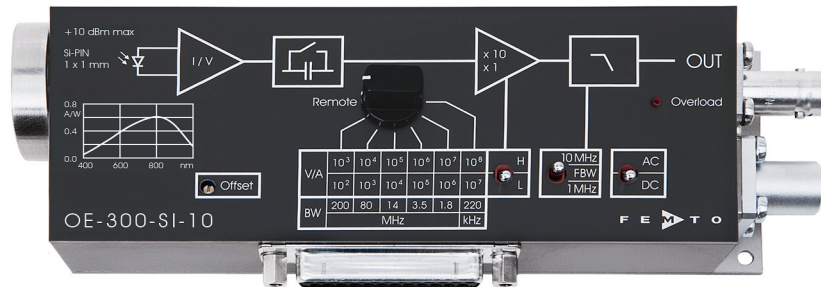


200 MHz Variable Gain Photoreceiver



The image shows model OE-300-SI-10-FST with 1.035"-40 threaded flange and coupler ring.

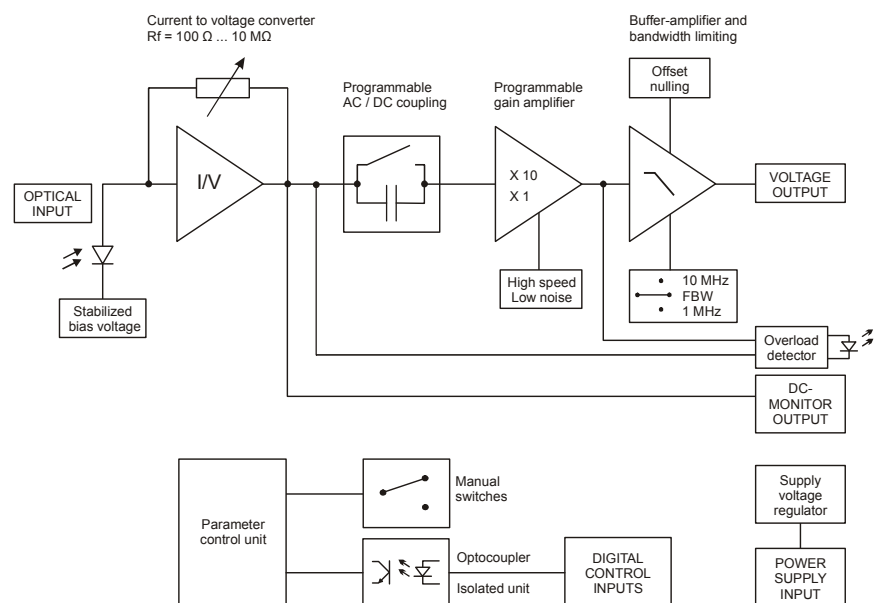
Features

- Adjustable transimpedance gain from 10^2 to 10^8 V/A
- Wide bandwidth up to 200 MHz
- Si-PIN photodiode covering the 400 to 1000 nm wavelength range
- Large optical detector size 1 x 1 mm
- High dynamic input range up to 10 mW optical power
- Very low noise, NEP down to 76 fW/vHz
- Switchable low pass filters for minimizing wideband noise
- Threaded 1.035"-40 and unthreaded 25 mm dia. free space input available, compatible with many optical standard accessories
- 1.035"-40 input easily convertible to fiber optic input with optional adapter
- Full manual and remote control capability

Applications

- All-purpose low-noise photoreceiver (O/E converter) for the MHz range
- Time resolved optical pulse and power measurements
- Laser intensity noise measurements (RIN)
- Optical front-end for oscilloscopes, spectrum analyzers, A/D converters and RF lock-in amplifiers

Block Diagram



BS-OE-300-R1

200 MHz Variable Gain Photoreceiver

Available Versions

OE-300-SI-10-FST



Internal threaded coupler ring with 30 mm outer diameter (included)

1.035"-40 threaded flange for free space applications compatible with many optical standard accessories and for use with various types of fiber connector adapters.

Optional: Fiber adapters PRA-FC and PRA-FSMA



OE-300-SI-10-FS



25 mm dia. unthreaded flange for free space applications compatible with many optical standard accessories.

