Ge Photodiodes

- Large and Small Area
- Wide Performance Range
- TE Coolers and Two-Color Sandwich
- Filtered Windows for High Power Available
- Standard and Custom Packages/Submounts

GPD Optoelectronics Corp
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Tel/Fax: (603)894-6865/6866
http://www.gpd-ir.com
Introduction

GPD Optoelectronics manufactures a broad range of Ge and InGaAs photodetectors to meet the most demanding military and commercial applications. This brochure contains technical specifications for Ge, dual (Si/Ge) detectors, and TE cooled Ge photodiodes. Custom devices and packages are also available.

Both Germanium and InGaAs are sensitive to light in the near-infrared region of the spectrum. While InGaAs detectors offer better noise performance, Ge detectors offer better linearity and cost advantages, particularly where a large detection area is required.

Glossary of Terms

- **DARK CURRENT (I_p)**
  The current through a photodetector when a specified reverse bias is applied under conditions of no incident radiation.

- **SHUNT RESISTANCE (R_{sh})**
  The resistance of a photodetector at or near zero bias; shunt resistance values in this catalog are calculated at 10mV reverse bias.

- **MAXIMUM REVERSE VOLTAGE (V_{RM})**
  The maximum reverse voltage that may be applied without damaging the detector.

- **RESPONSIVITY (R)**
  The photocurrent output per unit incident radiant power, usually at a specified wavelength.

- **NOISE EQUIVALENT POWER (NEP)**
  The incident radiant power that creates a signal-to-noise ratio of one at the photodetector output.

- **JUNCTION CAPACITANCE (C_J)**
  The total device capacitance, usually measured at a specified reverse bias and frequency.

- **CUTOFF FREQUENCY (f_c)**
  The frequency at which the responsivity decreases by 3 dB from the DC responsivity value. It can be calculated from the load resistance and the junction capacitance. \( f_c = 1/(2\pi R_L C_J) \)

Table of Contents

- Glossary of Terms 2
- Operating Circuits 3
- Ge pn Detectors 4-5
- Two-color Detector 6
- Package Outline Drawings 7-12
BASIC Operating CIRCUIT (ZERO BIAS)

BASIC OPERATING CIRCUIT (WITH BIAS)

HIGH SPEED CIRCUIT

EQUIVALENT CIRCUIT

- $I_p$: Photocurrent
- $I_N$: Noise Current
- $V_D$: Voltage across diode
- $V_B$: Bias Voltage
- $I_s$: Output Current
- $C_d$: Photodiode Capacitance
- $R_{sh}$: Shunt Resistance
- $R_S$: Series Resistance
- $R_f$: Feedback Resistance
- $V_0$: Output Voltage ($I_s \times R_f$)

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### Ge Photodiodes

#### TE Cooled Photodiodes

<table>
<thead>
<tr>
<th>TYPE</th>
<th>ACTIVE DIA.</th>
<th>SHUNT RES. @ $V_r=10mV$ (KΩ)</th>
<th>DARK CURRENT @ $V_r=V_{amp}$ (µA MAX)</th>
<th>TEST REVERSE BIAS (Volts)</th>
<th>MAX REVERSE VOLTS</th>
<th>CAPACITANCE @$V_r$, MAX (pF)</th>
<th>NEP (pW/√Hz)</th>
<th>CUT-OFF FREQ. @$V_r$, 50Ω$R_L$ (MHz)</th>
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VHS series: Designed for zero reverse bias applications requiring high shunt resistance.
VHR series: Designed for zero reverse bias applications.
HS series: Designed for < 5V reverse bias applications.
GM series: Designed for high speed applications with reverse bias > 10V.
TEC series: Mounted on a one- or two-stage thermoelectric cooler for low-noise applications.

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**Electrical Specifications**

**Dark Current vs. Reverse Bias**

**Linearity of Response**

**Shunt Resistance vs. Temperature**

**Optical Specifications**

**Responsivity vs. Wavelength**

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<th>Series</th>
<th>WAVELENGTH</th>
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<td></td>
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<td>GMVHR</td>
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**Uniformity of Response**

**Responsivity of Filtered Units**

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Two-Color Photodiodes

Special Options
- High response at short wavelength available
- BNC connectors
- Thermoelectric coolers (1- and 2-stage)
- Neutral density filters
- Bandpass Filters
- AR-coated lenses/windows
- Custom devices including arrays
- Calibrated spectral response

Si/Ge TWO-COLOR DETECTOR: ELECTRICAL SPECIFICATIONS

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<tr>
<th>Type</th>
<th>Active Diam. (mm)</th>
<th>Wavelength Range (nm)</th>
<th>Peak Resp. (A/W)</th>
<th>NEP (pW/√Hz)</th>
<th>$R_{\text{SHUNT}}$ (KΩ)</th>
<th>Max Reverse Volts (V)</th>
<th>Leakage Current</th>
<th>Forward Voltage (V) $I_{\text{PH}}$=10mA</th>
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<td>(Ge)</td>
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<td></td>
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<td></td>
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Dimensions in mm (in.) Many other packages (including lensed packages) available.

TO-18
(Chip Diameter to 1 mm)

TO-5
(Chip Diameter to 3 mm)

TO-8 (5 mm chip)

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Package Drawings

Dimensions in mm (in.) Many other packages (including lensed packages) available.

**TO-9**
(Chip Diameter to 13 mm)

**TO-18 with lens cap**
(Chip Diameter to 1 mm)

**TO-5 with lens cap**
(Chip Diameter to 3 mm)

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Package Drawings

Dimensions in mm (in.) Many other packages (including lensed packages) available.

TO-5 with TEC
(Chip Diameter to 3 mm)

TO-8 with TEC
(Chip Diameter to 5 mm)

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Package Drawings

GM8HSCS

GM10HSCS

GM10BNC

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Si/Ge Two-color Detector

Dimensions in mm (in.) Many other packages (including lensed packages) available.

Fiber-pigtailed Detector

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