIVITY LINEAR CAMERAS FOR MACHINE VISION

MODULES AND OPTICAL RECEIVERS ■

SmartBlue™ Linear Camera



CCD Linear Cameras – SmartBlue™ Linear Camera

Applications

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

Features and Benefits

- 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 photodiode CCD sensor
- CameraLink™ base output
- User controlled smart pixel correction
- Antiblooming control
- Single 12VDC power supply
- Electronic exposure control
- Adjustable gain levels
- Real time status LEDs
- Ultra-low image lag
- Square pixels with 100% fill factor
- Extended spectral range – 200 – 1000 nm

Product Description

The 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 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 μm 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.

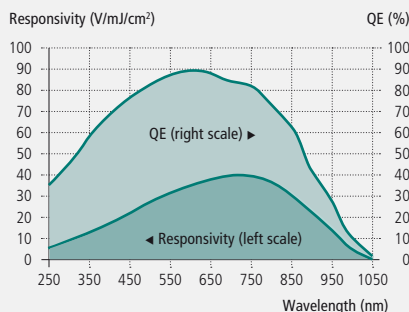
Technical Specification

SmartBlue™ Linear Camera

| Part Number | Resolution | Window | Aperture Length | Max. Line Rate |
|---------------|------------|--------|-----------------|----------------|
| SB0440CLG-011 | 512 | Glass | 7.2 mm | 68 kHz |
| SB0440CLQ-011 | 512 | Quartz | 7.2 mm | 68 kHz |
| SB1440CLG-011 | 1024 | Glass | 14.4 mm | 36.4 kHz |
| SB1440CLQ-011 | 1024 | Quartz | 14.4 mm | 36.4 kHz |
| SB2480CLG-011 | 2048 | Glass | 28.7 mm | 37.3 kHz |
| SB2480CLQ-011 | 2048 | Quartz | 28.7 mm | 37.3 kHz |
| SB4480CLG-011 | 4096 | Glass | 57.3 mm | 19.1 kHz |
| SB4480CLQ-011 | 4096 | Quartz | 57.3 mm | 19.1 kHz |

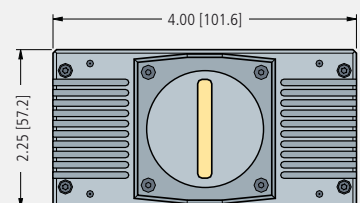
Technical Specification

Spectral Sensitivity Curve (1x Gain)



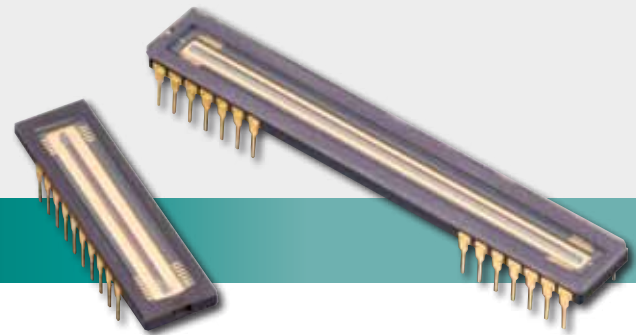
Technical Specification

Package Drawing*



* not for SB4480CLX

HIGH SPEED HIGH SENSITIVITY LINESCAN IMAGERS FOR MACHINE VISION



CCD Linear Imagers

Applications

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

Features and Benefits

- 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

Product Description

Excelitas' P-series linear imager combines 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. 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. These versatile imagers are available in array lengths of 512 to 4096 elements with either low-cost glass or UV-enhanced fused silica windows.

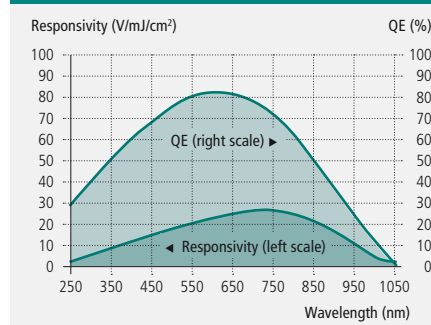
Technical Specification

P-Series CCD Linear Array

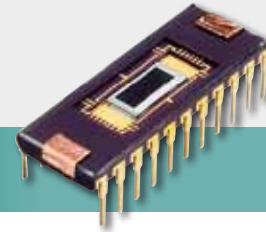
| Part Number | Pixel Count Elements | Pixel Size μm | Number of Outputs | Spectral Response Range nm | Pixel Data Rate MHz | Dynamic Range | Horizontal Clocking typ. |
|-------------|----------------------|--------------------------|-------------------|----------------------------|---------------------|---------------|--------------------------|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

Technical Specification

Quantum Efficiency



HIGH SENSITIVITY LARGE FORMAT PIXELS FOR SPECTROSCOPY



CMOS Linear Photodiode Arrays – L-Series

Applications

- Spectroscopy
- Colorimetry

Features and Benefits

- 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
- Two on-chip diodes for temperature monitoring

Product Description

Excelitas' 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-in-line packages with ground and polished fused silica windows and are pin-compatible with earlier Excelitas 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.

Technical Specification

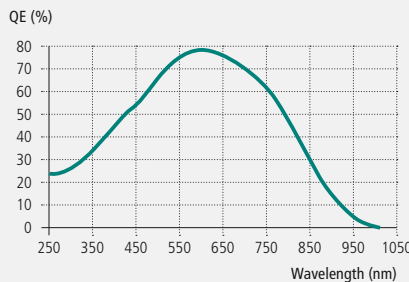
P-Series CCD Linear Array

| Part Number | Video Capacitance | | Sensitivity CJ/cm ² | Saturation Exposure nJ/cm ² | Saturation Charge pC | Dynamic Range | Dark Current Typ. pA |
|-------------|-------------------|-------------------|-----------------------------------|--|----------------------------|------------------|----------------------------|
| | @ 5V bias pF | @ 2.5V bias pF | | | | | |
| RL1201 | – | 6.7 | 2×10^{-4} | 50 | 10 | 70.000 | 0.2 |
| RL1202 | – | 10.2 | 2×10^{-4} | 50 | 10 | 70.000 | 0.2 |
| RL1205 | – | 15.4 | 2×10^{-4} | 50 | 10 | 70.000 | 0.2 |
| RL1210 | – | 28.7 | 2×10^{-4} | 50 | 10 | 70.000 | 0.2 |
| RL1501 | 9.1 | – | 4×10^{-4} | 50 | 20 | 100.000 | 0.4 |
| RL1502 | 14 | – | 4×10^{-4} | 50 | 20 | 100.000 | 0.4 |
| RL1505 | 25 | – | 4×10^{-4} | 50 | 20 | 100.000 | 0.4 |

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

Technical Specification

Quantum Efficiency



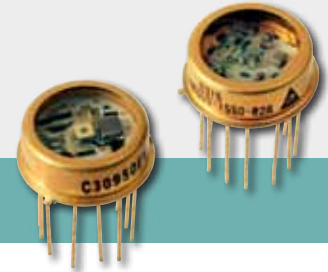
Technical Specification

P-Series CCD Linear Array

| Pixels | Pixel Pitch 25 μm | Pixel Pitch 50 μm |
|--------|------------------------------|------------------------------|
| 128 | RL1201LGQ-711 | RL1501LFQ-711 |
| 256 | RL1202LGQ-711 | RL1502LFQ-711 |
| 512 | RL1205LGQ-711 | RL1505LFQ-711 |
| 1024 | RL1210LGQ-711 | – |

PIN AND APD RECEIVER MODULES

FOR ANALYTICAL AND
INDUSTRIAL APPLICATIONS



Si PIN and APD Modules – InGaAs APD Modules

Applications

- Laser range finder
- Confocal microscopy
- Video scanning imager
- High speed analytical instrumentation
- Free space communication
- UV light sensing
- Distributed temperature sensing

Features and Benefits

- Ultra low noise
- High speed
- High transimpedance gain

Product Description

These modules comprise of a photodetector (PIN or APD) and a transimpedance amplifier in the same hermetically sealed package. Having both amplifier and photodetector in the same package allows low noise pickup from the surrounding environment and reduces parasitic capacitances from interconnect allowing lower noise operation.

The hybrid amplifier C30659 series includes an APD connected to a low noise transimpedance amplifier. 4 models are offered with Silicon APD and 2 models with InGaAs APD. Standard bandwidth of 50 MHz and 200 MHz can accommodate a wide range of applications. Two C30659 models are offered with the APD mounted on a Thermo-electric cooler (the LLAM series) to help improving noise or to keep the APD at constant temperature regardless of the ambient temperature.

The C30659 can be customized to meet application specific requirements by using one of the Excelitas rear entry APDs, by choosing a custom bandwidth or by qualifying it to your environmental conditions. Pigtailed versions are also available in a 14 pins DIL package allowing nearly 100% coupling efficiency.

The C30950EH offers a low cost alternative to the C30659. The amplifier is designed to neutralize the input capacitance of a unity voltage gain amplifier. The C30919E uses the same architecture of the C30950EH with the addition of a high voltage temperature compensation circuit which maintain module responsivity constant over a wide temperature range.

Two HUV modules are offered with a PIN detector for low frequency high gain application, covering a broad spectrum range from the UV to the near IR.

All optical receiver products can be qualified to meet the most demanding environmental specification as described in MIL-PRF-38534.

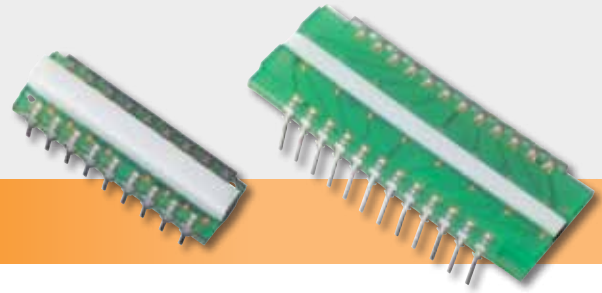
Product Table

Si PIN and APD Modules – InGaAs APD Modules

| Unit | Detector | Active Diameter | Bandwidth | Responsivity, 830 nm | Responsivity, 900 nm | Responsivity, 1060 nm | NEP | Output Voltage Swing, 50 Ohm | Package |
|-------------------|----------|-----------------|-----------|-------------------------|-------------------------|--------------------------|--------|------------------------------------|-------------|
| | | mm ² | MHz | kV/W | kV/W | kV/W | fW/√Hz | V | |
| C30659-900-R5BH | C30902 | 0.5 | 200 | 460 | 400 | - | 35 | 0.9 | TO-8 |
| C30659-900-R8AH | C30817 | 0.8 | 50 | 2700 | 3000 | - | 14 | 0.9 | TO-8 |
| C30659-1060-R8BH | C30954 | 0.8 | 200 | - | 370 | 200 | 55 | 0.9 | TO-8 |
| C30659-1060-3AH | C30956 | 3 | 50 | - | 450 | 280 | 55 | 0.9 | TO-8 |
| C30659-1550-R08BH | C30645 | 80 μm | 200 | - | 90 @ 1550 nm | - | 220 | 0.9 | TO-8 |
| C30659-1550-R2AH | C30645 | 200 μm | 50 | - | 340 @ 1550 nm | - | 130 | 0.9 | TO-8 |
| C30919E | C30817 | 0.8 | 40 | - | 1000 | 250 | 20 | 0.7 | TO, 1 in |
| C30950EH | C30817 | 0.8 | 50 | 520 | 560 | 140 | 27 | 0.7 | TO-8 |
| LLAM-1550-R2AH | C30662 | 0.2 | 50 | - | 340 @ 1550 nm | - | 130 | 0.9 | TO-8 flange |
| LLAM-1060-R8BH | C30954 | 0.8 | 200 | - | 370 | 200 | 55 | 0.9 | TO-8 flange |
| HUV-1100BGH | UV-100 | 2.5 | 1 kHz | - | 130 MV/W | - | 30 | 5 min | Custom |
| HUV-2000BH | UV-215 | 5.4 | 1 kHz | - | 130 MV/W | - | 70 | 5 min | Custom |

Left: 16 Element, 1.6 mm Pitch Photodiode Array With Segmented Csi Scintillator.

Right: 16 Element, 2.5 mm Pitch Photodiode Array With GOS Low Energy Screen Scintillator.



Photodiode Arrays – VTA Series

Applications

- Luggage scanning
- Cargo & container scanning
- Food inspection
- Non-destructive testing

Features and Benefits

- Various crystal types available (Csi, GOS, etc.)
- Custom chip geometry & pitch
- Single or dual-sided assemblies
- High responsivity and low capacitance
- Onboard electronics available on a custom basis
- Multiple photodiode rows

Product Description

These photodiode arrays are used to generate an X-ray image by scanning an object line by line. The X-rays are converted into light through the attached scintillator crystal. The light intensity is then measured by the photodiodes. The boards are employing chip-on-board technology with optically adapted scintillator crystals. The listed designs can be ordered as a standard part, but can also be customized to meet the needs of a wide variety of applications. Excelitas custom photodiode arrays give customers the option to choose the:

- active photodiode area
- total number of elements
- overall PCB and photodiode chip dimensions
- photodiode chip geometry and orientation
- electro-optical specifications
- single sided vs. double sided PCB
- alternative substrate materials (e.g. ceramic)
- electrical interface (e.g. connector)

First stage amplification electronics can also be added to the custom board design to convert the current generated by the photodiode into an easy to measure voltage.

Product Table

Photodiode Arrays • VTA Series

| Symbol | Substrate | | Active Area | Photodiode Chip Dimensions | Pitch | Number of Elements | Scintillator Crystal Type | Light Current Uniformity @ 540 nm, 30 nW/cm ² | Dark Current @ H=0, VR=10 mV | | Junction Capacitance @ H=0, VR=0 V | | Radiometric Sensitivity @ 540 nm |
|--------------------|-----------|------------|-------------|----------------------------|-------|--------------------|---------------------------|--|------------------------------|----------------|------------------------------------|----------------|----------------------------------|
| | Material | Dimensions | | | | | | | Design | Design | typ | max | typ |
| | Unit | mm | | mm ² | mm | mm | % | I _D | I _D | C _J | C _J | S _R | |
| VTA2164H-D-NC-00-0 | FR4 | 43.2x67.7 | 1.41 | 1.40x3.50 | 2.1 | 64 | Custom | ±5 | <10 | 90 | <100 | 200 | 0.30 |
| VTA1616H-H-SC-01-0 | FR4 | 8.0x25.4 | 2.58 | 1.51x3.25 | 1.6 | 16 | Csi | ±5 | - | 50 | - | 350 | 0.30 |
| VTA1616H-L-SC-02-0 | FR4 | 16.0x25.4 | 2.58 | 1.51x3.25 | 1.6 | 16 | GOS | ±5 | - | 50 | - | 350 | 0.30 |
| VTA2516H-H-SC-01-0 | FR4 | 8.0x40.0 | 5.20 | 2.45x3.15 | 2.5 | 16 | Csi | ±5 | - | 50 | - | 600 | 0.30 |
| VTA2516H-L-SC-02-0 | FR4 | 16.0x40.0 | 5.20 | 2.45x3.15 | 2.5 | 16 | GOS | ±5 | - | 50 | - | 600 | 0.30 |
| VTA1216H-H-NC-00-0 | FR4 | 10.2x19.0 | 3.44 | 2.30x4.95 (dual cell) | 1.2 | 16 | Custom | ±5 | - | 100 | - | 300 | 0.30 |
| VTA1216H-L-NC-00-0 | FR4 | 17.8x19.0 | 3.44 | 2.30x4.95 (dual cell) | 1.2 | 16 | Custom | ±5 | - | 100 | - | 300 | 0.30 |
| VTA0832H-H-NC-00-0 | FR4 | 17.8x25.4 | 0.50 | 1.59x2.34 (dual cell) | 0.8 | 32 | Custom | ±5 | - | 100 | - | 100 | 0.30 |

Electrical characteristics at T_{Ambient} = 25 °C

Figure 1

Side 1 Detail VTA2164H-D

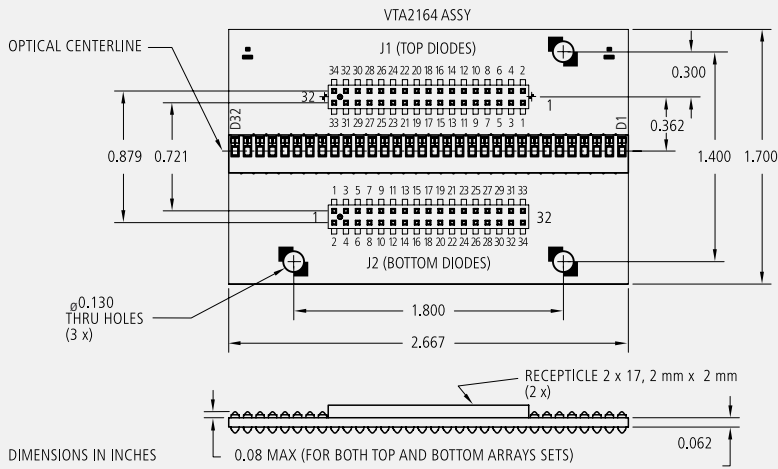


Figure 2

Side 2 Detail VTA2164H-D

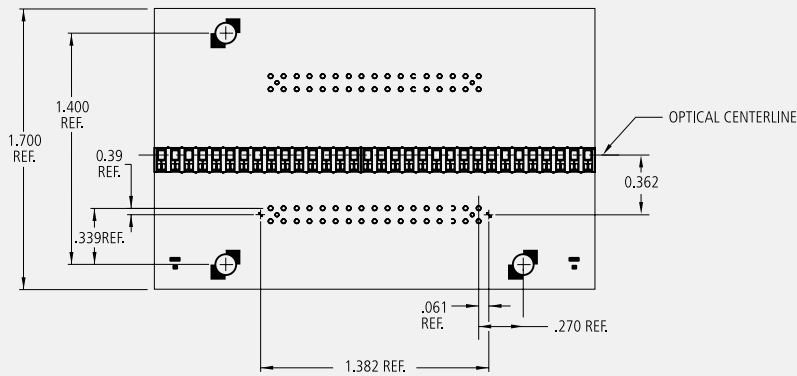
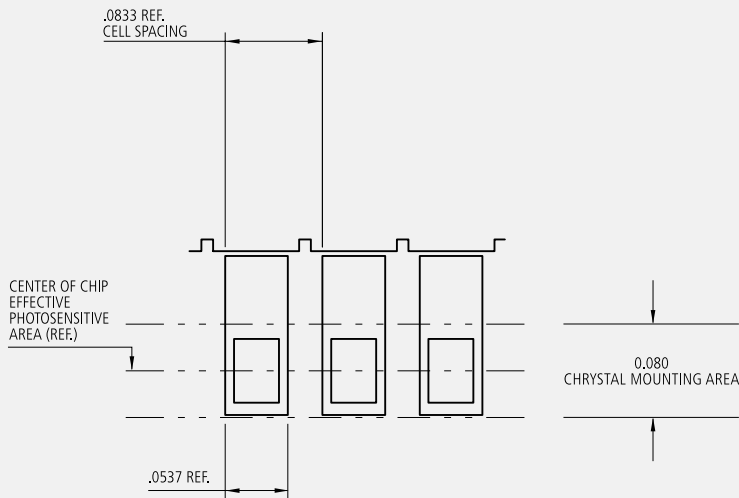


Figure 3

Chip Spacing Details, Side 1 (Typ) VTA2164H-D

Photosensitive Area 0.0545" x 0.0385 (Typ.) or 0.0021 SQ. IN.