Related OE-300 Models

See separate datasheets for following models on www.femto.de:

OE-300-SI-30-FST

Si-PIN, \varnothing 3 mm, 320 - 1000 nm
1.035"-40 threaded flange

OE-300-SI-30-FS

Si-PIN, \varnothing 3 mm, 320 - 1000 nm
25 mm dia. unthreaded flange

OE-300-IN-01-FC

InGaAs-PIN, \varnothing 80 μ m, 900 - 1700 nm
FC fiber receptacle only

OE-300-IN-03-FST

InGaAs-PIN, \varnothing 300 μ m, 800 - 1700 nm
1.035"-40 threaded flange

OE-300-IN-03-FS

InGaAs-PIN, \varnothing 300 μ m, 800 - 1700 nm
25 mm dia. unthreaded flange

OE-300-S

customized versions available on request

200 MHz Variable Gain Photoreceiver

Available Accessories

PRA-FSMA
PRA-FC



fiber-adaptor with external
1.035"-40 thread

PRA-PAP



post adapter plate,
easy to mount on
FEMTO photoreceiver series
OE, FWPR, HCA-S and LCA-S

PS-15

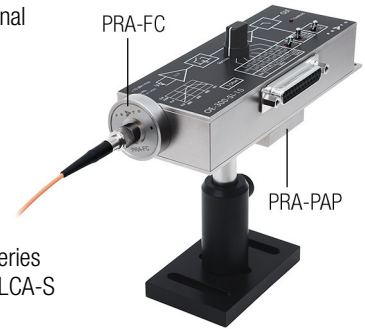


power supply,
input: 100 - 240 VAC,
output: ±15 VDC, +400/-250 mA

LUCI-10



compact digital I/O interface for USB remote control,
supports opto-isolation of amplifier signal path from PC
USB port, 16 digital outputs, 3 opto-isolated digital inputs,
bus-powered operation



Specifications

Test conditions

$V_s = \pm 15 \text{ V}$, $T_A = 25 \text{ }^\circ\text{C}$, system impedance = $50 \text{ } \Omega$

Gain

Transimpedance gain
Gain accuracy

$1 \times 10^2 \dots 1 \times 10^8 \text{ V/A}$
 $\pm 1 \%$

Frequency Response

Lower cut-off frequency
Upper cut-off frequency

DC/100 Hz, switchable
up to 200 MHz (see table below),
switchable to 1 MHz or 10 MHz

Input

Noise equivalent power (NEP)
Max. CW saturation power

see table below
see table below

Detector

Detector
Active area

Si-PIN photodiode
 $1 \text{ mm} \times 1 \text{ mm} (1 \text{ mm}^2)$

Spectral response
Sensitivity R
Dark current

400 - 1000 nm
 $0.58 \text{ A/W typ. @ } 850 \text{ nm}$
 0.12 nA typ.

200 MHz Variable Gain Photoreceiver

Specifications (continued)

Performance Depending on Gain Setting

Gain setting (low noise) (V/A)	10 ²	10 ³	10 ⁴	10 ⁵	10 ⁶	10 ⁷
Upper cut-off frequency (-3 dB)	200 MHz	80 MHz	14 MHz	3.5 MHz	1.8 MHz	220 kHz
NEP ($\sqrt{\text{Hz}}$, @ 850 nm)	322 pW	25 pW	2.9 pW	740 fW	260 fW	78 fW
Measured at	20 MHz	8 MHz	1.4 MHz	350 kHz	180 kHz	22 kHz
Integrated input noise (RMS)*	7.5 μW	580 nW	35 nW	4.9 nW	1.3 nW	100 pW
CW sat. power (@ 850 nm)	10 mW	1.7 mW	170 μW	17 μW	1.7 μW	170 nW
Gain setting (high speed) (V/A)	10 ³	10 ⁴	10 ⁵	10 ⁶	10 ⁷	10 ⁸
Upper cut-off frequency (-3 dB)	175 MHz	80 MHz	14 MHz	3.5 MHz	1.8 MHz	220 kHz
NEP ($\sqrt{\text{Hz}}$, @ 850 nm)	231 pW	10 pW	2.2 pW	670 fW	228 fW	76 fW
Measured at	18 MHz	8 MHz	1.4 MHz	350 kHz	180 kHz	22 kHz
Integrated input noise (RMS)*	4.5 μW	440 nW	31 nW	4.8 nW	1.3 nW	100 pW
CW sat. power (@ 850 nm)	1.7 mW	170 μW	17 μW	1.7 μW	170 nW	17 nW

