Resolved Instruments

DPD80 Balanced 1550nm
Datasheet

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General Description

The DPD80 Balanced is a low noise balanced photodetector which measures the difference in power incident on two photodiodes (P_1 - P_2). This data is sampled at 80 MSPS by an internal ADC and can be streamed directly to your computer through a USB 3.1 cable, which is also used to power the device. Our included software is freely downloadable from our website, https://resolvedinstruments.com, and allows you to acquire real-time data in either the time or frequency domain, eliminating the need for separate photodetectors, amplifiers, analog to digital converters, oscilloscopes, and spectrum analyzers in your experimental setup. In addition to our user interface you may automate data-taking with our Python and MATLAB libraries.

Along with the digital interface, the balanced output P_1 - P_2 is also output on an analog SMA connector. The individual incident powers P_1 and P_2 are measured using a two channel ADC and analog signals corresponding to these incident powers are output through the **S** and **T** MMCX ports.

The DPD80 Balanced has a built-in antialiasing filter that can be switched on and off. When the filter is on the noise floor is reduced and frequencies above 40 MHz will be suppressed. When the filter is turned off, it allows the user to view signals above 40 MHz that are mapped from higher Nyquist zones to the first.

The connections on the DPD80 are summarized in the following table:

Connector	Description
USB 3.1 Type-C	Used to power the device and stream digital data to your host computer. If you are using the analog output and not the digital data the USB cable may be plugged into a USB wall plug to power the device.
Analog Output - SMA	This SMA outputs a voltage between -2.8V to 2.8V, linearly corresponding to the difference in powers incident on the two photodiodes. This output allows the DPD80 Balanced to function as a drop-in low noise replacement for a analog balanced photodetector.
A - MMCX	This is a general purpose 12-bit analog outputs that can generate voltages between 0 V to 3.3 V. The settling time of these outputs is 1 ms.
B - MMCX	This is a general purpose digital output with PWM capability
Sync - MMCX	Mode 1 - This is a high-speed digital input collected at 80 MSPS and can be used to synchronize the DPD80 Balanced with another instrument. Mode 2 - An analog output with the voltage linearly corresponding to the power incident on photodiode 1
Trig - MMCX	Mode 1 - This is a high-speed digital input collected at 80 MSPS and can be used to trigger the data sampling of the DPD80 Balanced. Mode 2 - An analog output with the voltage linearly corresponding to the power incident on photodiode 1

Absolute Maximum Ratings

Parameter	Rating
Optical input power	5 mW
Voltage trigger input	0 V to +3.3 V
Voltage sync input	0 V to +3.3 V

Specifications

General Specifications

Parameter	Value	Figure
Common Mode Reduction	> 25 dB	
Wavelength sensitivity	900 nm - 1630 nm	7
Peak responsivity	0.95 A / W [1]	
Coupling	Free space with ball lens or fiber coupled (APC)	
Photodiode active area diameter	80 µm	
Ball lens diameter	1.5 mm	
Power source	USB 3.1 Type-C	
Trig, sync logic high	> 2.15 V	
Trig, sync logic low	< 0.82 V	

Digital Data Specifications

Parameter	Value	Figure
Minimum NEP	2.5 pW / $\sqrt{\text{Hz}}$	1, 2
Saturation power	± 75 µW	4
Anti-aliasing filter bandwidth	35 MHz	3
Digital bandwidth with aliasing	80 MHz	3
ADC sampling rate	80 MS/s	
ADC vertical resolution	14 bit	
Data output port	USB 3.1 Type-C	

[1] For more information on the photodiode please refer to part number g6854-01 in the hamamatsu datasheet https://www.hamamatsu.com/resources/pdf/ssd/g6854-01_kird1013e.pdf

Analog Output Specifications

Parameter	Value	Figure
Minimum NEP (P_1 - P_2)	2.5 pW / $\sqrt{\text{Hz}}$	
Analog saturation power (P_1 - P_2)	$\pm$ 75 µW	5
Analog bandwidth (P_1 - P_2)	80 MHz	3
Analog output gain (P_1 - P_2)	35 kV / W	5
Analog output impedance (P_1 - P_2)	50 Ω	
Analog saturation power (P_1, P_2)	1.1 mW	6
Analog output gain (P_1, P_2)	3.0 kV / W	6
Analog Bandwidth (P_1, P_2)	5 MHz	
Analog output impedance (P_1, P_2)	50 Ω	

Typical Performance Characteristics

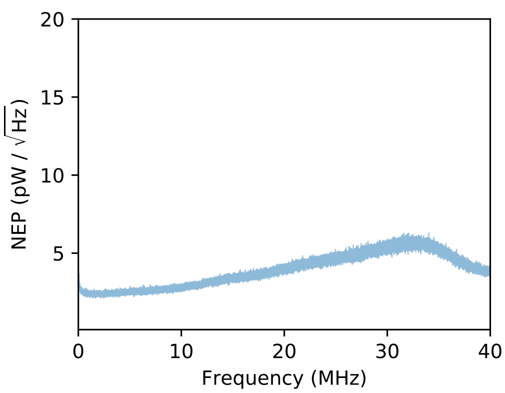

Figure 1: Digital noise floor at 1 kHz BW. [2]

