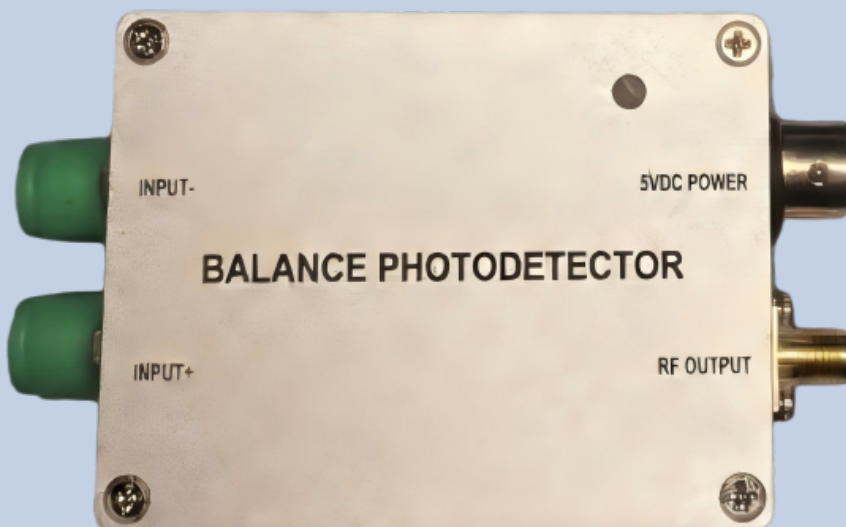


# Low-Noise Balanced Photodetectors



One Platform Many Possibilities

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## Venuslab™ Precision Balanced Photodetector Series

The Venuslab™ Precision Balanced Photodetector Series is a laboratory-grade optoelectronic instrument engineered specifically for **weak optical signal extraction** and **coherent heterodyne detection**. In modern photonics experiments, laser sources are often accompanied by Relative Intensity Noise (RIN), which severely limits the system's ability to detect extremely weak signals. By integrating a pair of precisely matched photodiodes (Si or InGaAs) and ultra-low noise differential amplification circuitry, this series accurately extracts the difference frequency signal from two interfering beams while effectively canceling out Common-Mode Noise.

This superior Common Mode Rejection Ratio (CMRR) enables Venuslab™ detectors to sensitively capture effective signals at the nanowatt (nW) or even picowatt (pW) level amidst strong background noise, making them the ideal demodulation core for Doppler Wind LiDAR, Optical Coherence Tomography (OCT), and Quantum Optical Transmission systems.

### Core Highlights & Positioning

**Positioning:** Precision optoelectronic instruments designed for Coherent Detection and Weak Signal Extraction, serving as core demodulation components for LiDAR, OCT imaging, and quantum optics.

#### Core Highlights:

**High CMRR:** Features a pair of precisely matched photodiodes (Si or InGaAs) to subtract two input signals, effectively cancelling Laser Intensity Noise (RIN) and common-mode background noise, significantly boosting SNR.

**Ultra-Wide Adjustable Gain:** The 450 series supports 5-step transimpedance gain adjustment from  $10^3$  to 10 V/A, allowing users to switch sensitivity flexibly without changing detectors.

**Flexible Bandwidth:** Offers bandwidth options from DC to 200MHz, covering detection needs from low-frequency fiber sensing to high-speed heterodyne beat signals.

**Versatile Coupling:** Available in both DC Coupled (full signal detection) and AC Coupled (DC blocking, AC focused) versions to suit different signal processing scenarios.

### Detailed Applications

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**Coherent Doppler LiDAR:** In wind speed measurement, balanced detectors are used to capture the weak Doppler frequency shift signals generated by the beating of aerosol scattered light and the local oscillator, enabling precise mapping of wind fields kilometers away.

**Fiber Optic Sensing:** Applied in DAS (Distributed Acoustic Sensing) or DTS (Distributed Temperature Sensing) systems to detect extremely weak Rayleigh or Brillouin scattering signals within optical fibers, used for oil pipeline monitoring or perimeter security.

**Spectroscopy & OCT Imaging:** As the standard receiver for Swept-Source OCT systems, balanced detectors reconstruct the deep microstructures of biological tissues through interference signals, offering medical imaging with deeper penetration than traditional microscopy.

## Technical Specifications

### Model 1: VL-BD-Si-Var

Photoelectric Performance      Photoelectric Performance (T=25 , ±12V Supply)

Parameter	Symbol	Min	Typ	Max	Unit
Spectral Response Range		320	~	1080	nm
Active Area Diameter	D	-	800	-	µm
-3dB Bandwidth	BW	-	DC - 150 / 45 / 4 / 0.3 / 0.1	-	MHz
Peak Responsivity	Rv	-	0.53	-	A/W
Transimpedance Gain	G	-	10 <sup>3</sup> /10 <sup>4</sup> /10 <sup>5</sup> /10 <sup>6</sup> /10 <sup>7</sup>	-	V/A
Output Responsivity	Rout	-	0.53×10 <sup>3</sup> ~ 10 <sup>7</sup>	-	V/W
Saturation Input Power (@820nm)	Pin	-	9	-	mW
NEP	NEP	-	1.4 (DC-0.1MHz) 1.1 (DC-0.3MHz) 3.3 (DC-4MHz) 28.9 (DC-45MHz) 123 (DC-150MHz)	-	pW/ Hz
Output Offset Voltage	Voffset	-	-	±15	mV
Supply Current	ICC	-	0.05	-	A
Optical Input	-	-	FC (Removable)	-	-
Signal Output	-	-	SMA	-	-