* The integrated input noise is measured with a shaded input in the full bandwidth ("FBW") setting (referred to 850 nm). The measurement bandwidth is 3 x the upper cut-off frequency at the specific gain setting; filter slope is a 1st order roll-off.

The input referred peak-peak noise can be calculated from the RMS noise as follows:

$$P_{\text{input noise peak-to-peak}} = P_{\text{input noise RMS}} \times 6$$

The output noise is given by:

$$U_{\text{output noise RMS}} = P_{\text{input noise RMS}} \times \text{gain} \times R$$

$$U_{\text{output noise peak-to-peak}} = U_{\text{output noise RMS}} \times 6 = P_{\text{input noise RMS}} \times \text{gain} \times R \times 6$$

The integrated noise will be reduced considerably by setting the low pass filter to "1 MHz" or "10 MHz" instead of "FBW". This is especially useful for continuous wave (CW) measurements.

Output

Output voltage range	$\pm 1 \text{ V}$ (@ 50 Ω load), for linear amplification
Output impedance	50 Ω (designed for 50 Ω load)
Slew rate	1000 V/ μs
Max. output current	$\pm 40 \text{ mA}$
Output offset compensation	adjustable by offset potentiometer and external control voltage, output offset compensation range min. $\pm 100 \text{ mV}$

Ext. Offset Control

Control voltage range	$\pm 10 \text{ V}$
Offset control input impedance	15 k Ω

Indicator LED

Function	overload
----------	----------

Digital Control

Control input voltage range	LOW bit: -0.8 ... +1.2 V, HIGH bit: +2.3 ... +12 V
Control input current	0 mA @ 0 V, 1.5 mA @ +5 V, 4.5 mA @ +12 V
Overload output	non active: <0.4 V @ 0 ... -1 mA active: typ. 5 ... 5.1 V @ 0 ... 2 mA

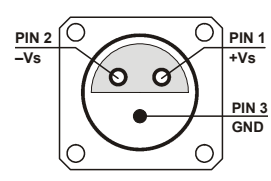
Power Supply

Supply voltage	$\pm 15 \text{ V}$
Supply current	+110/-90 mA (depends on operating conditions, recommended power supply capability min $\pm 200 \text{ mA}$)
Stabilized power supply output	$\pm 12 \text{ V}$, max. 20 mA, +5 V, max. 150 mA

Case

Weight	320 g (0.74 lb.)
Material	AlMg4.5Mn, nickel-plated

200 MHz Variable Gain Photoreceiver

Specifications (continued)									
Input Flange	Material	1.4305 stainless steel, glass bead blasted (1.035"-40 threaded flange) AlMg4.5Mn, nickel-plated (25 mm dia. unthreaded flange)							
Coupler Ring	Material	1.4305 stainless steel, glass bead blasted							
DC Monitor Output	Monitor output gain	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Mode</th> <th style="text-align: left;">Monitor gain</th> </tr> </thead> <tbody> <tr> <td>Low noise</td> <td>Gain setting divided by -1</td> </tr> <tr> <td>High speed</td> <td>Gain setting divided by -10</td> </tr> </tbody> </table>	Mode	Monitor gain	Low noise	Gain setting divided by -1	High speed	Gain setting divided by -10	
Mode	Monitor gain								
Low noise	Gain setting divided by -1								
High speed	Gain setting divided by -10								
	Monitor output polarity	inverting							
	Monitor output voltage range	±1 V (@ ≥1 MΩ load)							
	Monitor output bandwidth	DC ... 1 kHz							
	Monitor output impedance	1 kΩ (designed for ≥1 MΩ load)							
Temperature Range	Storage temperature	-40 ... +80 °C							
	Operating temperature	0 ... +60 °C							
Absolute Maximum Ratings	Max. CW power (averaged)	12 mW							
	Digital control input voltage	-5 V/+16 V relative to digital ground DGND (pin 9)							
	Analog control input voltage	±15 V relative to analog ground AGND (pin 3)							
	Power supply voltage	±20 V							
Connectors	Input	OE-300-SI-10-FST	1.035"-40 threaded flange for free space applications and for use with various types of fiber connector adapters						
		OE-300-SI-10-FS	25 mm unthreaded round flange for free space applications						
	Output	BNC jack (female)							
	Power supply	Lemo® series 1S, 3-pin fixed socket (mating plug type: FFA.1S.303.CLAC52)							
		Pin 1:	+15 V						
		Pin 2:	-15 V						
		Pin 3:	GND						
									