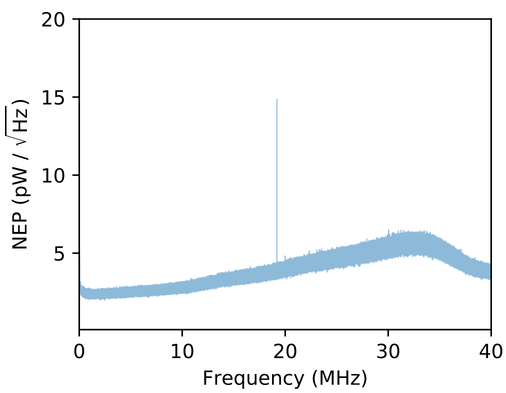

Figure 2: Digital noise floor at 10 Hz BW.

[2] All noise spectrums are single sided.

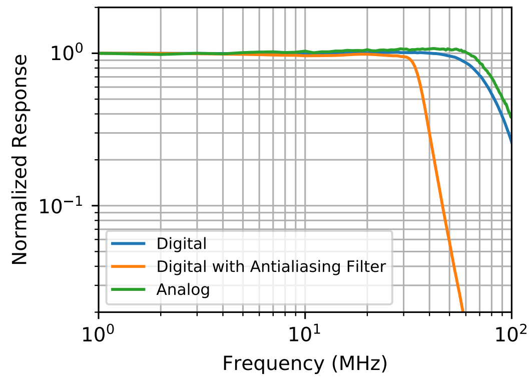

Figure 3: Frequency response of P_1 - P_2.[3]

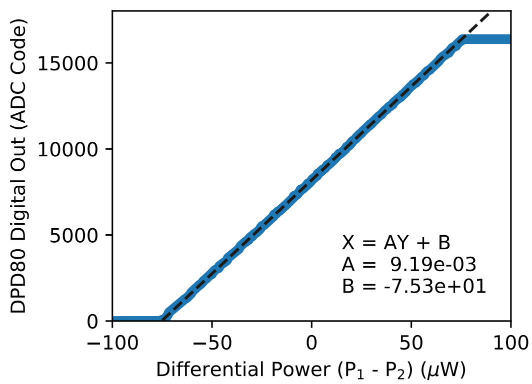

Figure 4: Digital ADC differential power calibration.

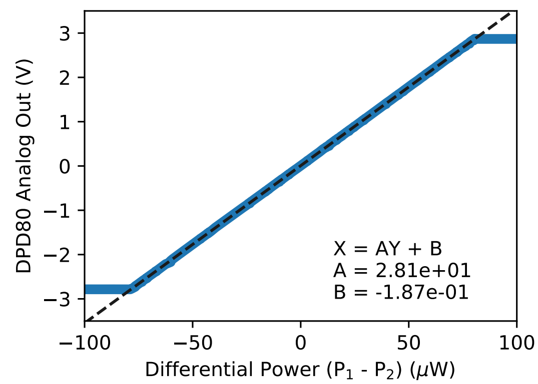

Figure 5: Analog differential power calibration.

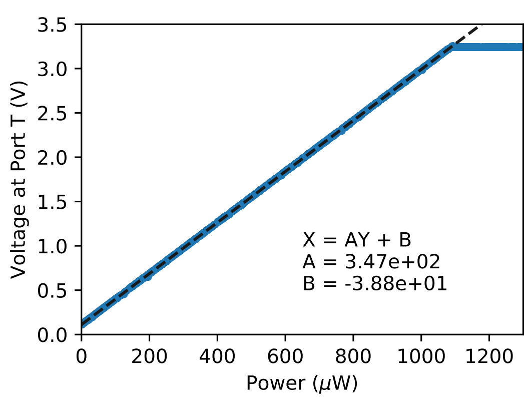

Figure 6: Typical power calibration for P_1 and P_2.

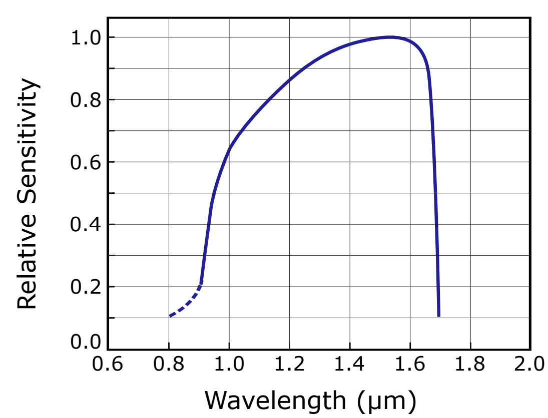

Figure 7: Spectral sensitivity

[3]Digital Measurements above 40 MHz are aliased.
[4]When measuring the analog output voltage with a 50 Ω terminated input, the voltage measured will halved.