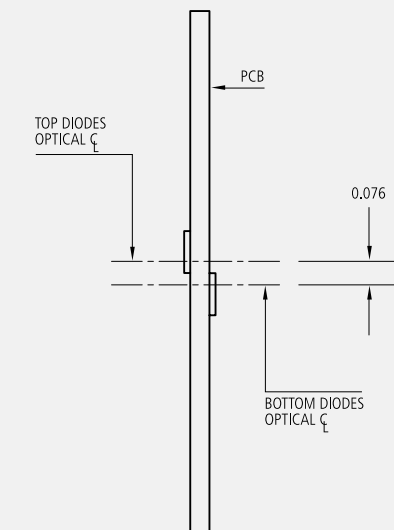
Pin Out VTA2164H-D

| Connector J1 (Top Diodes) | | Connector J2 (Bottom Diodes) | |
|---------------------------|------------|------------------------------|------------|
| Pin | Connection | Pin | Connection |
| 1 | D1 | 1 | D1 |
| 2 | D2 | 2 | D2 |
| 3 | D3 | 3 | D3 |
| 4 | D4 | 4 | D4 |
| 5 | D5 | 5 | D5 |
| 6 | D6 | 6 | D6 |
| 7 | D7 | 7 | D7 |
| 8 | D8 | 8 | D8 |
| 9 | D9 | 9 | D9 |
| 10 | D10 | 10 | D10 |
| 11 | D11 | 11 | D11 |
| 12 | D12 | 12 | D12 |
| 13 | D13 | 13 | D13 |
| 14 | D14 | 14 | D14 |
| 15 | D15 | 15 | D15 |
| 16 | D16 | 16 | D16 |
| 17 | D17 | 17 | D17 |
| 18 | D18 | 18 | D18 |
| 19 | D19 | 19 | D19 |
| 20 | D20 | 20 | D20 |
| 21 | D21 | 21 | D21 |
| 22 | D22 | 22 | D22 |
| 23 | D23 | 23 | D23 |
| 24 | D24 | 24 | D24 |
| 25 | D25 | 25 | D25 |
| 26 | D26 | 26 | D26 |
| 27 | D27 | 27 | D27 |
| 28 | D28 | 28 | D28 |
| 29 | D29 | 29 | D29 |
| 30 | D30 | 30 | D30 |
| 31 | D31 | 31 | D31 |
| 32 | D32 | 32 | D32 |
| 33 | N/C | 33 | N/C |
| 34 | Common | 34 | Common |

Figure 4

Pos. of Top Diodes Rel. to Bottom Diodes VTA2164H-D

(Optical Center Line to Optical Center Line)



AVALANCHE PHOTODIODES FOR INDUSTRIAL & ANALYTICAL APPLICATIONS



Avalanche Photodiodes – Silicon and InGaAs APDs

Applications

- Laser range finder
- Scanning video imager
- Confocal microscope
- Free space communication
- Spectrophotometers
- Fluorescence Detection
- Luminometer
- DNA sequencer
- Particle sizing

Features and Benefits

- Low noise
- High gain
- High quantum efficiency
- Built-in TE-cooler option
- Various optical input options

Product Description

These rear entry “reach-through” silicon APDs offer the best compromise in terms of cost and performance for applications requiring high speed and low noise photon detection from 400 nm up to 1100 nm. They feature low noise, high quantum efficiency and high gain while maintaining reasonably low operating voltage. The active area varies from 0.5 mm to 3 mm to accommodate a large variety of applications.

The “S” series of the C30902 family of APDs can be used in either their normal linear mode ($V_R < V_{BR}$) or as photon counter in the Geiger mode ($V_R > V_{BR}$). This series is particularly well-suited for ultra-sensitive photon measurements in biomedical and analytical instruments.

Precise temperature control can be achieved with a thermo electric cooler which can be used to improve noise and responsivity or to maintain constant responsivity over a wide range of ambient temperature.

High quantum efficiency can be achieved from 1100 nm to 1700 nm with our InGaAs Avalanche Photodiodes. They were designed to maintain high gain, high quantum efficiency and high bandwidth even with their large area of up to 200 μm . The short distance between to window and the active area allows easy interface with optical system.

Technical Specification

Avalanche Photodiodes – Silicon APDs

| Unit | Active Diameter mm | Capacitance pF | Rise/Fall Time ns | Dark Current nA | Breakdown Voltage min V | Breakdown Voltage max V | Temperature Coefficient V/°C | Typical Gain | Responsivity 830 nm A/W | Responsivity 900 nm A/W | Responsivity 1060 nm A/W | NEP fW/√Hz | Package |
|------------|-----------------------|-------------------|----------------------|--------------------|----------------------------|----------------------------|---------------------------------|--------------|----------------------------|----------------------------|-----------------------------|---------------|--------------------|
| C30817EH | 0.8 | 2 | 2 | 50 | 300 | 475 | 2.2 | 120 | | 75 | | 1 | TO-5 |
| C30872EH | 3 | 10 | 2 | 100 | 325 | 500 | 2.2 | 60 | | 37 | 9 | 30 | TO-8 |
| C30884E | 0.8 | 4 | 1 | 100 | 190 | 290 | 1.1 | 100 | | 63 | 8 | 13 | TO-5 |
| C30902BH | 0.5 | 1.6 | 0.5 | 15 | 185 | 265 | 0.7 | 150 | 77 | 60 | | 3 | Ball lens TO-18 |
| C30902BFCH | 0.5 | 1.6 | 0.5 | 15 | 185 | 265 | 0.7 | 150 | 77 | 60 | | 3 | FC receptacle |
| C30902BSTH | 0.5 | 1.6 | 0.5 | 15 | 185 | 265 | 0.7 | 150 | 77 | 60 | | 3 | ST receptacle |
| C30902EH | 0.5 | 1.6 | 0.5 | 15 | 185 | 265 | 0.7 | 150 | 77 | 60 | | 3 | TO-18, flat window |
| C30902SH | 0.5 | 1.6 | 0.5 | 15 | 185 | 265 | 0.7 | 250 | 128 | 108 | | 0.9 | TO-18, flat window |
| C30916EH | 1.5 | 3 | 3 | 100 | 315 | 490 | 2.2 | 80 | | 50 | 12 | 20 | TO-5 |
| C30921EH | 0.25 | 1.6 | 0.5 | 15 | 185 | 265 | 0.7 | 150 | 77 | 60 | | 3 | TO-18, flat window |
| C30921SH | 0.25 | 1.6 | 0.5 | 15 | 185 | 265 | 0.7 | 250 | 128 | 108 | | 0.9 | TO-18, light pipe |
| C30954EH | 0.8 | 2 | 2 | 50 | 300 | 475 | 2.4 | 120 | | 75 | 36 | 13 | TO-5 |
| C30955EH | 1.5 | 3 | 2 | 100 | 315 | 490 | 2.4 | 100 | | 70 | 34 | 14 | TO-5 |
| C30956EH | 3 | 10 | 2 | 100 | 325 | 500 | 2.4 | 75 | | 45 | 25 | 25 | TO-8 |

Product Table

Silicon APD – TE-Cooled

| Unit | Active Diameter mm | Active Area mm ² | Total Capacitance pF | Rise/Fall Time ns | Dark Current nA | Breakdown Voltage min V | Breakdown Voltage max V | Temperature Coefficient | Typical Gain | Responsivity 830 nm A/W | Responsivity 900 nm A/W | Responsivity 1060 nm A/W | Noise Current pA/sqrt(Hz) | Package |
|---------------------|-----------------------|--------------------------------|-------------------------|----------------------|--------------------|----------------------------|----------------------------|-------------------------|--------------|----------------------------|----------------------------|-----------------------------|------------------------------|-------------|
| C30902SH-TC | 0.5 | 0.2 | 1.6 | 0.5 | 2 | 225 | - | 0.7 | 250 | 128 | 108 | - | 0.04 | TO-8 flange |
| C30902SH-DTC | 0.5 | 0.2 | 1.6 | 0.5 | 1 | 225 | - | 0.7 | 250 | 128 | 108 | - | 0.02 | TO-8 flange |
| C30954E-TC | 0.8 | 0.5 | 2 | 2 | 50 | 300 | 475 | 2.4 | 120 | - | 75 | - | 0.2 | TO-8 flange |
| C30954E-DTC | 0.8 | 0.5 | 2 | 2 | 50 | 300 | 475 | 2.4 | 120 | - | 75 | - | 0.04 | TO-8 flange |
| C30955E-TC | 1.5 | 1.8 | 3 | 2 | 100 | 315 | 490 | 2.4 | 100 | - | 70 | - | 0.2 | TO-8 flange |
| C30955E-DTC | 1.5 | 1.8 | 3 | 2 | 100 | 315 | 490 | 2.4 | 100 | - | 70 | - | 0.05 | TO-8 flange |
| C30956E-TC | 3 | 7 | 10 | 2 | 100 | 325 | 500 | 2.4 | 75 | - | 45 | - | 0.2 | TO-8 flange |

TC stands for single stage cooler, operating temperature 0°C
 DTC stands for double stage cooler, operating temperature -20°C

Product Table

InGaAs APD

| Unit | Active Diameter µm | Capacitance pF | Bw MHz | Dark Current nA | Breakdown Voltage min V | Breakdown Voltage max V | Temperature Coefficient V/°C | Typical Gain | Responsivity 1550 nm A/W | NEP fW/sqrt(Hz) | Package |
|--------------------|-----------------------|-------------------|-----------|--------------------|----------------------------|----------------------------|---------------------------------|--------------|-----------------------------|--------------------|-----------------|
| C30662EH | 200 | 2.5 | 800 | 70 | 40 | 90 | 0.14 | 10 | 9.3 | 100 | TO-18 |
| C30662ECERH | 200 | 2.5 | 800 | 70 | 40 | 90 | 0.14 | 10 | 9.3 | 100 | Ceramic carrier |
| C30645EH | 80 | 1.25 | 1000 | 35 | 40 | 90 | 0.14 | 10 | 9.3 | 25 | TO-18 |
| C30645ECERH | 80 | 1.25 | 1000 | 35 | 40 | 90 | 0.14 | 10 | 9.3 | 25 | Ceramic carrier |
| C30644EH | 50 | 0.6 | 2000 | 25 | 40 | 90 | 0.14 | 10 | 9.3 | 15 | TO-18 |
| C30644ECERH | 50 | 0.6 | 2000 | 25 | 40 | 90 | 0.14 | 10 | 9.3 | 15 | Ceramic carrier |

Graph 1

Typical Spectral Responsivity @ 22°C

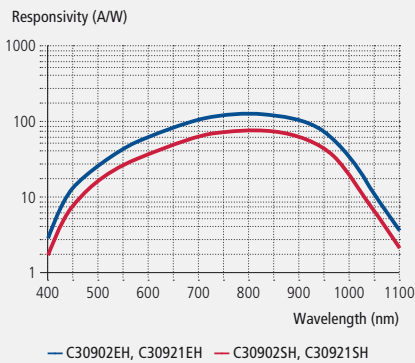


Figure 1

Package Drawing – TO-8 Flange

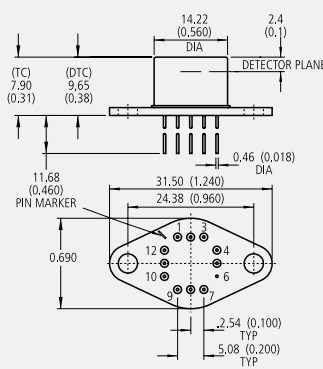


Figure 2

Typical TO-5 Package*

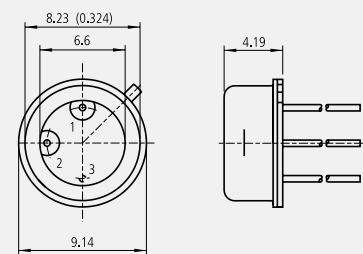


Figure 3

Typical TO-8 Package*

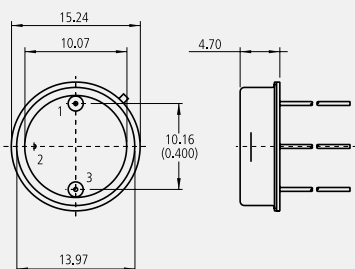


Figure 4

Ceramic Carrier

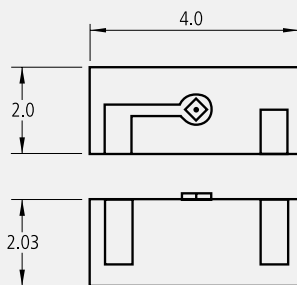
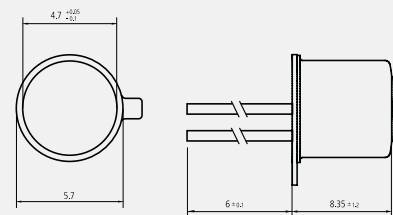


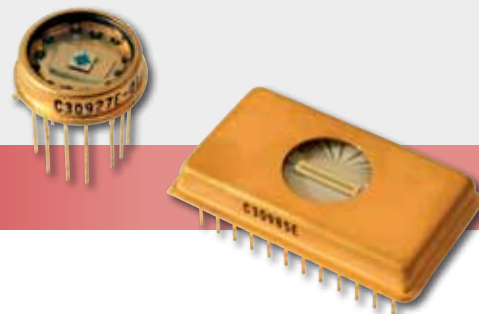
Figure 5

Typical TO-18 Package*



*Note: Package dimension for indication only. Exact package dimension can be found on products datasheets.

AVALANCHE PHOTODIODES FOR ANALYTICAL APPLICATIONS



Avalanche Photodiodes – Si APD Arrays

Applications

- Spectroscopy
- Particle detection
- Spot tracking and alignment systems
- Adaptive optics
- LIDAR (Light Detection And Ranging)

Features and Benefits

- High quantum efficiency
- Hermetically sealed packages
- Monolithic chip with minimal dead space between elements
- Specific tailored wavelength response
- RoHS compliant

Product Description

C30927 series of quadrant Si Avalanche Photodiode and the C30985E multi-element APD array utilize the double-diffused “reach-through” structure. This structure provides ultra high sensitivity at 400-1000 nm.

The C30927 quadrant structure has a common avalanche junction, with separation of the quadrants achieved by segmentation of the light entry p+ surface opposite the junction. With this design, there is no dead space between the elements and therefore no loss of response at boresight.

The C30927EH-01, -02 and -03 are optimized for use at wavelengths of 1060, 900, and 800 nm respectively. Each device type will provide high responsivity and excellent performance when operated within about 50 nm of the specified wavelength.

The C30985E is a 25 element monolithic linear APD array having a high inter-electrode resistance with a 75 μm dead space between the elements. Packages have a common ground and bias with a separate lead for each element output.

Product Table

Avalanche Photodiodes – Si APD Arrays

| Part Number | Number of Elements | Photo Sensitive Diameter | Responsivity | Dark Current per Element | Spectral Noise Current | Capacitance @ 100 KHz | Response Time | NEP | NEP |
|-------------|--------------------|--------------------------|---------------|--------------------------|------------------------|-----------------------|---------------|---------------|-----------|
| Unit | mm | mm | A/W | nA | pA/√Hz | pF | ns | fW/√Hz | V |
| C30927EH-01 | 4 | 1.5 | 15(@ 1060 nm) | 25 | 0.5 | 1 | 3 | 33(@ 1060 nm) | 275 - 425 |
| C30927EH-02 | 4 | 1.5 | 62(@ 900 nm) | 25 | 0.5 | 1 | 3 | 16(@ 900 nm) | 275 - 425 |
| C30927EH-03 | 4 | 1.5 | 55(@ 800 nm) | 25 | 0.5 | 1 | 3 | 9(@ 800 nm) | 275 - 425 |
| C30985E | 25 | 0.3 | 31(@ 900 nm) | 1 | 0.1 | 0.5 | 2 | 3(@ 900 nm) | 250 - 425 |

Figure 1

Package Drawing – C30927 Series

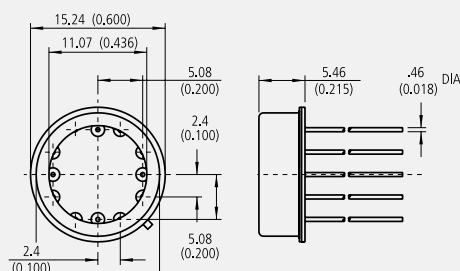
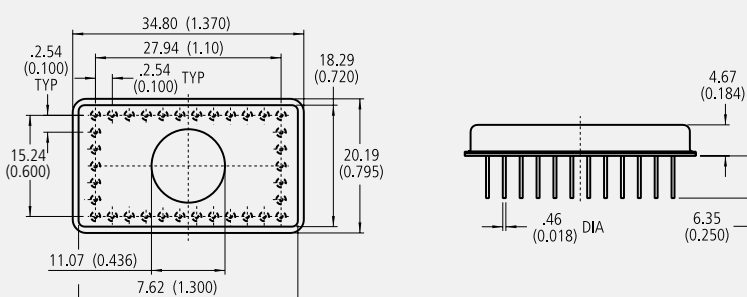
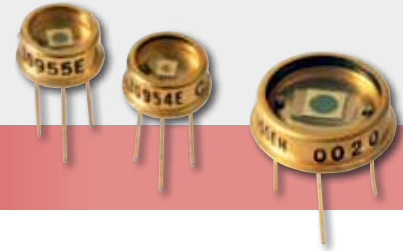


Figure 2

Package Drawing – C30985E



AVALANCHE PHOTODIODES FOR ANALYTICAL APPLICATIONS



1060 nm NIR Enhanced Si APDs

Applications

- Range finding
- LIDAR (Light Detection And Ranging)
- YAG laser detection

Features and Benefits

- High quantum efficiency at 1060 nm
- Fast response time
- Wide operating temperature range
- Low capacitance
- Hermetically sealed packages
- RoHS compliant

Product Description

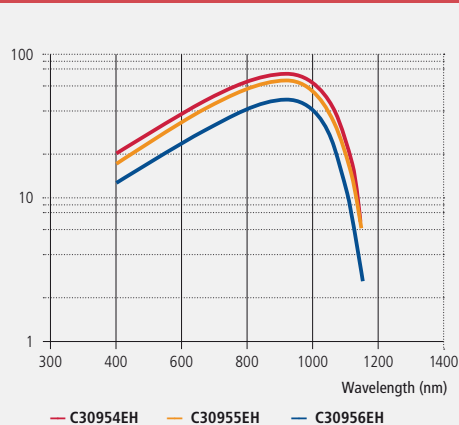
The C30954EH, C30955EH, and C30956EH are general purpose silicon avalanche photodiodes made using a double-diffused “reach-through” structure. The design of these photodiodes are such that their long wave response (i.e. >900 nm) has been enhanced without introducing any undesirable properties.

