
Optical probe, PD with integrating diode, 1M ohm coaxial pulse energy output signal

Features

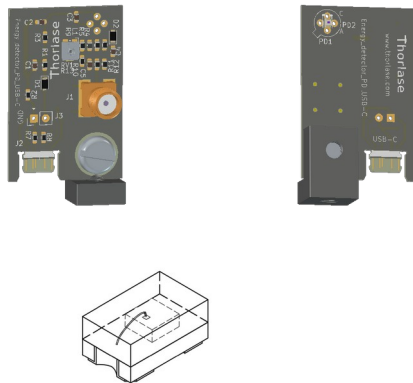
Fast pulse energy probe, - 1MHz
Compact
Prepared for post mount
USB-C power
Easy to customize with specialized PD

Applications

Optical oscilloscope probe
Pulsed to pulse energy stability
characterization
Optical alignment
Free space optics
Fiber optics

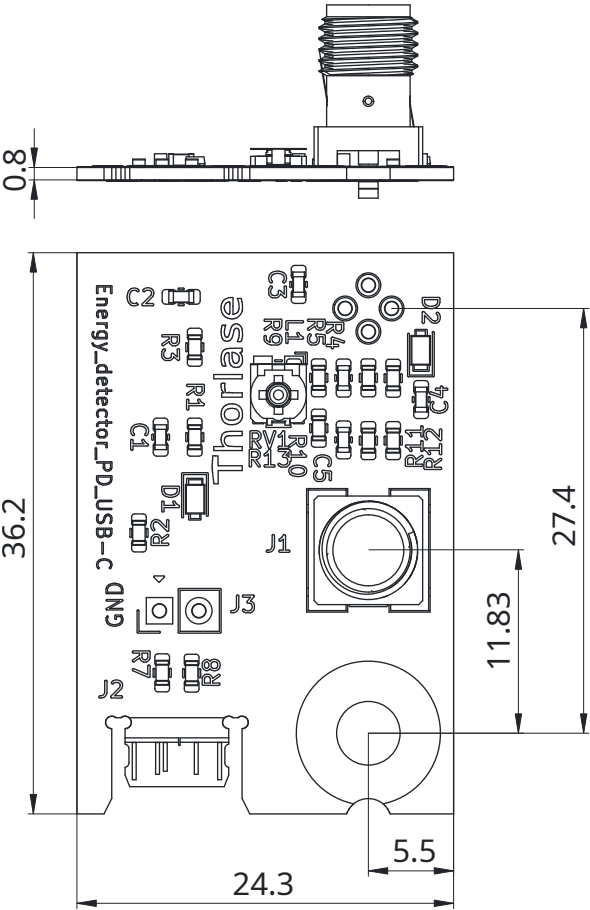
Description

The Energy detector PD USB-C is a photodiode based pulse energy probe. It uses a diode and capacitor integrator. The output has a peak voltage proportional to the pulse energy. It is used in conjunction with an oscilloscope (1M ohm input). It is particularly suited for characterization of pulse trains on digital oscilloscope. With a fast photodetector the finite Memory depth can lead to undersampling of the peak in pulse trains. The integration and filtering on the Energy_detector_PD_USB-C ensures that the pulse energy is correctly sampled even for long time scales. The board is standard fitted with a 0805 SMD Si PD. For particular wavelengths the PD can be replaced. The board has a through hole PD footprint to accommodate alternative TO can or plastic overmolded PD's.



High speed and high sensitive Si PIN
photodiode in 0805 SMD package.

Drawing (mm)



Absolute Maximum Ratings

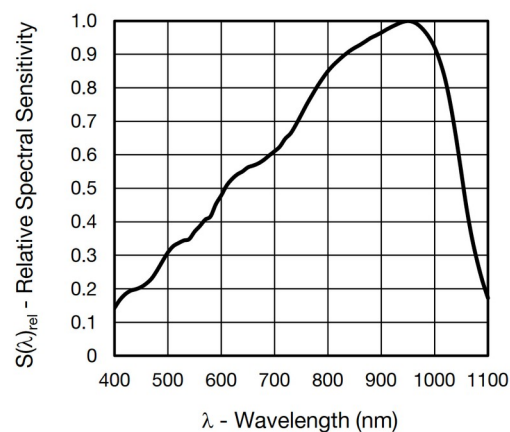
Bias voltage (J3).....	24V
I _{max_PD}	5μA
Maximum Operating Temperature.....	+50°C
Storage Temperature.....	-5°C to +50°C

Specifications

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Active area	A_{act}		0.23		mm ²	
Responsivity range	BW_o	350		1120	nm	
Peak Responsivity wavelength	λ_p		900		nm	
Peak Responsivity	R_p		0.55		A/W	
Output Conversion	V_e		0.6E9		V/J	Unit volt per joule

Note: Parameters for factory fitted 0805 SMD Si PD.

