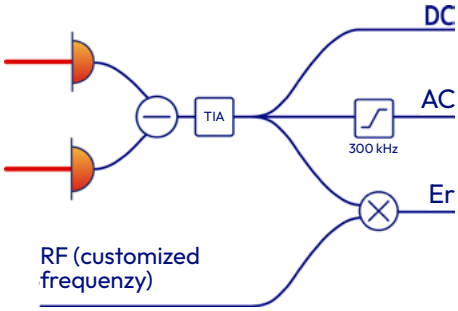
Noisy Labs

# SPECIFICATIONS HIGH QUANTUM EFFICIENCY LOW NOISE BALANCED DETECTOR AT 1064 nm AND 1550 nm

This balanced homodyne detector is engineered with a high Common Mode Rejection Ratio (CMRR) and low electronic noise, making it ideal for a wide array of applications in laser physics and quantum optics. It is available with photodiodes optimized for various wavelengths.


The balanced homodyne detector consists of two photodiodes for detecting optical signals. Each diode is illuminated separately with a laser beam and converts the incident optical signal into a photocurrent. The difference between these photocurrents is converted into a voltage. The generated voltage can be tapped directly via the DC output. The AC output supplies the voltage which has been filtered by a high-pass filter with a cut-off frequency of 300 kHz. In addition, the balanced detector offers the possibility of mixing the voltage signal with a demodulation signal. The result of this mixture can be taken from the demodulation output. The demodulation input as well as the DC, AC and demodulation outputs are equipped with SMA connectors.



## CHARACTERISTICS AT 1064 nm

| Characteristic | | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Central wavelength | | $\lambda$ | - | 1064 | - | nm |
| Quantum efficiency | | $\eta$ | | >95% | 99% | |
| Diameter of active area | | | | 500 | | µm |
| Common mode rejection ratio @1 MHz | | | | >50 | | dB |
| Angle of incidence | | | - | 10° | - | |
| Maximum total input power | | | | 20 | | mW |
| Supply voltage | | | | ±12 | | V |
| 3dB bandwidth | | | | 18 | | MHz |
| AC high pass cutoff | customizable | f | - | 300 | - | kHz |
| Output impedance | | Z | - | 50 | - | Ω |
| Dark noise clearance @ 5MHz | with 20 mW total optical power | | | 20 | | dB |
| DC output voltage | | | | | ±5 | V |
| RF input frequency | customizable | f | 0.15 | - | 100 | MHz |
| RF input power | | P | - | 7 | 12 | dBm |

## CHARACTERISTICS AT 1550 nm

| Characteristic | | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Central wavelength | | $\lambda$ | - | 1550 | - | nm |
| Quantum efficiency | | $\eta$ | | >95% | 99% | |
| Diameter of active area | | | | 500 or 100 | | µm |
| Common mode rejection ratio @1 MHz | | | | >50 | | dB |
| Angle of incidence | | | - | 10° | - | |
| Maximum total input power | | | | 20 | | mW |
| Supply voltage | | | | ±12 | | V |
| 3dB bandwidth | 500 µm PD<br>100 µm PD | | | 28<br>70 | | MHz<br>MHz |
| AC high pass cutoff | customizable | f | - | 300 | - | kHz |
| Output impedance | | Z | - | 50 | - | Ω |
| Dark noise clearance @ 5MHz | with 10mW total optical power | | | 20 | | dB |
| DC output voltage | | | | | ±5 | V |
| RF input frequency | customizable | f | 0.15 | - | 100 | MHz |
| RF input power | | P | - | 7 | 12 | dBm |

## GENERAL CHARACTERISTICS

| Characteristic | | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Operating temperature range | | T | 15 | - | 35 | °C |
| Humidity | | | 30 | 40 | 50 | % |
| Dimensions | W x H x D | | | 80 x 138 x 29 | | mm |

## NOISE EQUIVALENT POWER AND BANDWIDTH

The noise equivalent power (NEP) and the bandwidth of the balanced detector are inversely related. A lower NEP requires increasing the gain of the balanced detector. This is only possible at the expense of a lower 3dB-bandwidth. The plots below show this behavior for a 100 um PD at 1550 nm. The measurements were taken at the DC output port of the balanced detector. The gain was set to 5k and 51.1k as well as 115k. As the gain increases, the 3dB bandwidth decreases, while the NEP improves (decreases). For customized solutions tailored to your application needs, feel free to reach out to us.