These APDs have quantum efficiency of up to 40 % at 1060 nm. At the same time, the diodes retain the low noise, low capacitance, and fast rise and fall times characteristics.

To help simplify many design needs, these APDs are also available in Excelitas’ high-performance hybrid preamplifier module type C30659 series, as well as the preamplifier and TE cooler incorporated module type LLAM series. Please refer to the respective sections in this catalog.

Graph 1

Spectral Responsivity Characteristics



Product Table

Si APDs – NIR Enhanced

| Part Number | Photo Sensitive Diameter | Respon- sivity @ 1060 nm | Dark Current | Spectral Noise Current | Capacitance @ 100 KHz | Response Time | NEP @ 1060 nm | Vop Range |
|-------------|--------------------------|--------------------------|--------------|------------------------|-----------------------|---------------|---------------|-----------|
| Unit | mm | A/W | nA | pA/√Hz | pF | ns | fW/√Hz | V |
| C30954EH | 0.8 | 36 | 50 | 0.5 | 2 | 2 | 14 | 275 - 425 |
| C30955EH | 1.5 | 34 | 100 | 0.5 | 3 | 2 | 15 | 275 - 425 |
| C30956EH | 3.0 | 25 | 100 | 0.5 | 10 | 2 | 20 | 275 - 425 |

Figure 1

Package Drawing – C30954EH, C30955EH

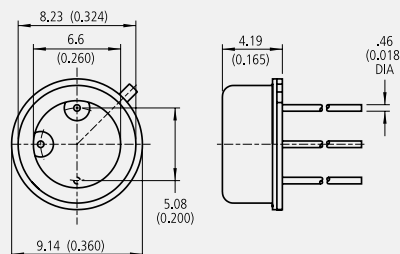
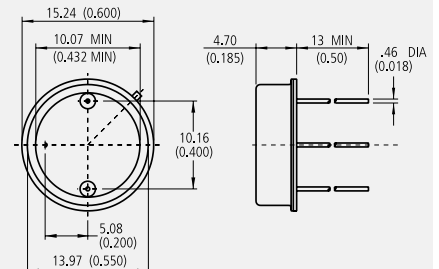


Figure 2

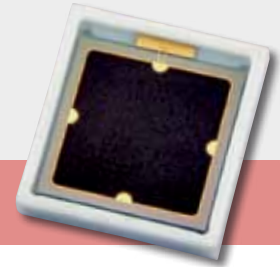
Package Drawing – C30956EH



AVALANCHE PHOTODIODES FOR HIGH ENERGY RADIATION DETECTIONS APPLICATIONS, MOLECULAR IMAGING

PHOTODIODES FOR HIGH-PERFORMANCE APPLICATIONS ■

Large Area Si-APDs – UV-Enhanced APDs



Large Area Si-APDs – UV-Enhanced APDs

Applications

- Nuclear medicine
- Fluorescence detection
- High energy physics
- Medical imaging
- Radiation detection
- Particle physics
- Instrumentation
- Environmental monitoring

Features and Benefits

- High quantum efficiency
- Low dark currents
- Easy coupling to scintillator crystals
- Immunity to electromagnetic fields
- Short wavelength enhanced responsivity
- Custom packaging available
- Excellent timing resolution
- RoHS compliant

Product Description

The C30739ECERH Silicon Avalanche Photodiode (APD) is intended for use in a wide variety of broadband low light level applications covering the spectral range from below 400 to over 700 nanometers. It has low noise, low capacitance and high gain. It is designed to have an enhanced short wavelength sensitivity, with quantum efficiency of 60% at 430 nm.

The standard ceramic carrier package allows for easy handling and coupling to scintillating crystals such as LSO and BGO. Combined with the superior short wavelength responsivity, it makes this APD ideal in demanding applications such as Positron Emission Tomography (PET).

The C30626FH and C30703FH series are large area Si APDs in flat pack packages for either direct detection or easy coupling to scintillator crystals.

The C30626 uses a standard reach through structure and has peak detection at about 900 nm. The C30703 is enhanced for blue wavelength response and has peak quantum efficiency at ~ 530 nm. These APDs are packaged in square flat pack with or without windows or on ceramics. The no-window devices can detect direct radiation of X-rays and electrons at the energies listed, and the windowed packages are best for easy scintillator coupling.

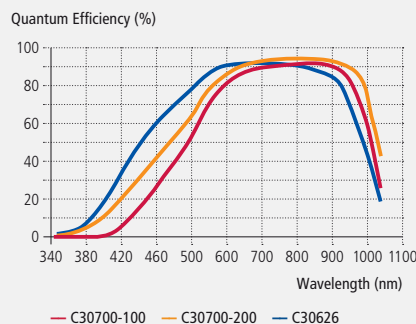
Product Table

Large Area Si-APDs – UV-Enhanced APDs

| Part Number | Photo Sensitive Diameter | Responsivity | Dark Current | Spectral Noise Current | Capacitance @ 100 KHz | Response Time | NEP | Vop Range |
|--------------------|--------------------------|-----------------|--------------|------------------------|-----------------------|---------------|-----------------|-----------|
| Unit | mm | A/W | nA | pA/√Hz | pF | ns | fW/(Hz) | V |
| C30626FH | 5 x 5 | 22 (@900 nm) | 250 | 0.5 | 30 | 5 | 23 (@900 nm) | 275 - 425 |
| C30703FH | 10 x 10 | 16 (@530 nm) | 10 | 0.7 | 120 | 5 | 40 (@530 nm) | 275 - 425 |
| C30739ECERH | 5.6 x 5.6 | 20 (@430 nm) | 50 | 1.4 | 60 | 2 | - | 275 - 425 |

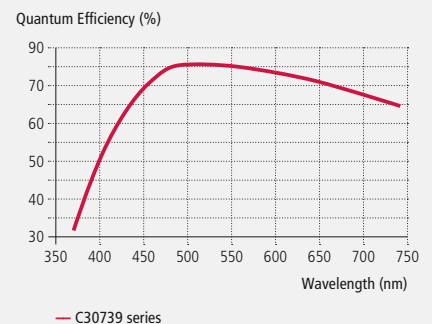
Graph 1

Quantum Efficiency vs. Wavelength



Graph 2

Quantum Efficiency vs. Wavelength



AVALANCHE PHOTODIODES FOR RANGE FINDING APPLICATIONS

PHOTODIODES FOR HIGH-PERFORMANCE APPLICATIONS ■

Right: TO-C30737PH Series
T-1 $\frac{3}{4}$ (TO-like) Through-Hole
Package (4.9 mm Diameter)

Left: C30737LH Series
Leadless Ceramic Carrier
Package (3 x 3 mm²)



C30737 High Speed, Low Voltage APD – C30724 Low Temperature Coefficient APD

Applications

- Laser range finding for 600 to 950 nm range
- Optical communication
- Analytical Instrumentation

Features and Benefits

- Optimized versions for 900 and 800 nm peak sensitivity
- Standard versions with 500 and 230 μ m active diameter
- Various package types: hermetic TO, plastic TO, SMD
- High gain at low bias voltage
- Low breakdown voltage
- Fast response, $t_R \sim 300$ ps
- Low noise, in ~ 0.2 pA/ $\sqrt{\text{Hz}}$
- RoHS compliant

Product Description

The Excelitas C30737 series silicon APDs provide high responsivity between 500 nm and 1000 nm, as well as extremely fast rise times at all wavelengths with a frequency response above 1 GHz. The C30724 as a low gain APD can be operated at fixed voltage without the need of a temperature compensation.

Standard versions are available in two active area sizes: 0.23 and 0.5 mm diameter. They are offered in the traditional hermetic TO housing (“E”), in cost effective plastic through-hole T-1 $\frac{3}{4}$ (TO-like, “P”) packages, and in leadless ceramic carrier (LCC, “L”) package for surface mount technology. All listed varieties are ideally suited for high-volume, low cost applications.

Customization of these APDs is offered to meet your design challenges. Operation voltage selection and binning or specific wavelength filtering options are among many of the application specific solutions available.

Product Table

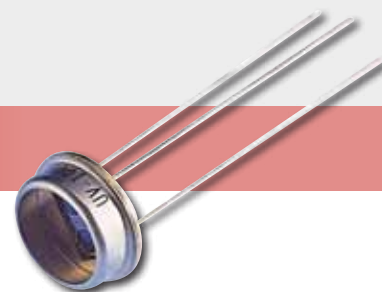
C30737 Epitaxial Silicon APD – C30724 Low Gain APD

| Part Number | Package | Optical Bandpass Filter | Active Area Diam. | Peak Sensitivity Wavelength | Breakdown Voltage | | Temp. Coeff. Of V_{op} , for Constant M | Gain@ λ_{peak} | Responsivity @ λ_{peak} | Total Dark Current (Bulk + Surface) | | Noise Current, (f = 10 kHz, $\Delta f = 1$ Hz) | Capacitance | Rise & Fall Time, (RL = 50 Ω , 10% - 90% - 10% Points) |
|-----------------|-------------------|-------------------------|-------------------|-----------------------------|-------------------|----------|---|------------------------|---------------------------------|-------------------------------------|-------|--|-------------|---|
| | | design | design | typ | min | max | typ | typ | typ | typ | typ | typ | | |
| | | nm | μ m | λ_{peak} | V_{BR} | V_{BR} | $V/^\circ\text{C}$ | M | M | I_D | I_D | $\text{pA}/\sqrt{\text{Hz}}$ | C_D | ns |
| C30737EH-230-80 | TO | - | 230 | 800 | 120 | 200 | 0.5 | 100 | 50 | 2.5 | 10 | 0.1 | 1.0 | 0.22 |
| C30737PH-230-80 | T-1 $\frac{3}{4}$ | - | 230 | 800 | 120 | 200 | 0.5 | 100 | 50 | 2.5 | 10 | 0.1 | 1.0 | 0.22 |
| C30737LH-230-80 | LCC | - | 230 | 800 | 120 | 200 | 0.5 | 100 | 50 | 2.5 | 10 | 0.1 | 1.0 | 0.22 |
| C30737LH-230-81 | LCC | 635 | 230 | 635 | 120 | 200 | 0.5 | 100 | 35 | 2.5 | 10 | 0.1 | 1.0 | 0.22 |
| C30737EH-500-80 | TO | - | 500 | 800 | 120 | 200 | 0.5 | 100 | 50 | 5 | 20 | 0.3 | 2.0 | 0.30 |
| C30737PH-500-80 | T-1 $\frac{3}{4}$ | - | 500 | 800 | 120 | 200 | 0.5 | 100 | 50 | 5 | 20 | 0.3 | 2.0 | 0.30 |
| C30737LH-500-80 | LCC | - | 500 | 800 | 120 | 200 | 0.5 | 100 | 50 | 5 | 20 | 0.3 | 2.0 | 0.30 |
| C30737LH-500-81 | LCC | 635 | 500 | 800 | 120 | 200 | 0.5 | 100 | 35 | 5 | 20 | 0.3 | 2.0 | 0.30 |
| C30737EH-230-90 | TO | - | 230 | 900 | 180 | 260 | 1.3 | 100 | 60 | 2.5 | 10 | 0.2 | 0.6 | 0.50 |
| C30737PH-230-90 | T-1 $\frac{3}{4}$ | - | 230 | 900 | 180 | 260 | 1.3 | 100 | 60 | 2.5 | 10 | 0.2 | 0.6 | 0.50 |
| C30737PH-230-90 | LCC | - | 230 | 900 | 180 | 260 | 1.3 | 100 | 60 | 2.5 | 10 | 0.2 | 0.6 | 0.50 |
| C30737PH-230-92 | LCC | 905 | 230 | 905 | 180 | 260 | 1.3 | 100 | 60 | 2.5 | 10 | 0.2 | 0.6 | 0.50 |
| C30737EH-500-90 | TO | - | 500 | 900 | 180 | 260 | 1.3 | 100 | 60 | 5 | 20 | 0.4 | 1.0 | 0.60 |
| C30737PH-500-90 | T-1 $\frac{3}{4}$ | - | 500 | 900 | 180 | 260 | 1.3 | 100 | 60 | 5 | 20 | 0.4 | 1.0 | 0.60 |
| C30737LH-500-90 | LCC | - | 500 | 900 | 180 | 260 | 1.3 | 100 | 60 | 5 | 20 | 0.4 | 1.0 | 0.60 |
| C30737LH-500-92 | LCC | 905 | 500 | 905 | 180 | 260 | 1.3 | 100 | 60 | 5 | 20 | 0.4 | 1.0 | 0.60 |
| C30724EH | TO | - | 500 | 920 | - | 350 | - | 15 | 8.5 | 20 | 40 | 0.1 | 1.0 | 5 |
| C30724PH | T-1 $\frac{3}{4}$ | - | 500 | 920 | - | 350 | - | 15 | 8.5 | 20 | 40 | 0.1 | 1.0 | 5 |

Electrical Characteristics at $T_{Ambient} = 22^\circ\text{C}$; at operating voltage, V_{op}

PIN PHOTO- DIODES FOR INDUSTRIAL APPLICATIONS

InGaAs and Si PIN Diodes – Quadrant Detectors – UV-Enhanced



Applications

- Telecom
- Instrumentation
- Photometry
- Laser power monitoring
- Fiber optic test equipment
- High speed switching
- Spot tracking
- Laser range finders
- Missile guidance
- Laser warning system

Features and Benefits

- High speed
- High responsivity
- Hermetically sealed
- Large area available
- High shunt resistance, low dark current

Product Description

Silicon PIN photodiodes are available in a wide variety of active area to accommodate a large variety of applications. The PIN structure allows high quantum efficiency and fast response for detection of photon in the 400 nm to 1100 nm range.

The YAG series offers an exceptional 0.4 A/W at 1060 nm by using a thick silicon material. Designed with a guard ring to collect current generated outside of the active area, they are the detectors of choice when the entire chip is illuminated by reducing unwanted carriers responsible for noise. Precise beam positioning can be achieved by using our quadrant detectors. They are designed with 4 pie-shaped quadrant sections from doping process thus reducing to almost zero the “dead” space between each quadrant. Each quadrant is connected to an isolated lead.

The C30741 provide fast response and good quantum efficiency in the spectral range between 300 nm to 1100 nm. Designed for high-speed, high-volume production and cost sensitive applications, these photodiodes are offered in plastic package, either TO style or SMD packages with a visible blocking filter option.

Our UV series are high quality Si PIN photodiode in hermetically sealed TO package designed for the 220 nm to 1100 nm wavelength region with enhanced operation in the UV range. Low noise detection is achieved by operating the UV series in photovoltaic mode (0V bias).

The InGaAs PIN detectors provide high quantum efficiency from 800 nm to 1700 nm. They feature low capacitance for extended bandwidth, high resistance for high sensitivity, high linearity, and uniformity within 2% across the detector active area.

Product Table

InGaAs PIN, High Speed, Peak Wavelength at 1550 nm

| Unit | Active Diameter µm | Responsivity Peak A/W | Capacitance pF | B _w GHz | Dark Current nA | Breakdown Voltage V | Operating Voltage V | Package |
|-------------|-----------------------|--------------------------|-------------------|-----------------------|--------------------|------------------------|------------------------|----------------------|
| C30616ECERH | 50 | 0.95 | 0.35 | 3.5 | <1 | 100 | 5 | Ceramic carrier |
| C30617BH | 100 | 0.95 | 0.8 | 3.5 | <1 | 100 | 5 | TO-18, ball lens |
| C30617BFCH | 100 | 0.95 | 0.8 | 3.5 | <1 | 100 | 5 | TO-18, FC receptacle |
| C30617BSCH | 100 | 0.95 | 0.8 | 3.5 | <1 | 100 | 5 | TO-18, SC receptacle |
| C30617BSTH | 100 | 0.95 | 0.8 | 3.5 | <1 | 100 | 5 | TO-18 ST receptacle |
| C30617ECERH | 100 | 0.95 | 0.6 | 3.5 | <1 | 100 | 5 | Ceramic carrier |
| C30618BFCH | 350 | 0.95 | 4 | 0.75 | 1 | 100 | 5 | TO-18, FC receptacle |
| C30618GH | 350 | 0.95 | 4 | 0.75 | 1 | 100 | 5 | TO-18 |
| C30618ECERH | 350 | 0.95 | 4 | 0.75 | 1 | 100 | 5 | Ceramic carrier |
| C30637ECERH | 75 | 0.95 | 0.4 | 3.5 | <1 | 100 | 5 | Ceramic carrier |

Product Table

InGaAs PIN, Large Area, Peak Wavelength at 1550 nm

| Unit | Active Diameter mm | Responsivity Peak A/W | Capacitance pF | Shunt Resistance Mega Ohm | B _w MHz | Dark Current nA | Breakdown Voltage V | Operating Voltage V | Package |
|--------------|-----------------------|--------------------------|-------------------|------------------------------|-----------------------|--------------------|------------------------|------------------------|-------------------------|
| C30641EH-TC | 1 | 0.95 | 40 | 50 | 75 | 5 | 80 | 0-5 | TO-8, flange, TE-cooled |
| C30641EH-DTC | 1 | 0.95 | 40 | 50 | 75 | 5 | 80 | 0-5 | TO-8, flange, dual TE |
| C30641GH | 1 | 0.95 | 40 | 50 | 75 | 5 | 80 | 0-5 | TO-18 |
| C30642GH | 2 | 0.95 | 150 | 25 | 20 | 10 | 50 | 0-5 | TO-5 |
| C30665GH | 3 | 0.95 | 200 | 10 | 3 | 25 | 50 | 0-5 | TO-5 |
| C30723GH | 5 | 0.95 | 950 | 5 | 3 | - | 50 | 0-5 | TO-5 |
| C30619GH | 0.5 | 0.95 | 8 | 250 | 350 | 1 | 80 | 0-10 | TO-18 |