## Maximum Absolute Ratings

Parameter	Unit	Symbol	Value
Operating Temperature	°C	TC?	-40 ~ +55
Storage Temperature	°C	TSTG	-55 ~ +100
Saturation Input Power	mW	Pin	9 (@Peak Wavelength)
Module Operating Voltage	V	VCC	±12
Module Power Consumption	mW	Pw	1500

## Model 2: VL-BD-IG-Var

### Photoelectric Performance Photoelectric Performance (T=25 , ±12V Supply)

Parameter	Symbol	Min	Typ	Max	Unit
Spectral Response Range		800	~	1700	nm
Active Area Diameter	D	-	300	-	µm
-3dB Bandwidth	BW	-	DC - 150 / 45 / 4 / 0.3 / 0.1	-	MHz
Peak Responsivity	Rv	-	1.0	-	A/W
Transimpedance Gain	G	-	10 <sup>3</sup> /10 <sup>4</sup> /10 <sup>5</sup> /10 <sup>6</sup> /10 <sup>7</sup>	-	V/A
Output Responsivity	Rout	-	1.0×10 <sup>3</sup> ~ 10 <sup>7</sup>	-	V/W
Saturation Input Power (@1550nm)	Pin	-	4.5	-	mW
NEP	NEP	-	0.6 (DC-0.1MHz) 0.45(DC-0.3MHz) 1.23(DC-4MHz) 12.5(DC-45MHz) 67.3(DC-150MHz)	-	pW/ Hz
Output Offset Voltage	Voffset	-	-	±15	mV
Supply Current	ICC	-	0.05	-	A
Optical Input	-	-	FC (Removable)	-	-
Signal Output	-	-	SMA	-	-

## Maximum Absolute Ratings

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Parameter	Unit	Symbol	Value
Operating Temperature	°C	TC	-40 ~ +55
Storage Temperature	°C	TSTG	-55 ~ +100
Saturation Input Power	mW	Pin	4.5 (@Peak Wavelength)
Module Operating Voltage	V	VCC	±12
Module Power Consumption	mW	Pw	1500

## Model 3: VL-BD-IG-200AC

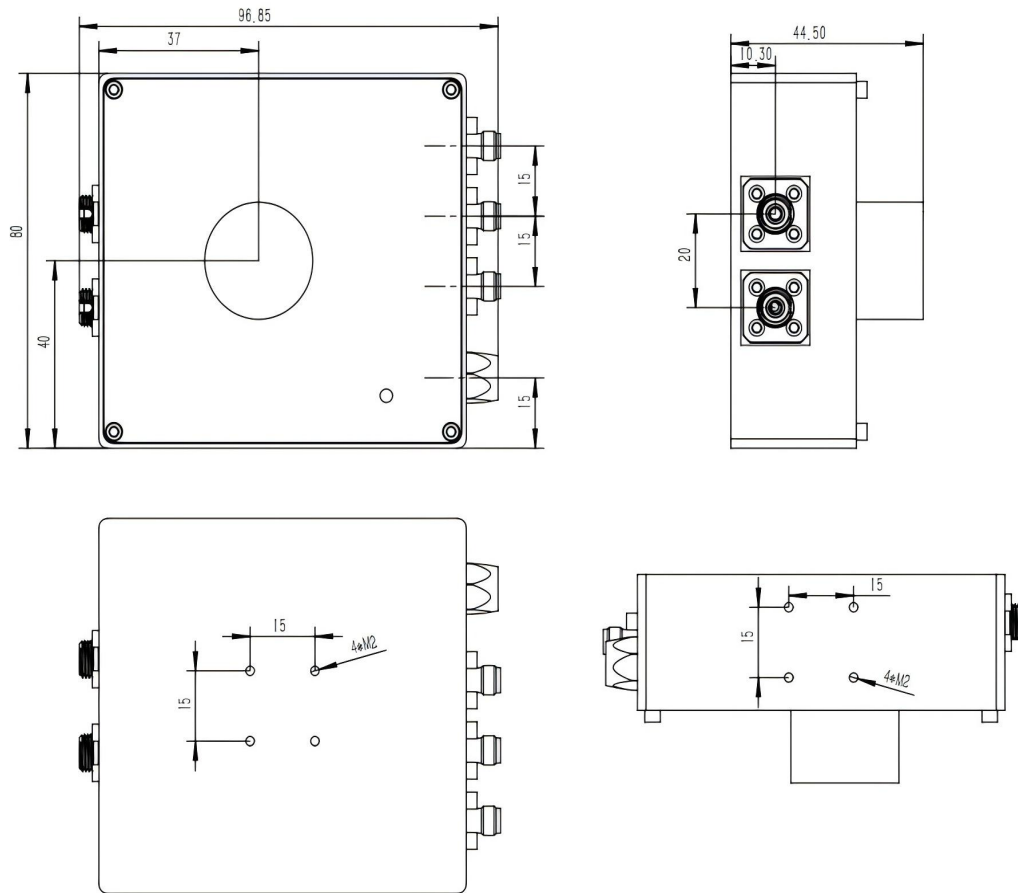
### Photoelectric Performance Photoelectric Performance (T=25 , ±12V Supply)