	Control port	Sub-D 25-pin, female, qual. class 2 Pin 1: +12 V (stabilized power supply output) Pin 2: -12 V (stabilized power supply output) Pin 3: AGND (analog ground for pins 1 - 8) Pin 4: +5 V (stabilized power supply output) Pin 5: digital output: overload (referred to pin 3) Pin 6: DC Monitor output Pin 7: NC (= not connected) Pin 8: output offset control voltage input Pin 9: DGND (ground for digital control pins 10 - 16) Pin 10: digital control input: gain, LSB Pin 11: digital control input: gain Pin 12: digital control input: gain, MSB Pin 13: digital control input: AC/DC Pin 14: digital control input: high speed / low noise Pin 15: upper cut-off frequency limit 10 MHz Pin 16: upper cut-off frequency limit 1 MHz Pin 17 - 25: NC (= not connected)							

200 MHz Variable Gain Photoreceiver

Scope of Delivery

OE-300-SI-10, threaded coupler ring ("FST" version only), Lemo® 3-pin connector, datasheet, transport package

Remote Control Operation

General
Remote control input bits are opto-isolated and connected by a logical OR function to the local switch settings. For remote control set the corresponding local switches to "Remote", "DC", "L" (low noise mode) and "FBW", and select the desired setting via a bit code at the corresponding digital inputs.
Mixed operation, e.g. local AC/DC setting and remote controlled gain setting, is also possible.

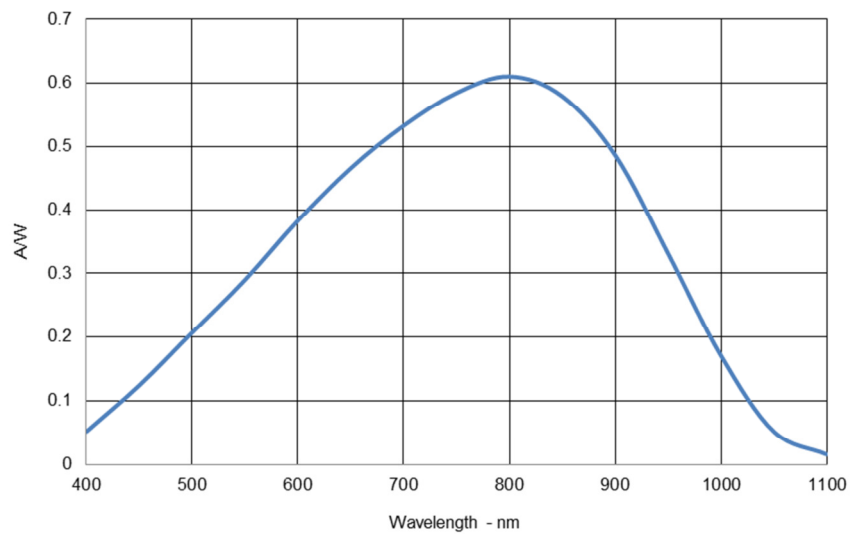
Gain setting	Low noise	High speed	Pin 12 Pin 14=LOW MSB	Pin 11	Pin 10 Pin 14=HIGH LSB
	Gain (V/A)	Gain (V/A)			
	10^2	10^3	LOW	LOW	LOW
	10^3	10^4	LOW	LOW	HIGH
	10^4	10^5	LOW	HIGH	LOW
	10^5	10^6	LOW	HIGH	HIGH
	10^6	10^7	HIGH	LOW	LOW
	10^7	10^8	HIGH	LOW	HIGH