Product Table

Silicon PIN

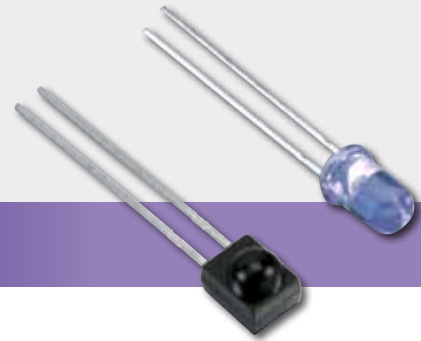
| Unit | Active Diameter um | Active Area mm ² | Responsivity Peak A/W | Peak Wavelength nm | Capacitance pF | Rise/Fall Time ns | Dark Current nA | Shunt Resistance MΩ | Breakdown Voltage V | Operating Voltage V | Package |
|---------------|-----------------------|--------------------------------|--------------------------|-----------------------|-------------------|----------------------|--------------------|------------------------|------------------------|------------------------|-------------------------------|
| C30741PH-15S | 1.5x1.5 | 2.25 | 0.47 | 800 | 11 | 2 | 0.05 | - | 300 | 10 | Plastic T-1¼ through-hole |
| C30741PFH-15S | 1.5x1.5 | 2.25 | 0.47 | 800 | 11 | 2 | 0.05 | - | 300 | 10 | T-1¼ visible blocking |
| C30807EH | 1 | 0.8 | 0.6 | 900 | 2.5 | 5 | 10 | - | >100 | 45 | TO-18 |
| C30808EH | 2.5 | 5 | 0.6 | 900 | 6 | 8 | 30 | - | >100 | 45 | TO-5 |
| C30822EH | 5 | 20 | 0.6 | 900 | 17 | 10 | 50 | - | >100 | 45 | TO-8 |
| C30809EH | 8 | 50 | 0.6 | 900 | 35 | 15 | 70 | - | >100 | 45 | TO-8 |
| C30810EH | 11 | 100 | 0.6 | 900 | 70 | 20 | 300 | - | >100 | 45 | TO-36 |
| C30971EH | 0.5 | 0.2 | 0.5 | 830 | 1.6 | 0.5 | 10 | - | >200 | 100 | TO-18 |
| FFD-100H | 2.5 | 5.1 | 0.6 | 850 | 8.5 | 3.5 | 5 | - | >125 | 15 | TO-5 |
| FFD-200H | 5.0 | 20 | 0.6 | 850 | 30 | 5 | 10 | - | >125 | 15 | 3 pin, 0.6 inch dia. |
| FND-100QH | 2.5 | 5.1 | 0.64 | 920 | 8.5 | <1n | 10 | - | 150 | 100 | TO-5 |
| UV-040BQH | 1.0 | 0.81 | 0.62 | 900 | 25 | - | - | >500 | - | 0 | TO-5, response down to 200 nm |
| UV-100BQH | 2.5 | 5.1 | 0.62 | 900 | 150 | - | - | >100 | - | 0 | TO-5, response down to 200 nm |
| UV-215BGH/340 | 0.0 | | | | | - | - | - | - | 0 | TO-5, response down to 250 nm |
| UV-215BQH | 5.5 | 23.4 | 0.62 | 900 | 700 | - | - | >50 | - | 0 | TO-5, response down to 200 nm |
| UV-245BGH | 5 | 18.5 | 0.62 | 900 | 630 | - | - | >75 | - | 0 | TO-5, response down to 250 nm |
| UV-245BQH | 5 | 18.5 | 0.62 | 900 | 630 | - | - | >75 | - | 0 | TO-5, response down to 200 nm |
| YAG-100AH | 2.5 | 5.1 | 0.7 | 1000 | 2.5 | 5 | <20 | - | >200 | 180 | TO-5 |
| YAG-200H | 5.0 | 20 | 0.7 | 1000 | 6 | 5 | <100 | - | >200 | 180 | TO-8 |
| YAG-444AH | 16.0 | 200 | 0.7 | 1000 | 35 | 5 | <200 | - | >200 | 180 | TO-36 |
| SR10BP | | 0.65 | | 900 | 10 | 10 | 10 | | 170 | | SMT |
| SR10BP-B | | 0.65 | | 900 | 10 | 10 | 10 | | 170 | | SMT |
| SR10DE | | 0.56 x 0.56 | | | 4 | 150 | 10 | | 170 | | SMT |
| SR10DE-B | | 6.71 | | | 4 | 150 | 10 | | 170 | | SMT |
| PFD10 | | 0.31 | 0.6 | 880 | 25 | 200 | 5 | | 170 | | SMT |
| CR50DE | | | 0.5 | 880 | 2.5 | 3000 | 0.5 | | 50 | | |

Product Table

Specialty Silicon Detectors

| Unit | Description | Active Diameter mm | Active Area mm ² | Capacitance pF | Rise/Fall Time ns | Dark Current nA | Breakdown Voltage min V | Responsivity 900 nm A/W | Responsivity 1060 nm A/W | Noise Current pA/sqrt(Hz) | Package |
|-------------|---|-----------------------|--------------------------------|-------------------|----------------------|--------------------|----------------------------|----------------------------|-----------------------------|------------------------------|---------|
| C30845EH | Quadrant PIN | 8 | 50 | 8/q | 6 | 70 nA | 100 | 0.6 | 0.17 | 0.26/q | TO-8 |
| YAG-444-4AH | Quadrant PIN | 11.3 | 100 | 9/q | 8 | <75 nA | 200 | 0.6 | 0.5 | 0.2/q | Custom |
| DTC-140H | Dual wavelength detector Si-Si (Top/Bottom) | 3.5 | 9.9 | 300/300 | - | 50/50 MΩ | - | 0.6/0 | 0.25/0.15 | 0.033/0.133 | Custom |

OPTOELECTRONIC COMPONENTS FOR SMOKE DETECTOR APPLICATIONS



Selected Photodiodes and Infrared Emitting Diodes (IREds)

Applications

- Electro-optical smoke detection

Features and Benefits

- High quality components: photodiodes, IREds (UL- listed)
- Binning for optimized transfer function
- Customized optical block (PD+IREd) assemblies
- Smoke chamber assemblies according specified transfer function

Product Description

An electro-optical smoke detector consists of an Infrared LED (IREd) and Photodiode (PD) assembly, which exhibits a signal under the presence of smoke in the detection volume (smoke chamber). Signal range under smoke and clean-air conditions and their long term stability are key features of a smoke detector module. Excelitas offers IREd and PD components as well as customized assemblies with specified signal level range. Such an assembly can be an optical block containing an IREd and PD for (SMD) board soldering or the complete smoke chamber, which are produced in high-volumes. Please contact Excelitas to discuss your requirements.

Product Table

Selected Photodiodes Used in Smoke Detection Applications

| Symbol | Package | Active Area | Short Circuit Current | Dark Current | Junction Capacitance | Radiometric Sensitivity @ λ_P | Spectral Range | Peak Wavelength | Noise Equivalent Power |
|-----------|-----------------------|-------------|-----------------------|--------------|----------------------|---------------------------------------|-------------------|-----------------|------------------------|
| | | | min | max | typ | typ | | λ_P | typ |
| Unit | | mm | I_{sc} | I_o | C_j | S_R | λ_{RANGE} | nm | NEP |
| | | | μA | nA | nF | A/W | nm | nm | W/√Hz |
| VTP7840H | Lensed sidelooker IRT | 5.27 | 50 | 20 | 40 | 0.55 | 725-1150 | 925 | 5.3 x 10-14 |
| VTP413H | Lensed sidelooker | 7.45 | 120 (typ) | 30 | 50 | 0.55 | 400-1150 | 925 | 2.3 x 10-14 |
| VTP100H | Flat sidelooker IRT | 7.45 | 35 | 30 | 50 | 0.5 | 725-1150 | 925 | 2.5 x 10-14 |
| VTP1188SH | Lensed ceramic | 11 | 200 (typ) | 30 | 300 | 0.55 | 400-1100 | 925 | - |

Product Table

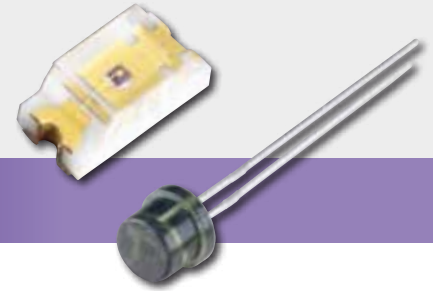
Selected Infrared LEDs (IREds) Used in Smoke Detection Applications

| Symbol | Package | Total Power | Test Current | Forward Drop Voltage | Half Power Beam Angle |
|------------|-------------|-------------|--------------|----------------------|-----------------------|
| | | typ | typ | @ I_{FT} | typ |
| Unit | | P_o | I_{FT} | V_F | $\Theta_{1/2}$ |
| | | | mA (pulsed) | V | degree |
| VTE1291-1H | T-1¼ lensed | 20 | 100 | 1.5 | ±12 |
| VTE1291-2H | T-1¼ lensed | 25 | 100 | 1.5 | ±12 |
| VTE1295 | T-1¼ lensed | 20 | 100 | 1.5 | ±8 |

Left: Spectrally Adapted Photodiodes and Phototransistors

Right: C30737PH Series T-1¼ (TO-like) Through-Hole Package (4.9mm Diameter)

AMBIENT LIGHT SENSORS



Spectrally Adapted Photodiodes and Phototransistors

Applications

- Interior and exterior light switching (dusk/dawn switch)
- Interior and exterior light control (dimming)
- Automotive headlight dimmer
- Display contrast control
- Energy conservation
- Oil burner flame monitoring

Features and Benefits

- Response approaching human eye using Excelitas' IR-BLOC™ technology
- Perfect light sensor in conjunction with Excelitas pyroelectric detectors for motion controlled light switches
- RoHS compliant
- Selectable wavelength detection range
- Small footprint
- Surface mount packages

Product Description

Ambient light sensors from Excelitas provide an easy solution for applications that require a response similar to the human eye, making it ideal when the response should only be influenced by visible light. These devices contribute in various applications to energy conservation in both fixed and portable devices. There are three main device types, one being filtered photodiodes, the second filtered phototransistors and finally wavelength selective devices based on III-V material. They are available in a number of standard packages, including surface mount for automated assembly.

Product Table

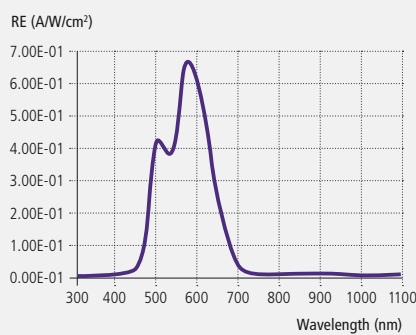
Spectrally Adapted Photodiodes and Phototransistors

| Symbol | Package | Active Area | Short Circuit Current @ H=100fc, 2850K | | Junction Capacitance | | Radio-metric Sensitivity @ λ _P | Spectral Range | Peak Wavelength | |
|-----------------|-----------|-----------------|--|----------------|----------------------|----------------|---|----------------|--------------------|----------------|
| | | | min | typ | max | typ | | | | max |
| Unit | | mm ² | I _{sc} | I _d | I ₀ | C _J | C _J | S _R | λ _{RANGE} | λ _P |
| | | | μA | nA | nA | pF | pF | A/W | nm | nm |
| VTP1220FBH | T-1¼ flat | 1.219 | 0.7 | - | 10 | - | 18 | 0.27 | 400-700 | 550 |
| VTP9812FH | T-1¼ flat | 1.548 | 0.7 | - | 10 | - | 18 | 0.034 | 400-700 | 580 |
| VTT9812FH | T-1¼ flat | 0.192 | 100 | - | 100 | - | - | 7 | 450-700 | 585 |
| SR10SPD 470-0.9 | SMT | 0.70 | - | - | 0.03 | 150 | - | 0.18 | 380-556 | 470 |
| SR10SPD 525-0.9 | SMT | 0.73 | - | - | 0.03 | 100 | - | 0.25 | 480-560 | 525 |

Electrical characteristics at T_{Ambient} = 25 °C

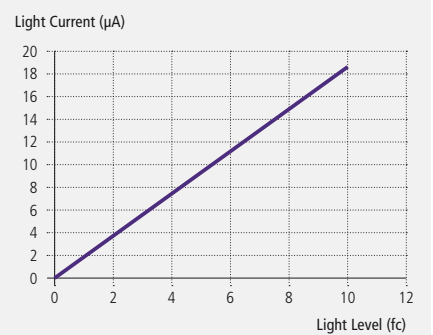
Graph 1

Responsivity @ 25° C VTT9812FH IR-BLOC™



Graph 2

VTT9812FH Output Versus Low Light Levels



FAST RESPONSE SILICON PHOTODIODES FOR INDUSTRIAL AND COMMERCIAL APPLICATIONS

Silicon Photodiodes – VTP Series

Applications

- Smoke detection
- Barcode scanning
- Light meters
- Pulse oximeters

Features and Benefits

- Visible to IR spectral range
- Integral visible rejection filters available
- 1 to 2 % linearity over 7 to 9 decades
- Low dark currents
- High shunt resistance
- Low capacitance



Product Description

Photodiodes in this series have been designed for low junction capacitance. The lower the capacitance, the faster the response of the photodiode when the RC time constant is your limiting factor. Also, speed can be further increased by reverse biasing the photodiodes. These devices have excellent response in the IR region and are well matched to IR LEDs (VTE series). Some photodiodes are available in packages which incorporate a visible rejection filter, effectively blocking light below 700 nm. Photodiodes made with the VTP process are suitable for operation under reverse bias conditions but may be used in the photovoltaic mode. Typical reverse breakdown voltages are around 140 V. Low dark currents under reverse bias are also a feature of this series.

Product Table

Silicon Photodiodes – VTP Series

| Symbol | Package | Active Area mm ² | Short Circuit Current | Dark Current | Junction Capacitance | Radiometric Sensitivity @ λ _P | Spectral Range λ _{RANGE} nm | Peak Wavelength | Active Area |
|------------|----------------------|--------------------------------|-----------------------|----------------------|----------------------|--|--|-----------------|-------------------------|
| | | | min | max | max | typ | | λ _P | typ |
| | | | I _{SC} μA | I _D nA | C _J pF | S _R A/W | | NEP W/√Hz | |
| VTP100H | Flat sideloooker IRT | 7.45 | 35 | 30 | 50 | 0.5 | 725-1150 | 925 | 2.5 x 10 ⁻¹⁴ |
| VTP100CH | Flat sideloooker | 7.45 | 50 | 30 | 50 | 0.55 | 400-1150 | 925 | 9.0 x 10 ⁻¹⁴ |
| VTP1012H | TO-46 | 1.6 | 10 | 7 | 6 | 0.55 | 400-1150 | 925 | 8.7 x 10 ⁻¹⁴ |
| VTP1112H | TO-46 lensed | 1.6 | 30 | 7 | 6 | 0.55 | 400-1150 | 925 | 8.7 x 10 ⁻¹⁴ |
| VTP1188SH | Lensed ceramic | 11 | 200 (typ) | 30 | 300 | 0.55 | 400-1100 | 925 | - |
| VTP1220FBH | T-1¾ flat | 1.219 | 0.7 | 10 | 18 | 0.27 | 400-725 | 550 | - |
| VTP1232H | T-1¾ | 2.326 | 100 | 25 | 180 | 0.6 | 400-1100 | 920 | - |
| VTP1232FH | T-1¾ flat | 2.326 | 21 | 25 | 180 | 0.6 | 400-1100 | 920 | - |
| VTP1332H | T-1¾ IRT | 2.326 | 75 | 25 | 180 | 0.55 | 725-1150 | 920 | - |
| VTP1332FH | T-1¾ flat IRT | 2.326 | 17 | 25 | 180 | 0.55 | 725-1150 | 920 | - |
| VTP3310LAH | T1 | 0.684 | 24 | 35 | 25 | 0.55 | 400-1150 | 925 | 1.9 x 10 ⁻¹³ |
| VTP3410LAH | T1 IRT | 0.684 | 15 | 35 | 25 | 0.55 | 700-1150 | 925 | 1.9 x 10 ⁻¹³ |

Electrical characteristics at T_{Ambient} = 25 °C

Product Table

Silicon Photodiodes – VTP Series

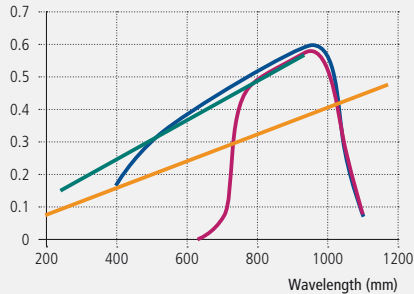
| Symbol | Package | Active Area mm ² | Short Circuit Current | | Dark Current | | Junction Capacitance | Radiometric Sensitivity @ λ _P | Spectral Range | Peak Wavelength | Active Area |
|-----------------|-----------------------|--------------------------------|-----------------------|----------------|----------------|----------------|----------------------|--|-------------------------|-----------------|-------------|
| | | | min | max | max | typ | λ _{RANGE} | λ _P | typ | | |
| | | | I _{SC} | I _D | C _J | S _R | λ _{RANGE} | λ _P | NEP | | |
| Unit | | | μA | nA | pF | A/W | nm | nm | W/√Hz | | |
| VTP413H | Lensed sidelooper | 7.45 | 120 (typ) | 30 | 50 | 0.55 | 400-1150 | 925 | 2.3 x 10 ⁻¹⁴ | | |
| VTP4085H | Ceramic | 21 | 200 (typ) | 100 | 500 | 0.55 | 400-1100 | 925 | - | | |
| VTP4085SH | Ceramic | 21 | 200 (typ) | 50 | 500 | 0.55 | 400-1100 | 925 | - | | |
| VTP5050H | TO-5 | 7.45 | 40 | 18 | 24 | 0.55 | 400-1150 | 925 | 1.4 x 10 ⁻¹³ | | |
| VTP6060H | TO-8 | 20.6 | 120 | 35 | 60 | 0.55 | 400-1150 | 925 | 1.9 x 10 ⁻¹³ | | |
| VTP7110H | Lateral | 0.684 | 6 | 35 | 25 | 0.55 | 400-1150 | 925 | 1.9 x 10 ⁻¹³ | | |
| VTP7210H | Lateral IRT | 0.684 | 5 | 35 | 25 | 0.55 | 700-1150 | 925 | 1.9 x 10 ⁻¹³ | | |
| VTP7840H | Lensed sidelooper IRT | 5.27 | 50 | 20 | 40 | 0.55 | 725-1150 | 925 | 5.3 x 10 ⁻¹⁴ | | |
| VTP8350H | Ceramic | 7.45 | 65 | 30 | 50 | 0.55 | 400-1150 | 925 | 1.8 x 10 ⁻¹³ | | |
| VTP8440H | 8 mm ceramic | 5.16 | 30 | 15 | 15 | 0.55 | 400-1150 | 925 | 1.3 x 10 ⁻¹³ | | |
| VTP8551H | Mini-DIP | 7.45 | 50 | 30 | 50 | 0.55 | 400-1150 | 925 | 1.8 x 10 ⁻¹³ | | |
| VTP8651H | Mini-DIP IRT | 7.45 | 35 | 30 | 50 | 0.5 | 725-1150 | 925 | 2.0 x 10 ⁻¹³ | | |
| VTP8740_TRH | SMT clear plastic | 5.269 | 75 | 20 | 50 | 0.6 | 400-1150 | 925 | 2.0 x 10 ⁻¹³ | | |
| VTP8840_TRH | SMT IRT | 5.269 | 50 | 20 | 50 | 0.6 | 725-1150 | 925 | 2.0 x 10 ⁻¹³ | | |
| VTP9412H | 6 mm ceramic | 1.6 | 10 | 7 | 6 | 0.55 | 400-1150 | 925 | 8.7 x 10 ⁻¹⁴ | | |
| VTP9812FH | T-1 3/4 flat | 1.548 | 0.7 | 10 | 18 | 0.034 | 400-700 | 580 | - | | |
| SR10SPD 880-0.9 | SMT | 0.73 | - | 0.01 | - | - | 820-935 | 890 | - | | |