Parameter	Symbol	Min	Typ	Max	Unit
Spectral Response Range		-	800 ~ 1700	-	nm
-3dB Bandwidth	BW	-	AC - 200	-	MHz
Detector Responsivity	Rv	-	0.95	-	A/W
Transimpedance Gain	G	-	30	-	kV/A
Saturation Input Power	Pin	-	150	-	μW
NEP	NEP	-	4	-	pW/ Hz
CMRR	CMRR	30	-	-	dB
Output Impedance	Ro	-	50	-	
Supply Current	ICC	-	140	-	mA
Optical Input	-	-	FC/APC	-	-
Signal Output	-	-	SMA	-	-

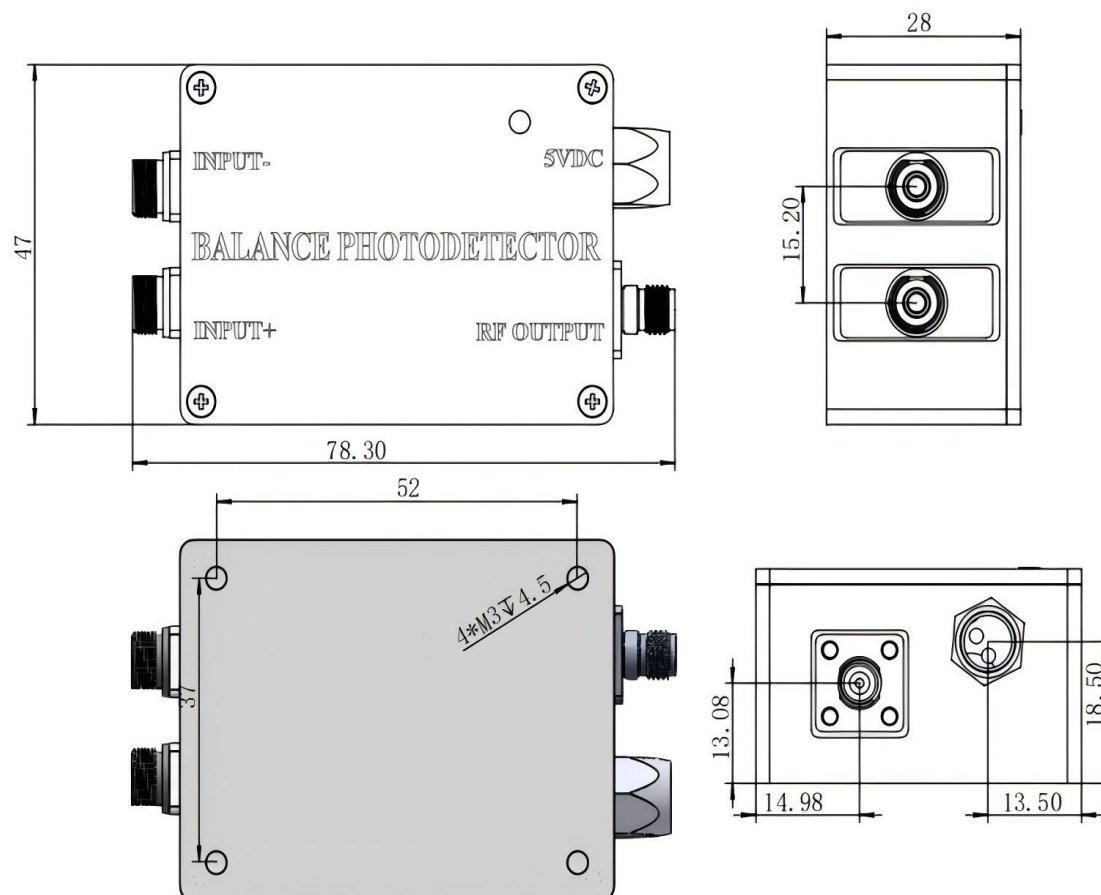
## Maximum Absolute Ratings

Parameter	Unit	Symbol	Value
Operating Temperature	°C	TC	-40 ~ +85
Storage Temperature	°C	TSTG	-55 ~ +100
Saturation Input Power	μW	Pin	150
Module Operating Voltage	V	VCC	5
Module Power Consumption	mW	Pw	800

## Structural Dimension Diagram: VL-BD-Si-Var/VL-BD-IG-Var



## Structural Dimension Diagram: VL-BD-IG-200AC



Get in touch with our team to explore configurations, request a quote, or learn more about customized solutions tailored to your needs.

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