

Datasheet

OE-300-IN-03

200 MHz Variable Gain Photoreceiver



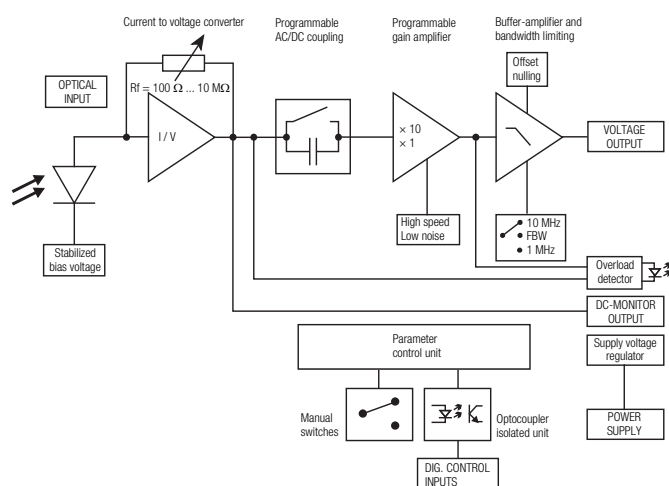
Features

- Adjustable transimpedance gain from 10^2 to 10^8 V/A
- Wide bandwidth up to 200 MHz
- InGaAs-PIN photodiode covering the 800 to 1700 nm wavelength range
- High dynamic input range up to 10 mW optical power
- Very low noise, NEP down to 52 fW/√Hz
- Switchable low pass filters for minimizing wideband noise
- Free-space input 1.035"-40 threaded
- 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



BS01-OE-300_R2

SOPHISTICATED TOOLS FOR SIGNAL RECOVERY

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OE-300-IN-03_R3/TH, JMa/11 APR 2024

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Intended Use

The OE-300-IN-03 is a high speed variable gain photoreceiver. It is designed for fast and precise conversion of small optical signals into equivalent output voltages. Operation is mostly self-explanatory. If in doubt, consult this document or contact support@femto.de.

For safe operation, please refer to the damage thresholds specified in the "Absolute Maximum Ratings", "Temperature Range" and "Power Supply" sections of this document.

The operating environment must be free of smoke, dust, grease, oil, condensing moisture, and other contaminants that could affect the operation or performance.

Available Version

OE-300-IN-03-FST



1.035"-40 threaded flange for free space applications compatible with many optical standard accessories

Please note: Using the fiber-adapters PRA-FC and PRA-FSMA is not recommended as the small size of the active area can drastically reduce the coupling efficiency

Related OE-300 Models

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

OE-300-SI-10-FST Si-PIN, 1 × 1 mm, 400 - 1000 nm
1.035"-40 threaded flange

OE-300-SI-30-FST Si-PIN, Ø 3 mm, 320 - 1000 nm
1.035"-40 threaded flange

OE-300-IN-01-FC InGaAs-PIN, Ø 80 µm, 900 - 1700 nm
FC fiber receptacle only

Available Accessories

PRA-PAP



Alternative mounting option:
post adapter plate, easy to mount
on FEMTO photoreceiver series OE,
FWPR, PWPR, HCA-S and LCA-S

PS-15-25-L



Power Supply
input: 100 – 240 VAC
output: ±15 VDC

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

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Specifications	Test conditions	$V_s = \pm 15\text{ V}$, $T_A = 25\text{ }^\circ\text{C}$, output load impedance $50\text{ }\Omega$, warm-up 20 minutes (min. 10 minutes recommended)					
Gain	Transimpedance gain	$1 \times 10^2 \dots 1 \times 10^8\text{ V/A}$ (output load $50\text{ }\Omega$)					
	Gain accuracy	$\pm 1\%$ electrical, between settings					
Frequency Response	Lower cut-off frequency	DC / 100 Hz, switchable					
	Upper cut-off frequency (-3 dB)	up to 200 MHz (see table below), switchable to 1 MHz or 10 MHz					
Input	Optical CW saturation power	see table below					
	Noise equivalent power (NEP)	see table below					
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
	Rise/fall time (10 % - 90 %)	1.9 ns	3.45 ns	27 ns	85 ns	212 ns	1.6 μs
	NEP ($\sqrt{\text{Hz}}$, @1550 nm)	192 pW	23 pW	1.9 pW	410 fW	152 fW	55 fW
	Measured at	20 MHz	8 MHz	1.4 MHz	350 kHz	180 kHz	22 kHz
	Integr. input noise (RMS)*	4.8 μW	370 nW	23 nW	3.4 nW	0.82 nW	64 pW
	CW sat. power (@ 1550 nm)	10 mW	1.0 mW	100 μW	10 μW	1.0 μW	100 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
	Rise/fall time (10 % - 90 %)	2.3 ns	3.6 ns	27 ns	85 ns	210 ns	1.7 μs
	NEP ($\sqrt{\text{Hz}}$, @ 1550 nm)	137 pW	6.8 pW	1.4 pW	360 fW	127 fW	52 fW
	Measured at	18 MHz	8 MHz	1.4 MHz	350 kHz	175 kHz	22 kHz
	Integr. input noise (RMS)*	2.9 μW	270 nW	20 nW	3.3 nW	0.82 nW	64 pW
	CW sat. power (@ 1550 nm)	1.0 mW	100 μW	10 μW	1.0 μW	100 nW	10 nW
* The integrated input noise is measured with a shaded input in the full bandwidth ("FBW") setting (referred to 1550 nm). The measurement bandwidth is $3 \times$ 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: $U_{\text{Output noise RMS}} = P_{\text{Input noise RMS}} \times \text{gain}$ $U_{\text{Output noise peak-to-peak}} = U_{\text{Output noise RMS}} \times 6 = P_{\text{Input noise RMS}} \times \text{gain} \times 6$ 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.							
Detector	Detector type	InGaAs-PIN photodiode					
	Active area	300 μm diameter					
	Spectral range	800 - 1700 nm					
	Sensitivity	0.95 A/W typ. (@ 1550 nm)					
	Dark current	0.1 nA typ.					
Output	Output voltage rang	$\pm 1\text{ V}$ (@ $50\text{ }\Omega$ output load), for linear amplification					
	Output impedance	$50\text{ }\Omega$ (designed for $50\text{ }\Omega$ load)					
	Max. output current	$\pm 40\text{ mA}$ (short-circuit proof)					
	Slew rate	1000 V/ μs					
	Output offset compensation	adjustable by offset potentiometer and external control voltage, output offset compensation range min. $\pm 100\text{ mV}$					