Electrical characteristics at T_{ambient} = 25 °C

Graph 1

Absolute Spectral Response*

Radiometric Sensitivity, A/W

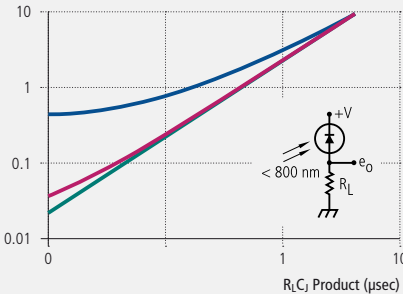


— Q.E. = 0.50 — glass window or epoxy coated
— Q.E. = 0.75 — visible blocking filter

Graph 2

Rise/Fall Times – Non Saturated*

Response Time (μsec 10–90%)

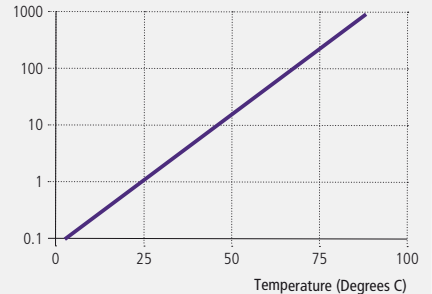


— photovoltaic — V = 10V — R.C. limit

Graph 3

Relative Dark Current vs. Temperature*

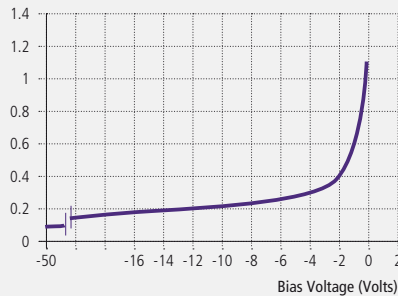
Relative Dark Current



Graph 4

Rel. Junction Capacitance vs. Voltage*

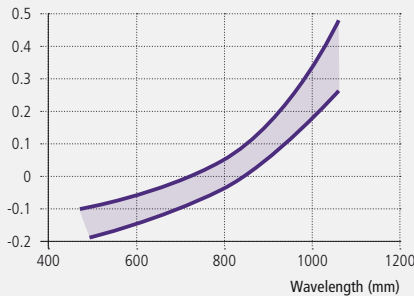
Relative Capacitance



Graph 5

Temp. Coefficient of Light Current vs. Wavelength*

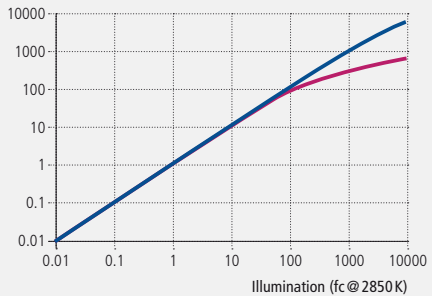
Temperature Coefficient (%) / Degree (C)



Graph 6

Rel. Short Circuit Current vs. Illumination*

Relative Short Circuit Current



* Typical characteristic curves @ 25°C (unless otherwise noted)

INDUSTRY STANDARD SILICON PHOTODIODES



Silicon Photodiodes – VTD Series

Applications

- Pulse oximetry
- Automotive
- Surface mount assembly process

Features and Benefits

- Alternate source for industry standard photodiodes
- Surface mount package available
- Available in package with integrated IR filtering
- Large area PIN available on ceramic package
- RoHs compliant

Product Description

The VTD series are photodiodes which have been used in many applications as replacement for competitive devices.

Product Table

Silicon Photodiodes – VTD Series

| Symbol | Industry Equivalent | Package | Active Area | Short Circuit Current | | Junction Capacitance | Radiometric Sensitivity @ λ_P | Spectral Range | Peak Wavelength | Noise Equivalent Power |
|-----------|---------------------|---------------|-----------------|--------------------------------------|----------------|----------------------|---------------------------------------|-------------------|-----------------|-------------------------|
| | | | | min | max | | | | | |
| Unit | | | mm ² | I _{sc} | I _b | C _j | S _R | λ_{RANGE} | λ_P | NEP |
| | | | | μA | nA | nF | A/W | nm | nm | W/Hz |
| VTD31AAH | CLD31AA | Ceramic | 16.73 | 150 @ 5 mW/cm ² , 2850 K | 50 | 0.50 | 0.55 | 400-1150 | 860 | - |
| VTD34H | BPW34 | Mini-DIP | 7.45 | 50 @ 1000 Lux, 2850 K | 30 | 0.060 | 0.60 | 400-1100 | 900 | 4.8 x 10 ⁻¹⁴ |
| VTD34FH | BPW34F | Mini-DIP | 7.45 | 15 @ 0.5 mW/cm ² , 940 nm | 30 | 0.060 | 0.60 | 725-1150 | 940 | 4.8 x 10 ⁻¹⁴ |
| VTD34SMH | BPW34 | SMT | 7.45 | 50 @ 1000 Lux, 2850 K | 30 | 0.025 | 0.60 | 400-1100 | 900 | 4.8 x 10 ⁻¹⁴ |
| VTD34FSMH | BPW34F | SMT | 7.45 | 15 @ 0.5 mW/cm ² , 940 nm | 30 | 0.080 | 0.60 | 725-1150 | 940 | 4.8 x 10 ⁻¹⁴ |
| VTD205H | SFH205 | TO-92 | 7.41 | 15 @ 0.5 mW/cm ² , 940 nm | 30 | 0.072 | 0.60 | 800-1100 | 925 | - |
| VTD205KH | SFH205K | TO-92 | 7.41 | 50 @ 1000Lux, 2850 K | 30 | 0.072 | 0.60 | 400-1100 | 925 | - |
| VTD206H | SFH206 | TO-92 | 7.41 | 15 @ 0.5 mW/cm ² , 940 nm | 30 | 0.072 | 0.60 | 750-1100 | 925 | - |
| VTD206KH | SFH206K | TO-92 | 7.41 | 50 @ 1000Lux, 2850 K | 30 | 0.072 | 0.60 | 400-1100 | 925 | - |
| VTH2090H | S1723-04 | Black ceramic | 84.64 | 65 @ 100 Lux | 10 | 0.070 | 0.60 | 400-1100 | 960 | - |

Figure 1

Package Drawing – VTD Series – Mini-DIP Package

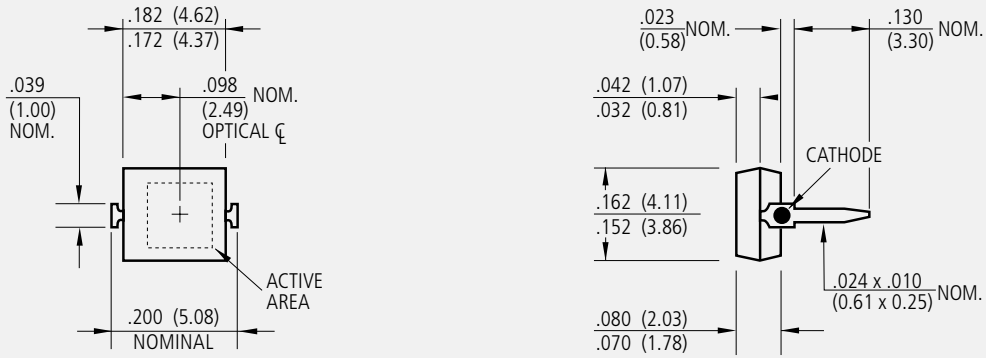


Figure 2

Package Drawing – VTD Series – SMT Package

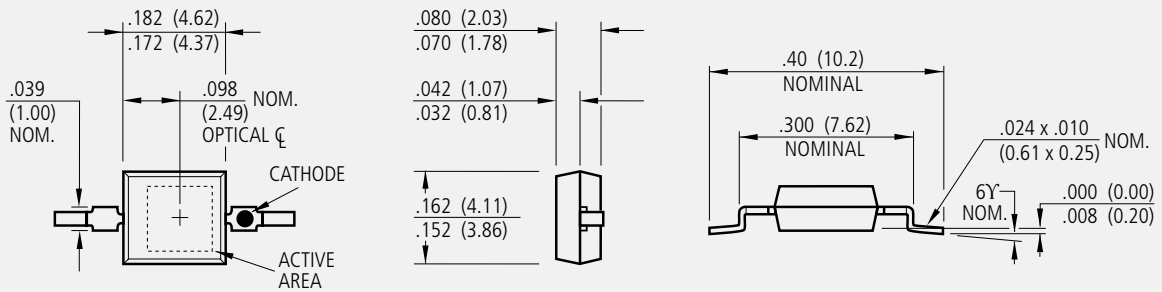
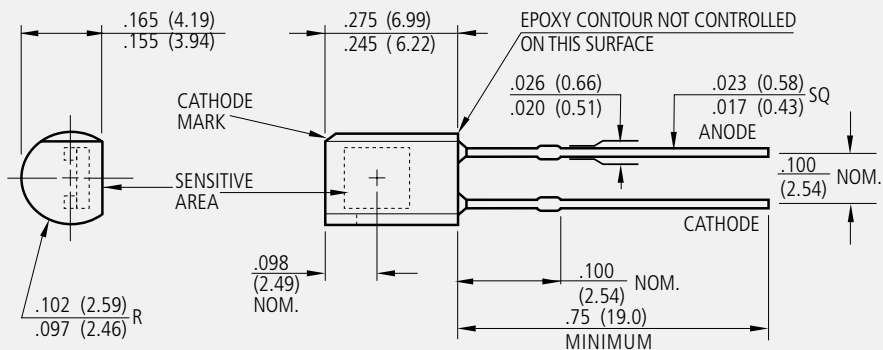


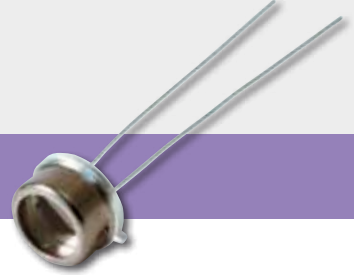
Figure 3

Package Drawing – VTD Series – TO-92 Package



BLUE-ENHANCED SILICON PHOTODIODES FOR INDUSTRIAL AND COMMERCIAL APPLICATIONS

Silicon Photodiodes – VTB Series – Ultra High Dark Resistance



Applications

- Ambient light sensing
- UV and blue light sensing
- Flame monitoring
- Light meters
- Photometry

Features and Benefits

- UV to IR spectral range
- Integral IR rejection filters available
- Response @ 365 nm, 0.14 A/W typical
- Response @ 220 nm, 0.06 A/W typical with UV window
- 1 to 2 % linearity over 7 to 9 decades
- Very low dark current
- High shunt resistance
- RoHs compliant

Product Description

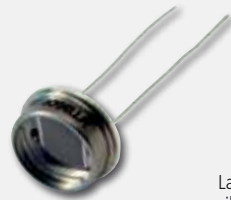
This series of P on N silicon planar photodiodes have been designed for optimum response through the visible part of the spectrum. Units with UV transmitting windows also exhibit excellent response in the UV. “B” series units have a built-in infrared rejection filter for applications requiring a response approximating the human eye. Photodiodes made with the VTB process are primarily intended to be used in photovoltaic mode but may be used with a small reverse bias. All photodiodes in this series exhibit very high shunt resistance. This characteristic leads to very low offsets when used in high gain transimpedance op-amps circuits.

VTB1012



Small area planar silicon photodiode in flat window TO-46 package

VTB6061



Large area planar silicon photodiode in a flat window TO-8 package

VTB4051



Planar silicon photodiode mounted on a ceramic substrate and coated with a layer of clear epoxy

VTB8341



Planar silicon photodiode mounted on a ceramic substrate and coated with a layer of clear epoxy

Silicon Photodiodes – VTB Series – Ultra High Dark Resistance

| Symbol | Package | Active Area | Short Circuit Current @ 100 fc, 2850 K | | Dark Current | Junction Capacitance | Radiometric Sensitivity @ 365 nm | Spectral Range | Peak Wavelength | Noise Equivalent Power |
|-------------|------------------|-----------------|--|----------------------|----------------------|-----------------------|----------------------------------|----------------------|-------------------------|------------------------|
| | | | min | max | | | | | | |
| Unit | | mm ² | I _{sc} μA | I _D nA | C _J nF | S _R A/W | λ _{RANGE} nm | λ _P nm | NEP W/√Hz | |
| VTB100AH | Flat sidelooper | 7.1 | 50 | 0.50 | 0.10 | 0.55 @ 925 nm | 400 - 1150 | 925 | 9.0 x 10 ⁻¹⁴ | |
| VTB1012H | TO-46 | 1.6 | 8.0 | 0.10 | 0.31 | 0.09 | 320 - 1100 | 920 | 3.0 x 10 ⁻¹⁴ | |
| VTB1012BH | TO-46 | 1.6 | 0.80 | 0.10 | 0.31 | 0.28 @ 540 nm | 330 - 720 | 580 | 5.3 x 10 ⁻¹⁴ | |
| VTB1013H | TO-46 | 1.6 | 8.0 | 0.02 | 0.31 | 0.09 | 320 - 1100 | 920 | 5.9 x 10 ⁻¹⁵ | |
| VTB1013BH | TO-46 | 1.6 | 0.80 | 0.02 | 0.31 | 0.28 @ 540 nm | 330 - 720 | 580 | 1.1 x 10 ⁻¹⁴ | |
| VTB1112H | TO-46 lensed | 1.6 | 30.0 | 0.10 | 0.31 | 0.19 | 320 - 1100 | 920 | 3.0 x 10 ⁻¹⁴ | |
| VTB1112BH | TO-46 lensed | 1.6 | 3.0 | 0.10 | 0.31 | 0.28 @ 540 nm | 330 - 720 | 580 | 5.3 x 10 ⁻¹⁴ | |
| VTB1113H | TO-46 lensed | 1.6 | 30.0 | 0.02 | 0.31 | 0.19 | 320 - 1100 | 920 | 5.9 x 10 ⁻¹⁵ | |
| VTB1113BH | TO-46 lensed | 1.6 | 3.0 | 0.02 | 0.31 | 0.28 @ 540 nm | 330 - 720 | 580 | 1.1 x 10 ⁻¹⁴ | |
| VTB4051H | Ceramic | 14.8 | 100 | 0.25 | 3.0 | 0.10 | 320 - 1100 | 920 | 2.1 x 10 ⁻¹⁴ | |
| VTB5051H | TO-5 | 14.8 | 85 | 0.25 | 3.0 | 0.10 | 320 - 1100 | 920 | 2.1 x 10 ⁻¹⁴ | |
| VTB5051BH | TO-5 | 14.8 | 8 | 0.25 | 3.0 | 0.28 @ 540 nm | 330 - 720 | 580 | 3.7 x 10 ⁻¹⁴ | |
| VTB5051JH | TO-5 with 3 pins | 14.8 | 85 | 0.25 | 3.0 | 0.10 | 320 - 1100 | 920 | 2.1 x 10 ⁻¹⁴ | |
| VTB5051UVH | TO-5 | 14.8 | 85 | 0.25 | 3.0 | 0.038 @ 220 nm | 200 - 1100 | 920 | 2.1 x 10 ⁻¹⁴ | |
| VTB5051UVJH | TO-5 with 3 pins | 14.8 | 85 | 0.25 | 3.0 | 0.038 @ 220 nm | 200 - 1100 | 920 | 2.1 x 10 ⁻¹⁴ | |
| VTB6061H | TO-5 | 37.7 | 260 | 2.0 | 8.0 | 0.10 | 320 - 1100 | 920 | 5.7 x 10 ⁻¹⁴ | |
| VTB6061BH | TO-5 | 37.7 | 26 | 2.0 | 8.0 | 0.28 @ 540 nm | 330 - 720 | 580 | 1.0 x 10 ⁻¹³ | |
| VTB6060CIEH | TO-5 | 37.7 | | 2.0 | 8.0 | | 460 - 675 | 555 | 1.0 x 10 ⁻¹³ | |
| VTB6061JH | TO-5 with 3 pins | 37.7 | 260 | 2.0 | 8.0 | 0.10 | 320 - 1100 | 920 | 5.7 x 10 ⁻¹⁴ | |
| VTB6061UVH | TO-5 | 37.7 | 260 | 2.0 | 8.0 | 0.04 @ 220 nm | 200 - 1100 | 920 | 5.7 x 10 ⁻¹⁴ | |
| VTB6061UVJH | TO-5 with 3 pins | 37.7 | 260 | 2.0 | 8.0 | 0.04 @ 220 nm | 200 - 1100 | 920 | 5.7 x 10 ⁻¹⁴ | |
| VTB8341H | Ceramic | 5.16 | 35 | 0.10 | 1.0 | 0.10 | 320 - 1100 | 920 | 2.4 x 10 ⁻¹⁴ | |
| VTB8440H | 8 mm ceramic | 5.16 | 35 | 2.0 | 1.0 | 0.10 | 320 - 1100 | 920 | 5.9 x 10 ⁻¹⁴ | |
| VTB8440BH | 8 mm ceramic | 5.16 | 4 | 2.0 | 1.0 | 0.28 @ 540 nm | 330 - 720 | 580 | 1.1 x 10 ⁻¹³ | |
| VTB8441H | 8 mm ceramic | 5.16 | 35 | 0.10 | 1.0 | 0.10 | 320 - 1100 | 920 | 1.3 x 10 ⁻¹⁴ | |
| VTB8441BH | 8 mm ceramic | 5.16 | 4 | 0.10 | 1.0 | 0.28 @ 540 nm | 330 - 720 | 580 | 2.4 x 10 ⁻¹⁴ | |
| VTB9412H | 6 mm ceramic | 1.6 | 8 | 0.10 | 0.31 | 0.09 | 320 - 1100 | 920 | 3.0 x 10 ⁻¹⁴ | |
| VTB9412BH | 6 mm ceramic | 1.6 | 0.8 | 0.10 | 0.31 | 0.28 @ 540 nm | 330 - 720 | 580 | 5.3 x 10 ⁻¹⁴ | |
| VTB9413H | 6 mm ceramic | 1.6 | 8 | 0.02 | 0.31 | 0.09 | 320 - 1100 | 920 | 5.9 x 10 ⁻¹⁵ | |
| VTB9413BH | 6 mm ceramic | 1.6 | 0.8 | 0.02 | 0.31 | 0.28 @ 540 nm | 330 - 720 | 580 | 1.1 x 10 ⁻¹⁴ | |