AC/DC setting	Coupling	Pin 13
DC	LOW	
AC	HIGH	

Low pass filter setting	Upper cut-off freq. limit	Pin 15	Pin 16
full bandwidth		LOW	LOW
10 MHz		HIGH	LOW
1 MHz		LOW	HIGH

High speed / low noise setting	Mode	Pin 14
low noise mode		LOW
high speed mode		HIGH

Spectral Responsivity



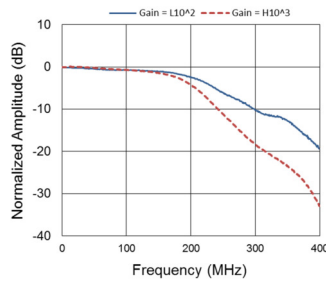
200 MHz Variable Gain Photoreceiver

Typical Performance Characteristic

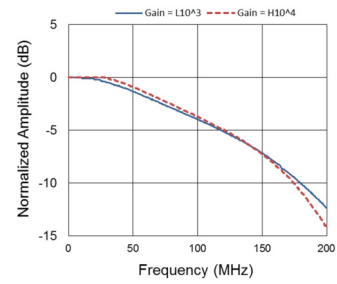
Frequency response

$$V_{\text{Supply}} = \pm 15 V_{\text{DC}}; R_{\text{Load}} = 50 \Omega$$

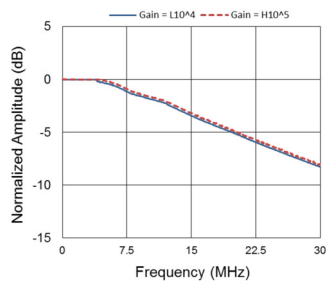
Gain setting: $L10^2, H10^3$



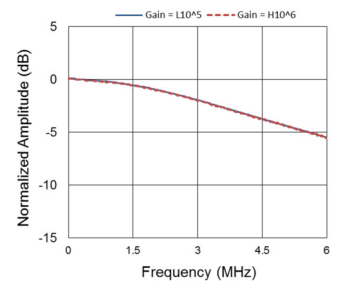
Gain setting: $L10^3, H10^4$



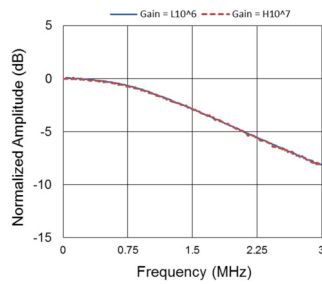
Gain setting: $L10^4, H10^5$



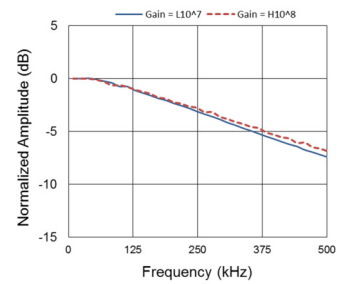
Gain setting: $L10^5, H10^6$



Gain setting: $L10^6, H10^7$



Gain setting: $L10^7, H10^8$

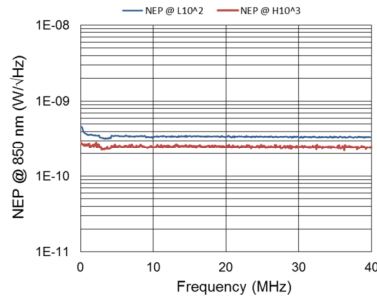


200 MHz Variable Gain Photoreceiver

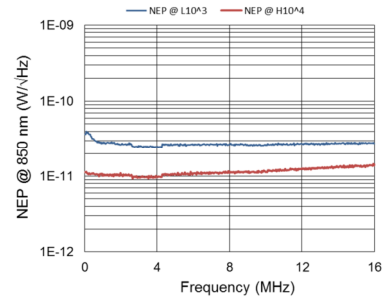
Typical Performance
Characteristic (continued)