Relative responsivity



Connector pinning

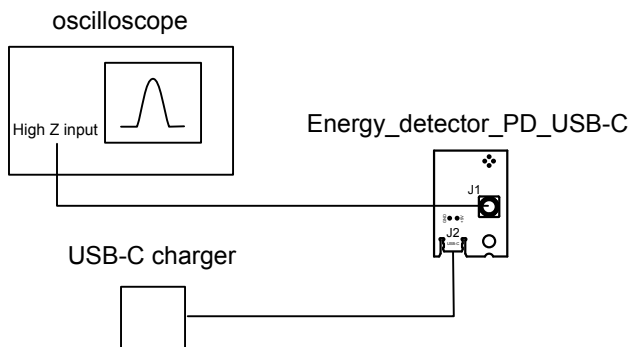
J1 SMA Connector Receptacle, Female Socket 50 Ohms	
pin	Description
1	Vout
2	Earth

J3 HEADER VERT 2POS 2.54MM	
pin	Description
1	GND, Alternative / additional GND connection
2	Alternative bias supply input. Use when J2 is not connected

J2 USB-C power	
pin	Description
A1	GND
A4	VBUS +5V
A5	CC1 5.1k ohm to GND
A9	VBUS +5V
A12	GND
B1	GND
B4	VBUS +5V
B5	CC2 5.1k ohm to GND
B9	VBUS +5V
B12	GND

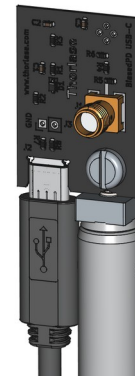
Application Information

The typical application of the Energy_detector_PD_USB-C is characterization pulse train transients. The setup is shown the connections to oscilloscope (high Z, 1M ohm) input. The PCB connector J2 is input for USB-C power.



The coaxial output J1 from the Energy_detector_PD_USB-C is connected to a 1M ohm oscilloscope input to visualize the signal. The signal maximum value is proportional to the pulse energy on the PD.

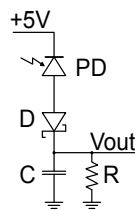
The mechanical arrangement for measuring free space optical beams is shown below.



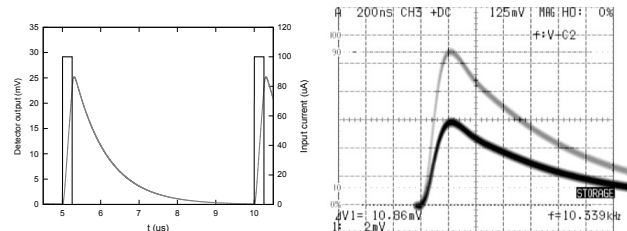
The board can be mounted on an ½ inch metric (M4) optical post with a mounting bracket.

Working principle

A simplified schematic of the Energy_detector_PD_USB-C show the reverse based PD, which acts as a current source. The current goes through the diode (D) so the charge accumulate on the capacitor (C). The resistor (R) gives a discharge path to reset in between pulses.



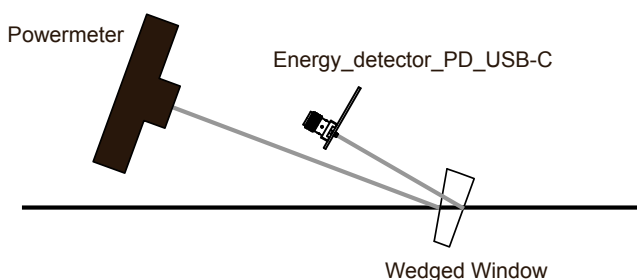
The graph show a simulated detector response to a 250ns square pulse



The detector integrates the pulse. The pulse energy is proportional to the max value of the signal. Signal filtering on the board produce a smooth signal, which is not demanding on the oscilloscope. The oscilloscope screenshot is for a 2ns pulse at two energy levels. The signal decays in between pulses. The Energy_detector_PD_USB-C has a trimmer to optimize the decay time for the measured pulse train. The signal conditioning on the board is all passive for maximum stability. The EPDUSB can be calibrated in a fixed setup or used for measuring relative variations.

Beam tapping

A good peak power on the PD is around 10 mW peak. To characterize lasers with higher peak power use a beam tap.



An uncoated wedged window makes a good beam tap, beam sampler. Any piece of glass gives ~4% reflection. For smaller tap ratio use an AR coated window. A wedged window prevents interference between front and back facet reflections. The divergence between the two beams gives two tap signals. Use one for the EPD and the other for power or energy meter. The small size of the Energy_detector_PD_USB-C allow a compact setup.

PD replacement

One of the advantage of the Energy_detector_PD_USB-C is that the photodiode can be changed by the user. This allows selection of a PD with spectral response matching the laser under characterization. For energy detection select a large area PD, eg. 1 mm² or larger for better light collection and without excessive speed. Use Desoldering Tweezers to remove the fitted 0805 PD. Alternatively use a solder iron with a large drop of solder to desolder both terminals at the same time. Clean the PD through hole footprint with a desolder pump.

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Output Conversion for EPD board, 1k ohm trimmer set	Vc		1.0E9		V/C	Unit volt per coulomb

List of accessories

This is a list of accessories that are not included in the kit but are often used together with the kit.

Description	Supplier	Part number
SMA to BNC male cable	SparkFun Electronics	27480
	Amphenol	RF 095-850-249M100
Ø12.7 mm Stainless Steel Optical Post	Ibtek	OP-75
	Thorlabs	TR100/M
TUNING TOOL FLAT 5"	Bourns Inc.	H-91
Specialty photodiode 400nm - 1100nm	ams OSRAM AG	SFH 203 P
Specialty photodiode 750nm - 1750nm	Marktech Optoelectronics	MTPD3001D3-030
Wedged Window	Thorlabs	WW41050
	Lambda	Wedge Windows (WW)

Document control

Version	Apply to	Data
Datasheet_Energy_detector_PD_USB-C	Energy_detector_PD_USB-C_V1r3	20261030