Figure 1

Package Drawing – VTB Series – Flat Sidelooper Package

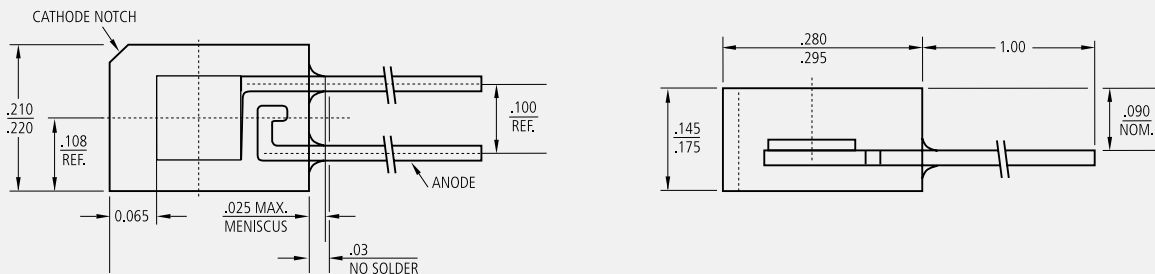


Figure 2

Package Drawing – VTB Series – TO-46 Package

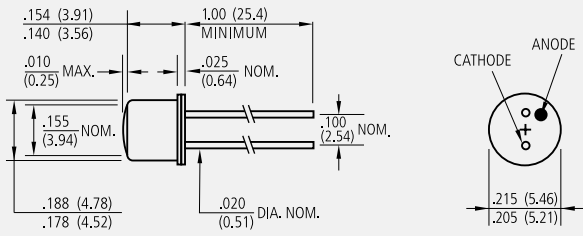


Figure 3

Package Drawing – VTB Series – TO-5 Package

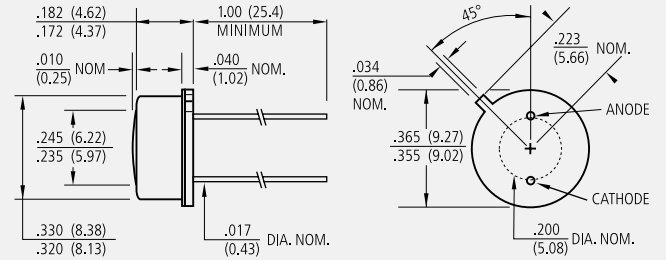


Figure 4

Package Drawing – VTB Series – 8mm Ceramic Package

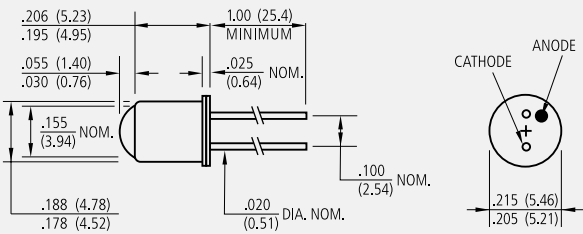


Figure 5

Package Drawing – VTB Series – TO-46 Lensed

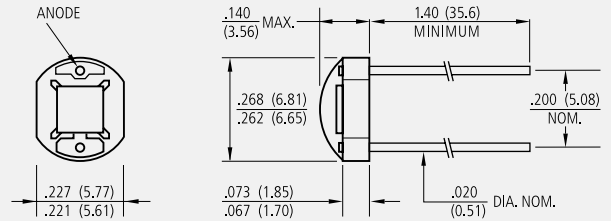


Figure 6

Package Drawing – VTB Series – Ceramic Package

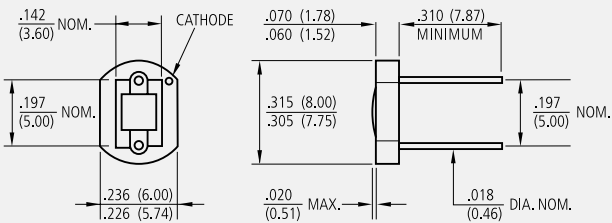
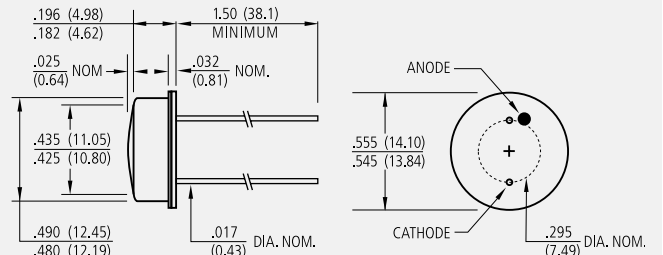


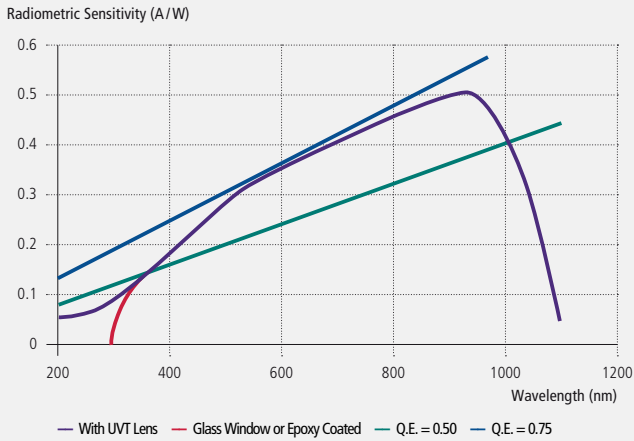
Figure 7

Package Drawing – VTB Series – TO-8 Package



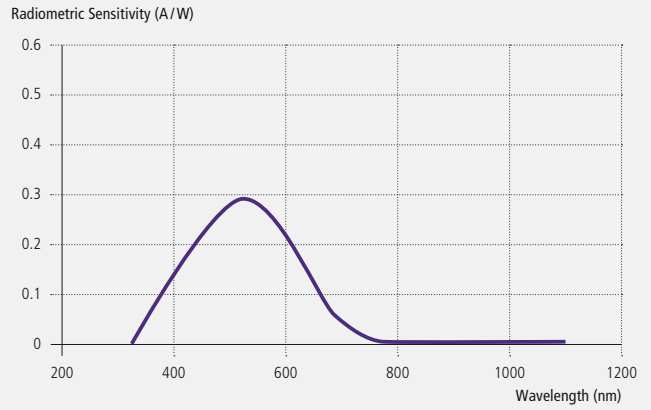
Graph 1

Absolute Spectral Response



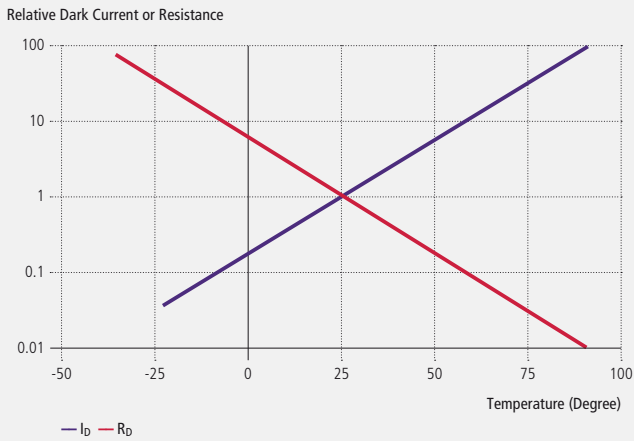
Graph 2

Absolute Spectral Response "B" Series (Filtered)



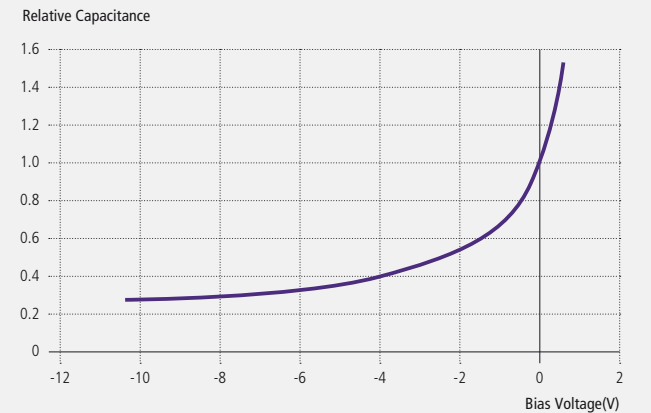
Graph 3

Rel. Current or Resistance vs. Temperature (Referred to 25°C)



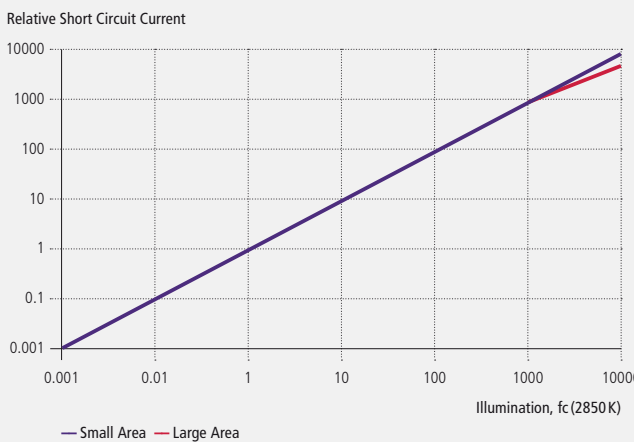
Graph 4

Relative Junction Capacitance vs. Voltage (Referred to Zero Bias)



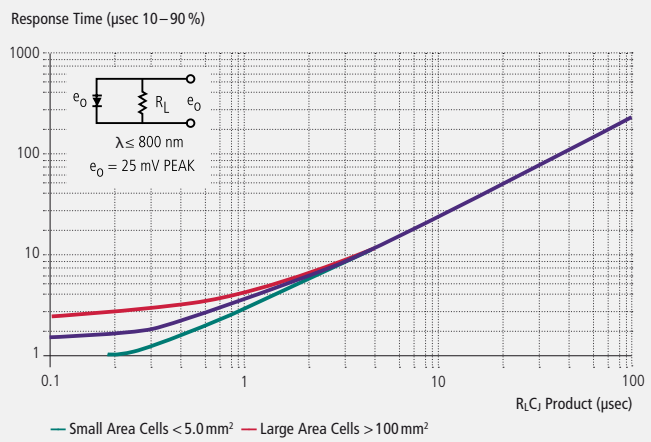
Graph 5

Relative Short Circuit Current vs. Illumination



Graph 6

Rise/Fall Times – Non Standard



Phototransistors – VTT Series – CR Series

| Symbol | Package | Exposed Active Area | Light Current @ 100 fc, V _{CE} = 5 V | | Dark Current @ V _{CE} = 10 V | | Collector Breakdown @ I _C = 100 μA, 0 fc | Emitter Breakdown @ I _C = 100 μA, 0 fc | Saturation Voltage @ I _C = 100 μA, 100 fc | Rise/Fall Time I _C = 1.0 mA RL = 100 Ω | Angular Response | Spectral Range |
|------------|------------------|---------------------|---|-----------------|---------------------------------------|----------------------|---|---|--|---|------------------|--------------------|
| | | | min | max | min | max | V _{BR(CEO)} | V _{BR(CEO)} | V _{CE(SAT)} | Typical | Typical | λ _{RANGE} |
| Unit | | mm ² | I _C | I _{CE} | V _{BR(CEO)} | V _{BR(CEO)} | V _{CE(SAT)} | τ _r /τ _f | θ _{1/2} | ° | nm | |
| | | | mA | nA | V | V | V | μS | | | | |
| VTT1222WH | T-1 3/4 | 0.19 | 1.9 | 10 @ VCE = 20V | 50 | 6.0 | 0.25 | 2.0 | ±40 | 400-1050 | | |
| VTT1223WH | T-1 3/4 | 0.19 | 1.5 | 10 @ VCE = 20V | 40 | 6.0 | 0.25 | 3.0 | ±40 | 400-1050 | | |
| VTT1225H | T-1 3/4 | 0.19 | 4.0 | 100 | 30 | 5.0 | 0.25 | 1.5 | ±5 | 400-1050 | | |
| VTT1226H | T-1 3/4 | 0.19 | 7.5 | 100 | 30 | 5.0 | 0.25 | 3.0 | ±5 | 400-1050 | | |
| VTT1227H | T-1 3/4 | 0.19 | 12.0 | 100 | 30 | 5.0 | 0.25 | 4.0 | ±5 | 400-1050 | | |
| VTT3122EH | Coax hermetic | 0.19 | 1.2 | 100 @ VCE = 20V | 40 | 6.0 | 0.25 | 2.5 | ±8 | 400-1050 | | |
| VTT3123EH | Coax hermetic | 0.19 | 4.0 | 100 | 30 | 4.0 | 0.25 | 4.0 | ±8 | 400-1050 | | |
| VTT3323LAH | Long T-1 | 0.19 | 2.0 @ 20 fc | 100 | 30 | 5.0 | 0.25 | 3.0 | ±10 | 400-1050 | | |
| VTT3324LAH | Long T-1 | 0.19 | 4.0 @ 20 fc | 100 | 30 | 5.0 | 0.25 | 4.0 | ±10 | 400-1050 | | |
| VTT3325LAH | Long T-1 | 0.19 | 6.0 @ 20 fc | 100 | 30 | 5.0 | 0.25 | 5.0 | ±10 | 400-1050 | | |
| VTT3423LAH | Long T-1 | 0.19 | 1.0 @ 20 fc | 100 | 30 | 5.0 | 0.25 | 3.0 | ±10 | 700-1050 | | |
| VTT3424LAH | Long T-1 | 0.19 | 2.0 @ 20 fc | 100 | 30 | 5.0 | 0.25 | 4.0 | ±10 | 700-1050 | | |
| VTT3425LAH | Long T-1 | 0.19 | 3.0 @ 20 fc | 100 | 30 | 5.0 | 0.25 | 5.0 | ±10 | 700-1050 | | |
| VTT7122H | Lateral | 0.19 | 1.0 | 100 | 30 | 5.0 | 0.25 | 2.0 | ±36 | 400-1050 | | |
| VTT7123H | Lateral | 0.19 | 2.0 | 100 | 30 | 5.0 | 0.25 | 2.0 | ±36 | 400-1050 | | |
| VTT7125H | Lateral | 0.19 | 4.5 | 100 | 30 | 5.0 | 0.25 | 2.0 | ±36 | 400-1050 | | |
| VTT7222H | Lateral | 0.19 | 0.9 | 100 | 30 | 5.0 | 0.25 | 2.0 | ±36 | 700-1050 | | |
| VTT7223H | Lateral | 0.19 | 1.8 | 100 | 30 | 5.0 | 0.25 | 2.0 | ±36 | 700-1050 | | |
| VTT7225H | Lateral | 0.19 | 4.0 | 100 | 30 | 5.0 | 0.25 | 4.0 | ±36 | 700-1050 | | |
| VTT1212H | T-1 3/4 | 0.63 | 2.0 @ 20 fc | 100 | 30 | 5.0 | 0.25 | 4.0 | ±10 | 400-1050 | | |
| VTT1214H | T-1 3/4 | 0.63 | 4.0 @ 20 fc | 100 | 30 | 5.0 | 0.25 | 6.0 | ±10 | 400-1050 | | |
| VTT9002H | TO-106 flat | 0.63 | 2.0 | 100 | 30 | 6.0 | 0.55 | 4.0 | ±50 | 400-1050 | | |
| VTT9003H | TO-106 flat | 0.63 | 5.0 | 100 | 30 | 6.0 | 0.55 | 6.0 | ±50 | 400-1050 | | |
| VTT9102H | TO-106 lensed | 0.63 | 6.0 | 100 @ VCE = 5V | 30 | 4.0 | 0.55 | 6.0 | ±42 | 400-1050 | | |
| VTT9103H | TO-106 lensed | 0.63 | 13.0 | 100 @ VCE = 5V | 30 | 4.0 | 0.55 | 10.0 | ±42 | 400-1050 | | |
| VTT1015H | TO-46 | | 0.4 | 25 @ VCE = 20V | 40 | 6.0 | 0.40 | 5.0 | ±35 | 400-1050 | | |
| VTT1016H | TO-46 | | 1.0 | 25 @ VCE = 20V | 30 | 6.0 | 0.40 | 5.0 | ±35 | 400-1050 | | |
| VTT1017H | TO-46 | | 2.5 | 25 | 20 | 4.0 | 0.40 | 8.0 | ±35 | 400-1050 | | |
| VTT1115H | TO-46 lensed | | 1.0 @ 20 fc | 100 | 30 | 6.0 | 0.40 | 5.0 | ±15 | 400-1050 | | |
| VTT1116H | TO-46 lensed | | 2.0 @ 20 fc | 100 | 30 | 4.0 | 0.40 | 8.0 | ±15 | 400-1050 | | |
| VTT1117H | TO-46 lensed | | 4.0 @ 20 fc | 100 | 30 | 4.0 | 0.40 | 8.0 | ±15 | 400-1050 | | |
| VTT9812FH | T-1 3/4 flat | 0.19 | 0.10 | 100 | 30 | 5.0 | 0.25 | 1.5 | ±56 | 450-700 | | |
| CR50TE | Ceramic SMD (A2) | 0.18 | | 400 @ VCE = 20V | 40 | | 0.3 @ I _C = 2 mA | 4.0 @ RL = 50 Ω | Wide viewing angle | 400-1070 | | |

Figure 2

Package Drawing – VTT Series – T-1 Package

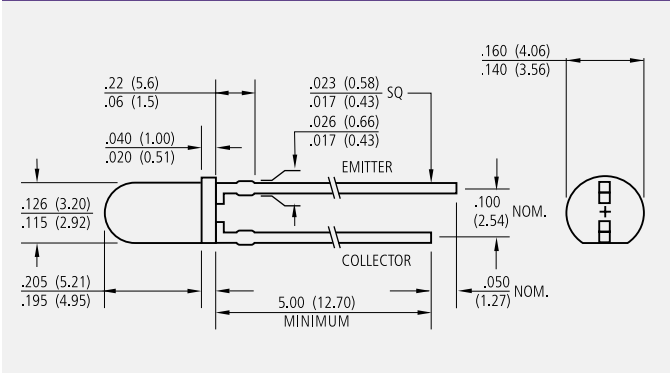
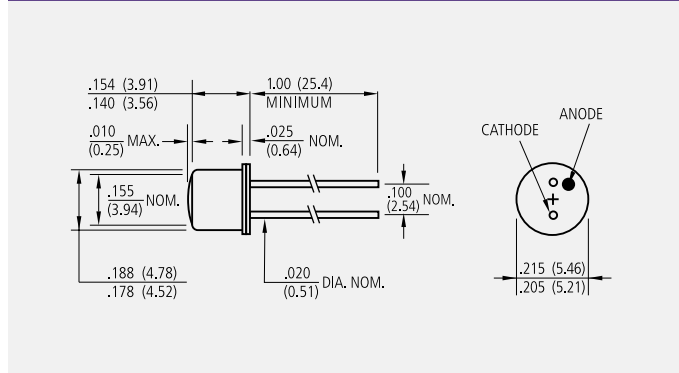