Input noise equivalent power (NEP)

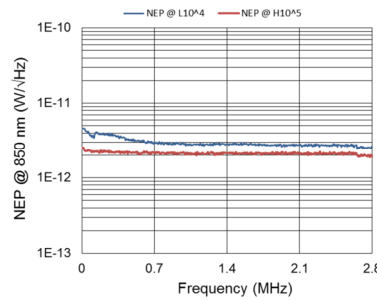
Gain setting $L10^2, H10^3$



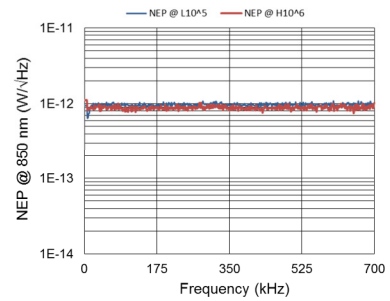
Gain setting $L10^3, H10^4$



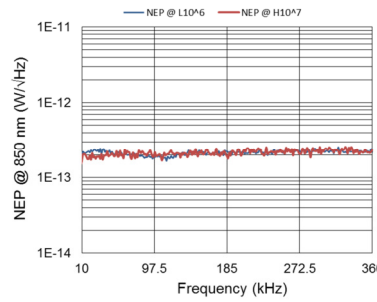
Gain setting: $L10^4, H10^5$



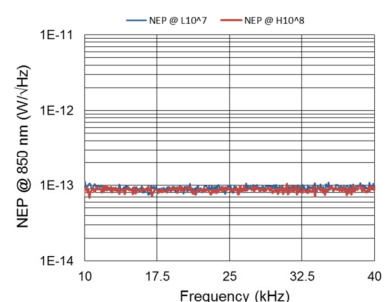
Gain setting: $L10^5, H10^6$



Gain setting: $L10^6, H10^7$



Gain setting: $L10^7, H10^8$

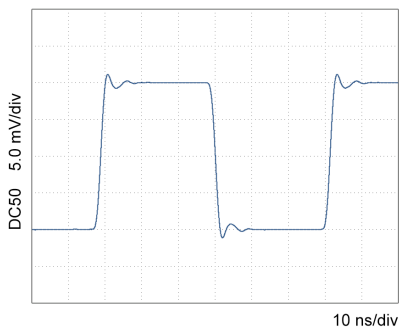


200 MHz Variable Gain Photoreceiver

Typical Performance
Characteristic (continued)