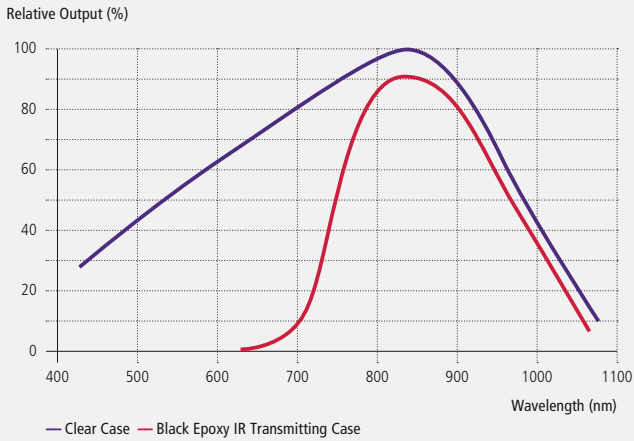
Figure 3

Package Drawing – VTT Series – TO-46 Package



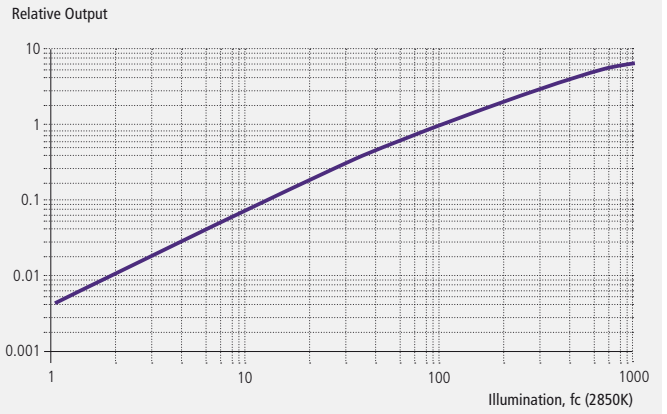
Graph 1

Rel. Spectral Response (Referred to Peak Response of Clear Case)



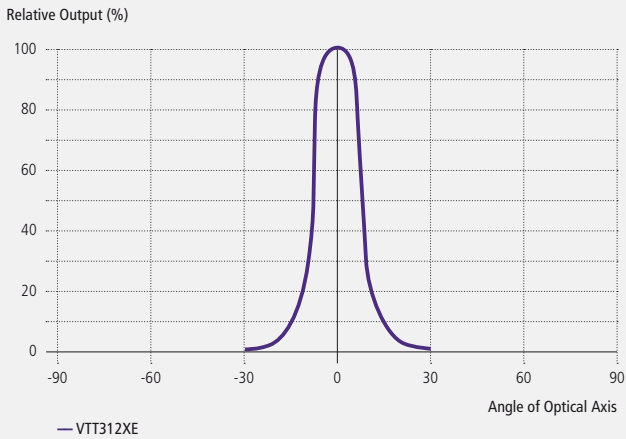
Graph 2

Relative Output vs. Illumination (Normalized at 100 fc)



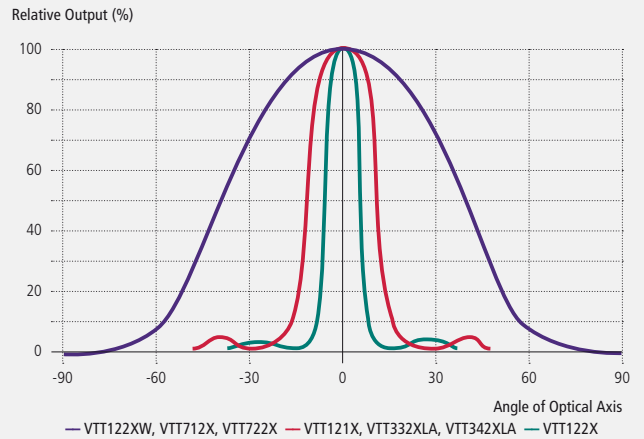
Graph 3

Angular Response Coax Packages



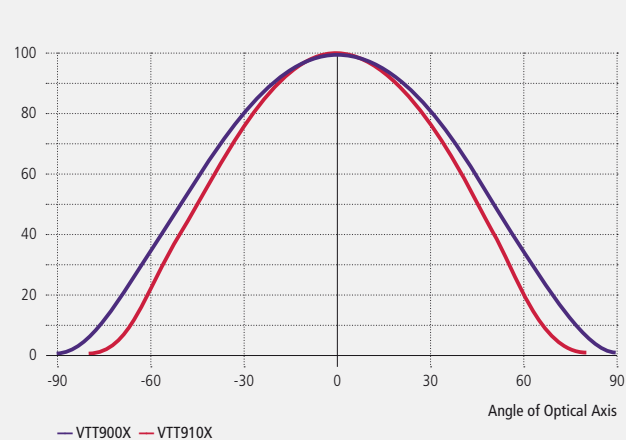
Graph 4

Angular Response Molded Epoxy Packages



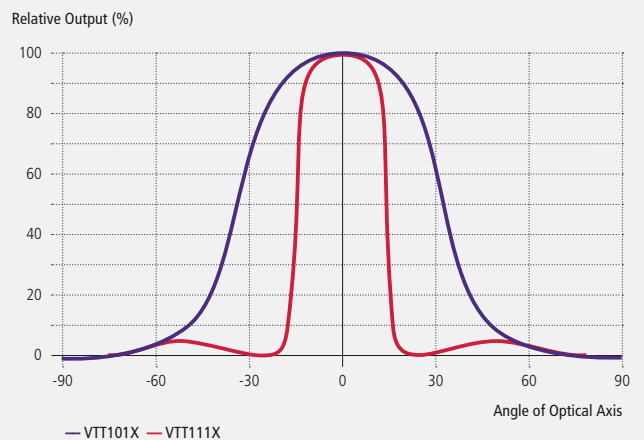
Graph 5

Angular Response Ceramic Packages

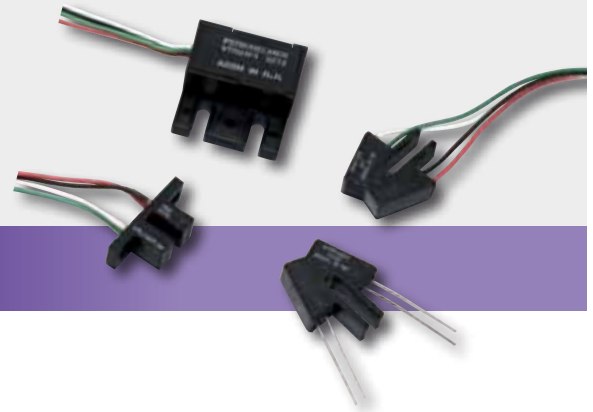


Graph 6

Angular Response 10-46 Packages



INFRARED SWITCHES



Infrared Switches – VTR – VTL Series

Applications

- Coin counters
- Paper-presence detection in copiers and printers
- Toner density control in copiers and printers
- Object sensing
- Distance detection
- Position sensing
- Rotational speed

Features and Benefits

- Fully integrated emitter and detector assembly
- Contains no mechanical parts to wear-out
- Provides non-contact object sensing
- Low power consumption
- Small size
- Low cost
- RoHs compliant

Product Description

Excelitas' optoswitches are ideal for non-contact sensing applications. They consist of an emitter and a detector integrated in a plastic housing. The emitter is an IR LED while the detector is either a phototransistor or a photodarlington. These optoswitches are available either in transmissive or reflective configuration.

Product Table

VTR Series Reflective Optoswitch

| Symbol | Light Current (min) | | | | Dark Current (max) | | | Output Element Detector Device |
|-----------------|---------------------|-------|----------|------|--------------------|-------|----------|--------------------------------|
| | Test Conditions | | | | Test Conditions | | | |
| | I_p | I_f | V_{CE} | d | I_d | I_f | V_{CE} | |
| Unit | mA | mA | V | mm | μ A | mA | V | |
| VTR16D1H | 0.3 | 20 | 5 | 2.5 | 0.1 | 0 | 5 | Phototransistor |
| VTR17D1H | 0.3 | 20 | 5 | 2.5 | 0.1 | 0 | 5 | Phototransistor |
| VTR24F1H | 6.0 | 20 | 30 | 50.8 | - | - | - | Photodarlington |

VTL11D Series Transmissive Optoswitch

| Symbol | Light Current (min) | | | Light Current (min) | | | Saturation Voltage (max) | | | Aperture Combination | |
|--------------------|---------------------|-------|----------|---------------------|-------|----------|--------------------------|-------|----------|----------------------|----------|
| | Test Conditions | | | Test Conditions | | | Test Conditions | | | Emitter | Detector |
| | I_p | I_f | V_{CE} | I_d | I_f | V_{CE} | V_{SAT} | I_f | V_{CE} | Width | Width |
| Unit | mA | mA | V | nA | mA | V | V | mA | V | mm | mm |
| VTL11D1H | 0.5 | 20 | 5 | 100 | 0 | 10 | 0.4 | 20 | 0.25 | None | None |
| VTL11D1-20H | 0.15 | 20 | 5 | 100 | 0 | 10 | 0.4 | 20 | 0.25 | 0.50 | None |
| VTL11D3H | 2 | 20 | 5 | 100 | 0 | 10 | 0.4 | 20 | 1.8 | None | None |
| VTL11D3-20H | 0.6 | 20 | 5 | 100 | 0 | 10 | 0.4 | 20 | 1.8 | 0.50 | None |
| VTL11D5-20H | 0.15 | 20 | 5 | 100 | 0 | 10 | 0.4 | 20 | 0.25 | 0.50 | 0.25 |
| VTL11D6-20H | 0.075 | 20 | 5 | 100 | 0 | 10 | 0.4 | 20 | 0.25 | 0.50 | 0.12 |
| VTL11D7H | 0.75 | 20 | 5 | 100 | 0 | 10 | 0.4 | 20 | 0.25 | None | 0.50 |
| VTL11D7-20H | 0.225 | 20 | 5 | 100 | 0 | 10 | 0.4 | 20 | 0.25 | 0.50 | 0.50 |

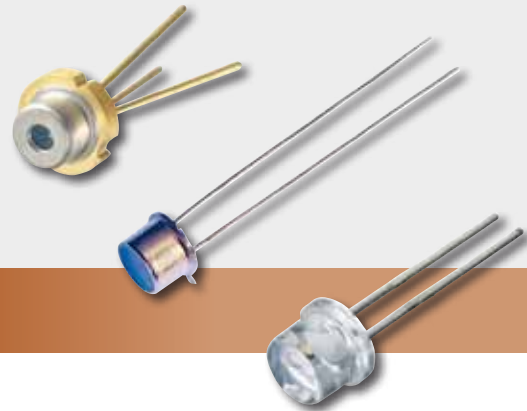
VTL23DxA Series Transmissive Optoswitch

| Symbol | Light Current (min) | | | Light Current (min) | | | Saturation Voltage (max) | | | Aperture Combination | |
|--------------------|---------------------|-------|----------|---------------------|-------|----------|--------------------------|-------|----------|----------------------|----------|
| | Test Conditions | | | Test Conditions | | | Test Conditions | | | Emitter | Detector |
| | I_p | I_f | V_{CE} | I_d | I_f | V_{CE} | V_{SAT} | I_f | V_{CE} | Width | Width |
| Unit | mA | mA | V | nA | mA | V | V | mA | V | mm | mm |
| VTL23D0A21H | 0.2 | 20 | 10 | 100 | 0 | 10 | 0.4 | 20 | 0.1 | 0.50 | 0.25 |
| VTL23D0A22H | 0.2 | 20 | 10 | 100 | 0 | 10 | 0.4 | 20 | 0.1 | 0.50 | 0.50 |
| VTL23D1A00H | 0.5 | 20 | 10 | 100 | 0 | 10 | 0.4 | 20 | 0.4 | 1.0 | 1.0 |
| VTL23D1A22H | 0.5 | 20 | 10 | 100 | 0 | 10 | 0.4 | 20 | 0.4 | 0.50 | 0.50 |
| VTL23D2A00H | 2.5 | 20 | 10 | 100 | 0 | 10 | 0.6 | 20 | 1.8 | 1.0 | 1.0 |
| VTL23D3A00H | 1.0 | 10 | 10 | 100 | 0 | 10 | 0.4 | 10 | 0.8 | 1.0 | 1.0 |

HIGH POWER LASER DIODES FOR RANGE FINDING

PULSED LASER DIODES AND INFRARED LEDS (IREDS) ■

Pulsed Laser Diodes
PGA – PGEW Series



Pulsed Laser Diodes – PGA – PGEW Series

Applications

- Range finders
- Safety light curtains
- Adaptive cruise control
- Laser therapy

Features and Benefits

- Multi cavity lasers concentrate emitting source size
- Quantum well structure
- High peak pulsed power into aperture
- Excellent power stability with temperature

Product Description

Pulsed semiconductor lasers in the near IR are commonly used for long distance time-of-flight or phase-shift range finder systems. Excelitas offers a broad range of suited pulsed 905 nm lasers designs include multi cavity monolithic structures with up to 4 active areas per chip resulting in up to 100 W of peak optical output power. Physical stacking of laser chips resulting in up to 300 W of peak optical output power.

Chip on board assemblies are available for hybrid integration. A selection of 6 metal, hermetically sealed package types are available for harsh environment applications. A molded epoxy resin TO-18 type package is available for high-volume applications.

Critical parameters are pulse-width and rise/fall times. The pulse width may be reduced allowing for increased current drive and resulting in higher peak optical power. Quantum well laser design offers rise and fall times of < 1 ns however the drive circuit lay out and package inductance play the greater role and should be designed accordingly. Excelitas offers a variety of package types with different inductive values to assist to this end.

Our core competencies include: MOVPE wafer growth; wafer processing of the grown GaAs wafers; assembly using either epoxy or solder die attach; epoxy encapsulation of lasers mounted on lead frame; hermetically sealed product qualification to MIL STD and custom requirements.

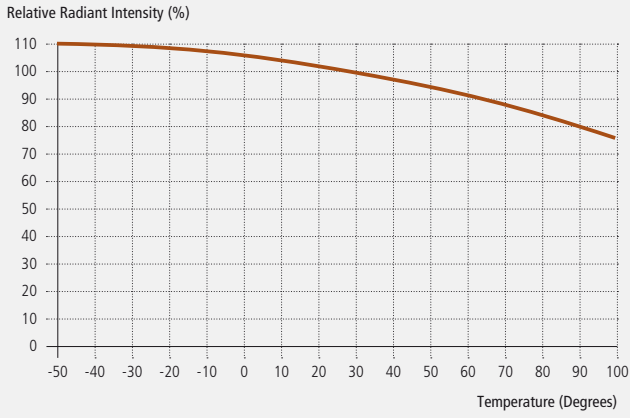
Product Table

PGA Pulsed Laser Family Selection Table, Typ. Wavelength 905 nm, 5 mm Spectral Width

| Device (X = pkg) (H = RoHS Compliance) | Description | | Emitting Area | | Typical Peak Power at 10 A, 100 ns | Typical Peak Power at 30 A, 100 ns | Beam Spread Parallel to Junction (FWHM) | Beam Spread Perpendicular to Junction (FWHM) | Typical Temperature Coefficient nm / ° C | Preferred Packages | |
|---|-------------|-----------------------------|---------------|----------------|------------------------------------|------------------------------------|---|--|---|---------------------|--------------------------------|
| | # of Chips | Total # of Emitting Stripes | Width μ m | Height μ m | 75 μ m (3 mils) Stripe Width | 225 μ m (9 mils) Stripe Width | $\Theta_{ }$ | Θ_{\perp} | | "S" Metal Can TO-18 | "W" Plastic Encapsulated TO-18 |
| PGAx1S03H | 1 | 1 | 75 | 1 | 8 W | | 10 | 25 | 0.25 | ✓ | ✓ |
| PGAx1S09H | 1 | 1 | 225 | 1 | | 30 W | 10 | 25 | 0.25 | ✓ | ✓ |
| DPGAx1S03H | 1 | 2 | 75 | 5 | 15 W | | 10 | 25 | 0.25 | ✓ | ✓ |
| DPGAx1S09H | 1 | 2 | 225 | 5 | | 50 W | 10 | 25 | 0.25 | ✓ | ✓ |
| TPGAx1S03H | 1 | 3 | 75 | 10 | 23 W | | 10 | 25 | 0.25 | ✓ | ✓ |
| TPGAx1S09H | 1 | 3 | 225 | 10 | | 75 W | 10 | 25 | 0.25 | ✓ | ✓ |
| QPGAx1S03H | 1 | 4 | 75 | 15 | 33 W | | 10 | 25 | 0.25 | ✓ | ✓ |
| QPGAx1S09H | 1 | 4 | 225 | 15 | | 100 W | 10 | 25 | 0.25 | ✓ | ✓ |
| TPGAx2S03H | 2 | 6 | 75 | 175 | 45 W | | 10 | 25 | 0.25 | ✓ | |
| TPGAx2S09H | 2 | 6 | 225 | 175 | | 150 W | 10 | 25 | 0.25 | ✓ | |
| QPGAx2S03H | 2 | 8 | 75 | 225 | 65 W | | 10 | 25 | 0.25 | ✓ | |
| QPGAx2S09H | 2 | 8 | 225 | 225 | | 200 W | 10 | 25 | 0.25 | ✓ | |
| QPGAx3S03H | 3 | 12 | 75 | 450 | 95 W | | 10 | 25 | 0.25 | ✓ | |
| QPGAx3S09H | 3 | 12 | 225 | 450 | | 300 W | 10 | 25 | 0.25 | ✓ | |