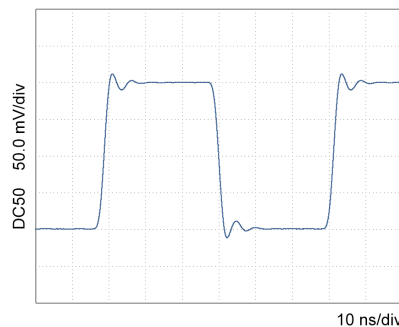
Signal pulse response

Gain setting L10²



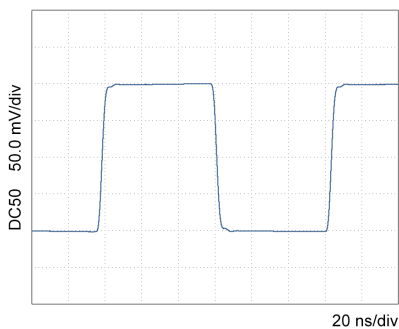
Rise: 1.85 ns Fall: 1.89 ns

Gain setting H10³



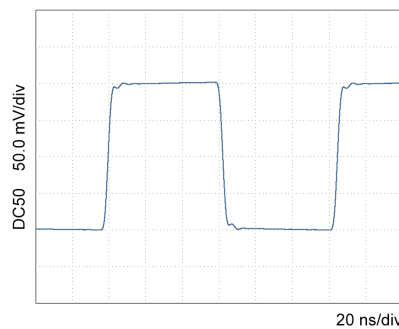
Rise: 2.23 ns Fall: 2.27 ns

Gain setting L10³



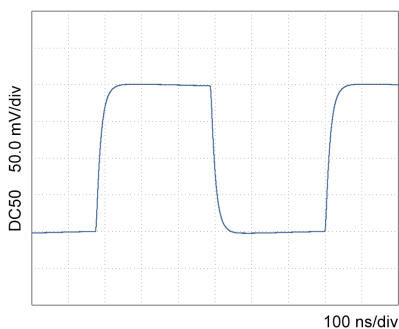
Rise: 3.20 ns Fall: 3.23 ns

Gain setting H10⁴



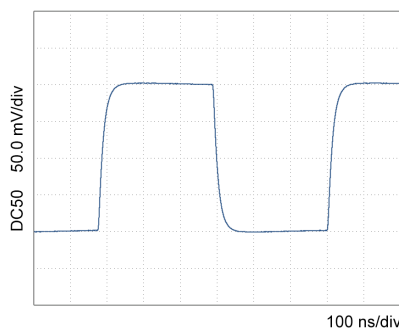
Rise: 3.44 ns Fall: 3.47 ns

Gain setting L10⁴



Rise: 26.87 ns Fall: 25.66 ns

Gain setting H10⁵

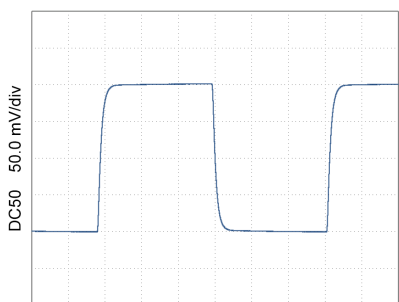


Rise: 27.02 ns Fall: 26.10 ns

200 MHz Variable Gain Photoreceiver

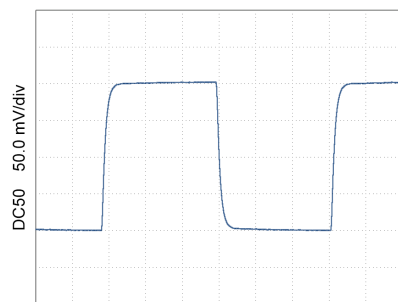
Typical Performance
Characteristic (continued)

Gain setting L10⁵



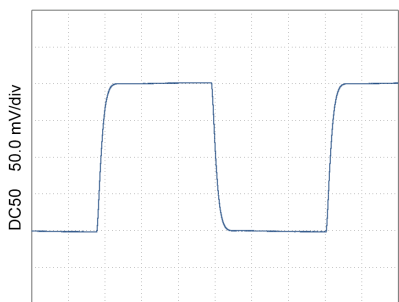
Rise: 91.80 ns Fall: 91.88 ns

Gain setting H10⁶



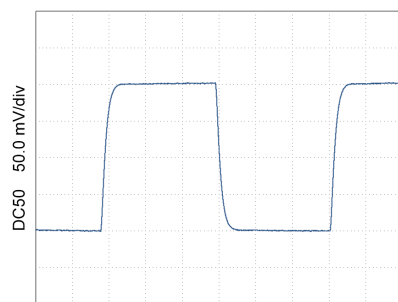
Rise: 94.44 ns Fall: 93.16 ns

Gain setting L10⁶



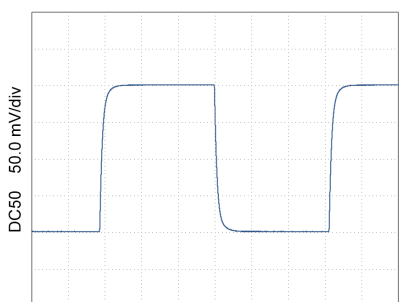
Rise: 233.36 ns Fall: 238.40 ns

Gain setting H10⁷



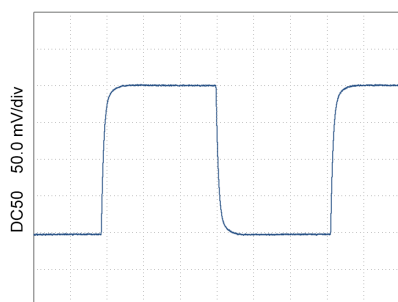
Rise: 231.92 ns Fall: 234.40 ns

Gain setting L10⁷



Rise: 1606.4 ns Fall: 1584.8 ns

Gain setting H10⁸

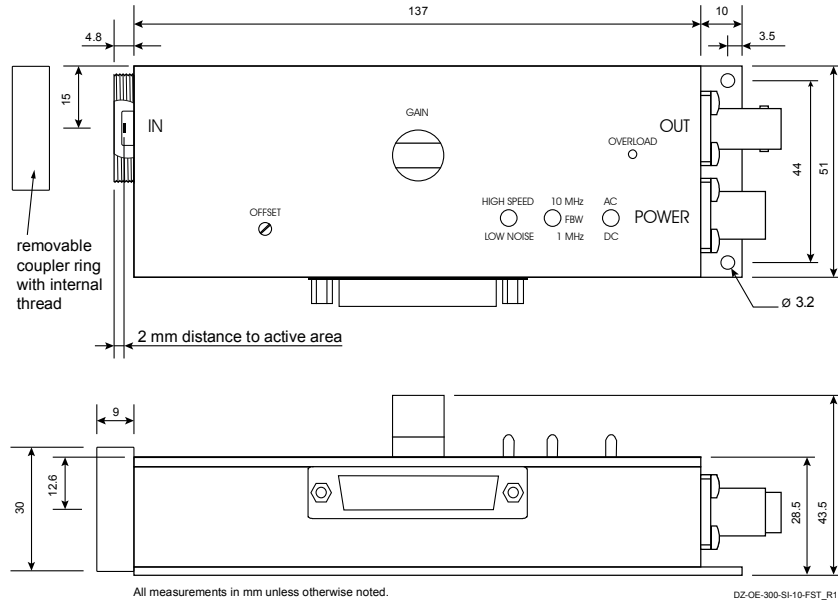


Rise: 1621.6 ns Fall: 1608.8 ns

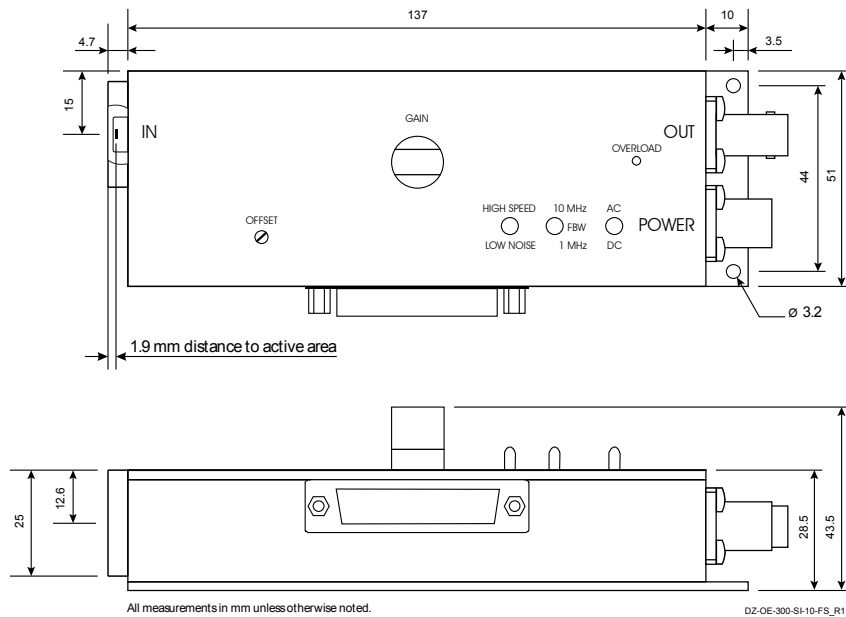
200 MHz Variable Gain Photoreceiver

Dimensions

Threaded free space input OE-300-SI-10-FST:



Free space input OE-300-SI-10-FS:



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