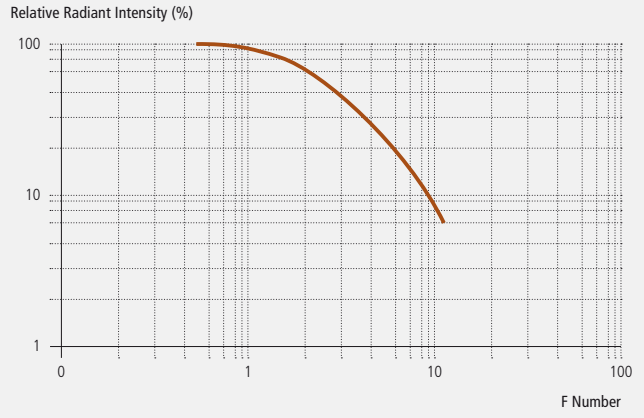
Graph 1

Peak Radiant Intensity vs. Temperature



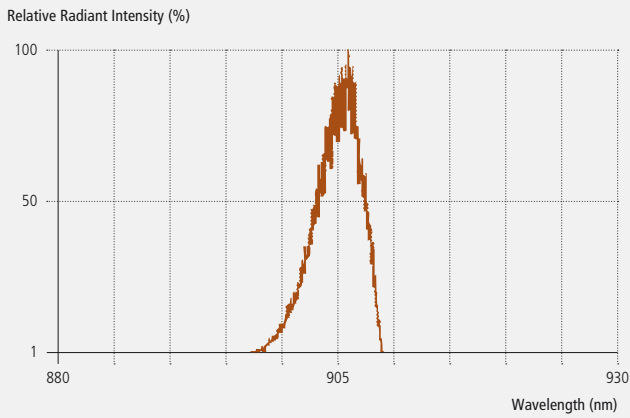
Graph 2

Radiant Intensity vs. F Number



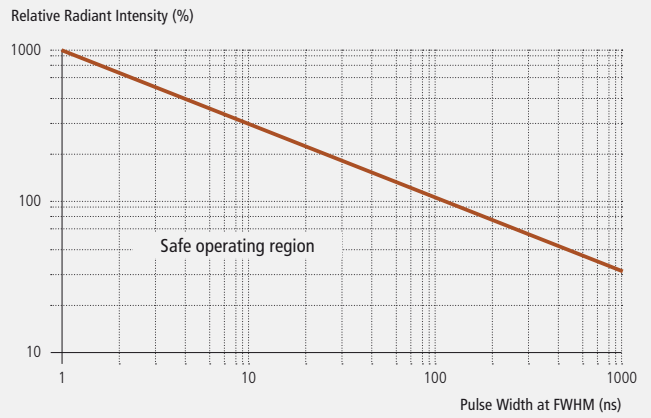
Graph 3

Spectral Plot Distribution



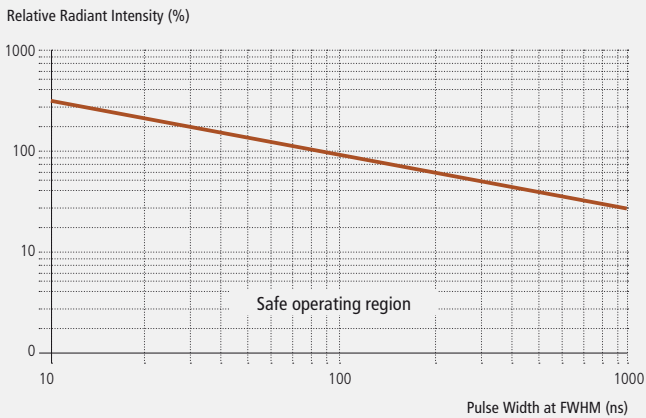
Graph 4

Radiant Intensity vs. Pulse Width for Safe Operation



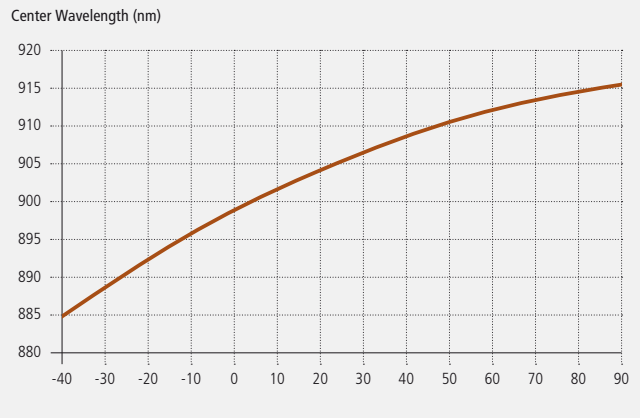
Graph 5

Safe Operation Region (Plastic Encaps.)



Graph 6

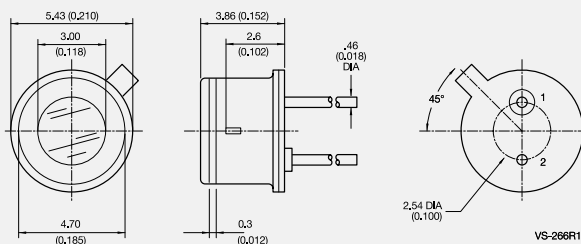
Center Wavelength vs. Temperature



QP6EW currently being verified.

Figure 1

Package Drawing



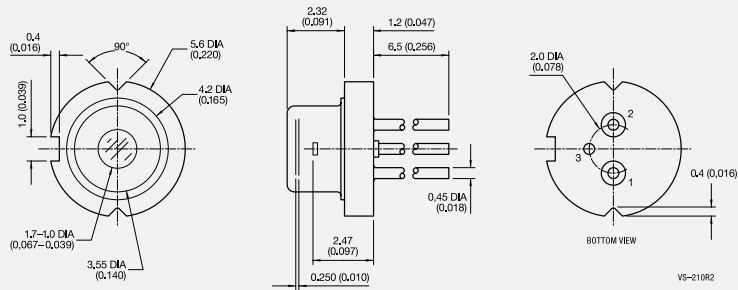
Package S (TO-18)



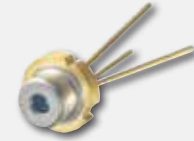
Pin out
 1. LD Anode (+),
 2. LD Cathode (-) Case,
 Inductance 5.2 nH

Figure 2

Package Drawing



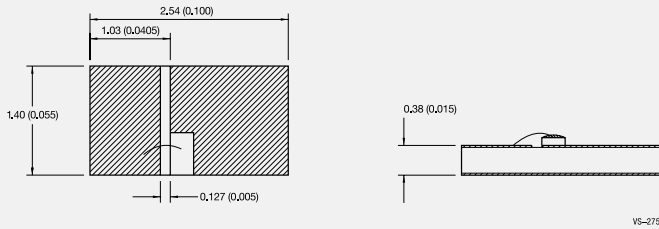
Package U (5 mm CD)



Pin out
 1. LD Anode (+),
 2. NC,
 3. LD Cathode (-) Case,
 Inductance 5.0 nH

Figure 3

Housing / Package Drawing • Laser Chip on Board



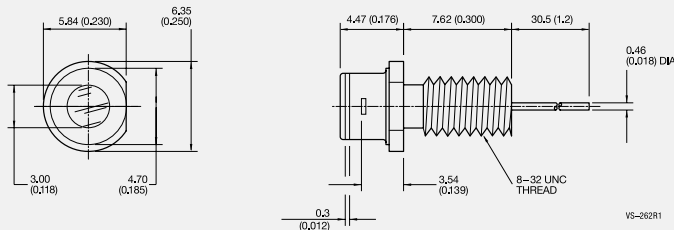
Package Y (Chip on Carrier)



Pin out
 1. LD Cathode (-) chip bottom,
 2. LD Anode (+) chip top,
 Inductance 1.6 nH

Figure 4

Package Drawing



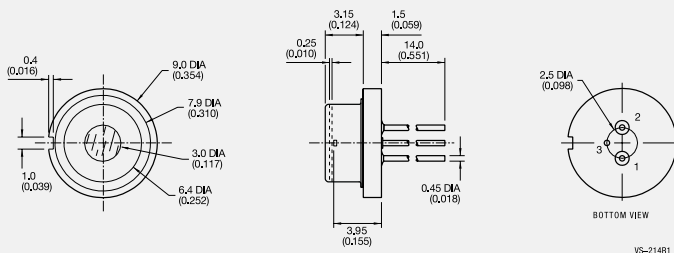
Package C (8-32 Coax)



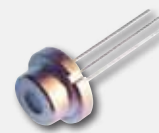
Pin out
 1. LD Anode (+),
 2. LD Cathode (-) Case,
 Inductance 12 nH

Figure 5

Package Drawing



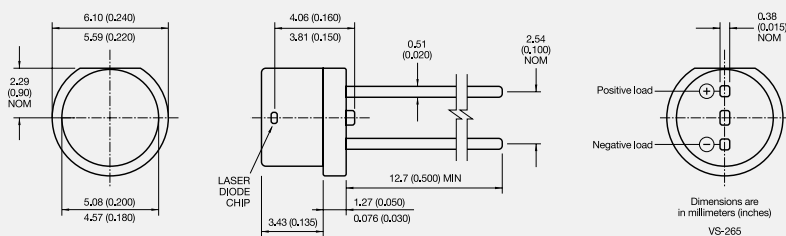
Package R (9 mm CD)



Pin out
 1. LD Anode (+),
 2. NC,
 3. LD Cathode (-) Case,
 Inductance 6.8 nH

Figure 6

Housing / Package Drawing • TO-18-“W” Plastic Package (1S Devices Only)



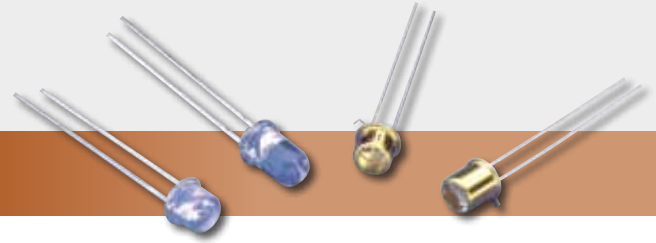
Package W (TO-18 Plastic)



Pin out
 1. (Pkg Flat) LD Anode (+),
 2. LD Cathode (-),
 Inductance 5.0 nH

INFRARED EMITTING DIODES

FOR HIGH-VOLUME APPLICATIONS



Infrared Emitting Diodes (IREDS) – VTE

Applications

- Consumer coin readers
- Lottery card readers
- Position sensors – joysticks
- Safety shields
- Encoders – measure speed and direction
- Printers – margin control
- Copiers – monitor paper position or paper stack height

Features and Benefits

- End and side radiating configurations
- Selection of emission angle spread using molded lenses
- Narrow band of emitted wavelengths
- Minimal heat generation
- Low power consumption

Product Description

IREDS are solid state light sources emitting in the near infrared part of the spectrum. The emission wavelength is closely matched to the response peak of silicon photodiodes and phototransistors. The product line provides a broad range of mounting lens and power output options. Both end and side radiating cases are available. Wide arrays of emission beam profiles are available. Devices may be operated in either CW or pulsed operating modes.

IREDS can be combined with Excelitas detectors or phototransistors in integrated assemblies for optoisolators, optical switches and retro sensors. Optical isolators are useful when electrical isolation is required, for example to transmit control logic signals to high power switching circuits (which can be noisy). In an optical switch an object is detected when it passes between the IRED and detector/phototransistor, for example a coin counter. In a retro sensor an object is detected when the IRED emitted beam is reflected onto the detector/photodetector. The retro sensor is used in applications where the object changes the reflectance, for example detecting the end of a ply wood sheet or other manufactured material.

Our core competencies include: LPE wafer growth; wafer processing of the grown GaAs wafers; assembly using either epoxy die attach; epoxy encapsulation of the IRED LEDs on lead frame; hermetically sealed package.

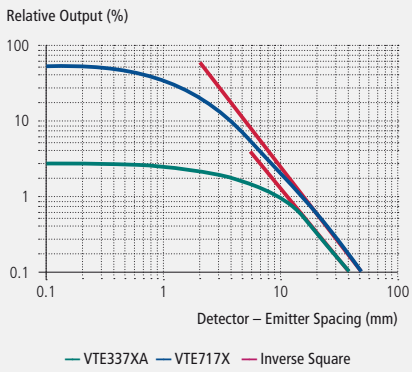
Product Table

Infrared Emitting Diodes (IREDS) – VTE

| Part Number | Package | Irradiance | Distance | Diameter | Radiant Intensity | Total Peak Power | Forward Test Current | Forward Voltage Drop | Max Pulsed Forward Current | Wavelength | Beam Angle FWHM |
|-------------|---------------------|--------------------|----------|----------|-------------------|------------------|----------------------|----------------------|----------------------------|------------|----------------------|
| Symbol | | E_e typ. | | | I_e min. | P_o | CW • / Pulsed • | V_f max | I_f max | | $\Theta \frac{1}{2}$ |
| Unit | | mW/cm ² | mm | mm | mW/sr | mW | mA | V | mA | nm | Degrees |
| VTE1013H | TO-46 | 2.7 | 36 | 6.4 | 27 | 30 | 1000 • | 2.5 | 3000 | 940 | ±35 |
| VTE1063H | TO-46 | 5.0 | 36 | 6.4 | 49 | 80 | 1000 • | 3.5 | 3000 | 880 | ±35 |
| VTE1113H | TO-46 | 15 | 36 | 6.4 | 156 | 30 | 1000 • | 2.5 | 3000 | 940 | ±10 |
| VTE1291-1H | T-1¾ (5 mm) | 3.3 | 36 | 6.4 | 32 | 20 | 100 • | 2.0 | 2500 | 880 | ±12 |
| VTE1291-2H | T-1¾ (5 mm) | 6.5 | 36 | 6.4 | 65 | 25 | 100 • | 2.0 | 2500 | 880 | ±12 |
| VTE1291W-1H | T-1¾ (5 mm) | 1.6 | 36 | 6.4 | 16 | 20 | 100 • | 2.0 | 2500 | 880 | ±25 |
| VTE1291W-2H | T-1¾ (5 mm) | 3.3 | 36 | 6.4 | 32 | 25 | 100 • | 2.0 | 2500 | 880 | ±25 |
| VTE1295H | T-1¾ (5 mm) | 5.5 | 36 | 6.4 | 39 | 20 | 100 • | 2.0 | 2500 | 880 | ±8 |
| VTE3322LAH | T-1 (3 mm) | 1.3 | 10.16 | 2.1 | 1.0 | 1.5 | 20 • | 1.6 | 3000 | 940 | ±10 |
| VTE3324LAH | T-1 (3 mm) | 2.6 | 10.16 | 2.1 | 2.0 | 2.5 | 20 • | 1.6 | 3000 | 940 | ±10 |
| VTE7172H | Lateral 4.57x1.65mm | 0.6 | 16.7 | 4.6 | 1.1 | 2.5 | 20 • | 1.8 | 2500 | 880 | ±25 |
| VTE7173H | Lateral 4.57x1.65mm | 0.8 | 16.7 | 4.6 | 1.7 | 5.0 | 20 • | 1.8 | 2500 | 880 | ±25 |
| CR10IRD | SMD | - | - | - | - | 6.3 | 50 • | 2.05 | 800 | 770 | - |
| CR50IRDA | SMD | - | - | - | - | 20 | 50 • | 1.8 | 800 | 870 | ±90 |
| CR50IRH | SMD | - | - | - | - | 10.6 | 50 • | 1.85 | 800 | 870 | ±90 |
| CR50IRK | SMD | - | - | - | - | 11.4 | 50 • | 1.7 | 800 | 950 | ±90 |

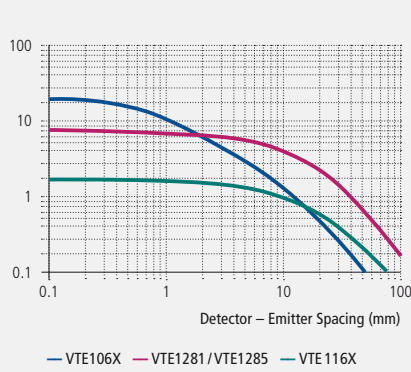
Graph 1

On Axis Rel. Irradiance T-1/Lateral Pack-



Graph 2

On Axis Relative Irradiance



Graph 3

Angular Emission

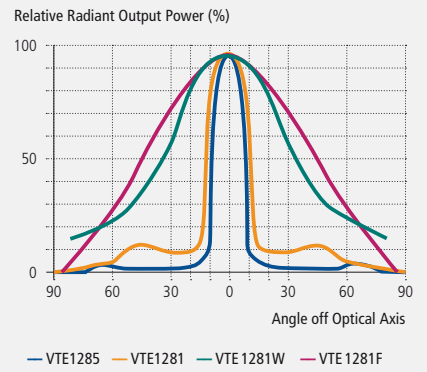
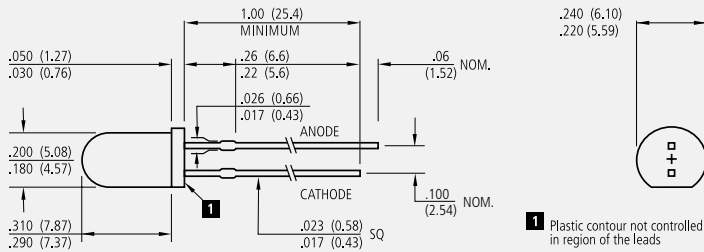


Figure 1

Housing / Package Drawing – VTE1291



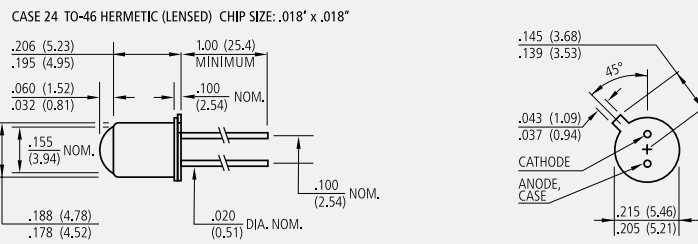
VTE1291H



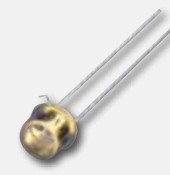
Narrow beam angle
T-1 3/4 bullet package

Figure 2

Housing / Package Drawing – VTE1113H



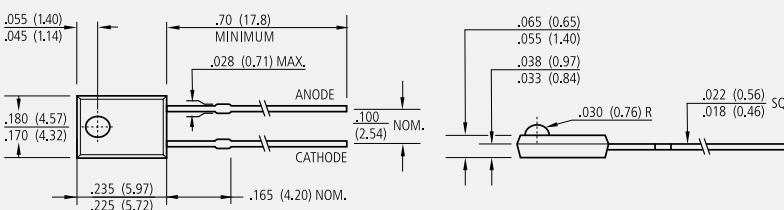
VTE1113H



TO-46 lensed cap

Figure 3

Housing / Package Drawing – VTE7172



VTE7172H



Molded lateral package

About Excelitas Technologies

Excelitas Technologies is a global technology leader focused on delivering innovative, customized solutions to meet the lighting, detection and other high-performance technology needs of OEM customers.

From aerospace and defense applications to medical lighting, analytical instrumentation, clinical diagnostics, industrial, and safety and security applications, Excelitas Technologies is committed to enabling our customers' success in their specialty end-markets. Excelitas Technologies has approximately 3,000 employees in North America, Europe and Asia, serving customers across the world.

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