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Specifications (continued)

DC Monitor Output

Monitor output gain

Mode	Monitor gain
Low noise	Gain setting divided by -1
High speed	Gain setting divided by -10

Monitor output polarity
Monitor output voltage range
Monitor output bandwidth
Monitor output impedance

inverting
 ± 1 V (@ ≥ 1 M Ω load)
DC ... 1 kHz
1 k Ω (designed for ≥ 1 M Ω load)

Indicator LED

Function

overload

Digital Control

Control input voltage range
Control input current
Overload output

LOW bit: -0.8 V ... +1.2 V, HIGH bit: +2.3 V ... +12 V
0 mA @ 0 V, 1.5 mA @ +5 V, 4.5 mA @ +12 V
non active: <0.4 V @ 0 ... -1 mA
active: typ. 5 ... 5.1 V @ 0 ... 2 mA

Ext. Offset Control

Control voltage range
Offset control input impedance

± 10 V
15 k Ω

Optical Input Connector

Material FST flange
Material FST coupler ring

1.4305 stainless steel, nickel-plated
1.4305 stainless steel, glass bead blasted

Power Supply

Supply voltage
Supply current

± 15 V (± 14.75 V ... ± 16.5 V)
 ± 110 / -90 mA typ. (depends on operating conditions,
recommended power supply capability min. ± 200 mA)

Case

Weight
Material

360 g (0.79 lbs)
AlMg4.5Mn, nickel-plated

Temperature Range

Storage temperature
Operating temperature

-40 °C ... +80 °C
0 °C ... +60 °C

Absolute Maximum Ratings

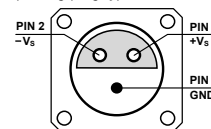
Optical input power (CW)
Digital control input voltage
Analog control input voltage
Power supply voltage

12 mW
-5 V/+16 V relative to digital ground DGND (pin 9)
 ± 15 V relative to analog ground AGND (pin 3)
 ± 20 V

Connectors

Input
Output
Power supply

1.035"-40 threaded flange for free space applications
BNC jack (female)
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

Connectors (continued)

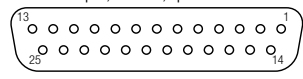
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	Control port	Sub-D 25-pin, female, qual. class 2  Pin 1: +12 V (stabilized power supply output*) Pin 2: -12 V (stabilized power supply output*) Pin 3: AGND (analog ground for pins 1 - 8) Pin 4: +5 V (stabilized power supply output*) Pin 5: digital output: overload (referred to pin 3) Pin 6: DC Monitor output Pin 7: NC Pin 8: 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 *stabilized power supply output current ±12 V: max. ±20 mA, +5V: max. 30 mA																																																																
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 <table><tr><th>Low noise Gain (V/A)</th><th>High speed Gain (V/A)</th><th>Pin 12</th><th>Pin 11</th><th>Pin 10</th></tr><tr><th>Pin 14=LOW</th><th>Pin 14=HIGH</th><th>MSB</th><th></th><th>LSB</th></tr><tr><td>10²</td><td>10³</td><td>LOW</td><td>LOW</td><td>LOW</td></tr><tr><td>10³</td><td>10⁴</td><td>LOW</td><td>LOW</td><td>HIGH</td></tr><tr><td>10⁴</td><td>10⁵</td><td>LOW</td><td>HIGH</td><td>LOW</td></tr><tr><td>10⁵</td><td>10⁶</td><td>LOW</td><td>HIGH</td><td>HIGH</td></tr><tr><td>10⁶</td><td>10⁷</td><td>HIGH</td><td>LOW</td><td>LOW</td></tr><tr><td>10⁷</td><td>10⁸</td><td>HIGH</td><td>LOW</td><td>HIGH</td></tr></table> AC/DC setting <table><tr><th>Coupling</th><th>Pin 13</th></tr><tr><td>DC</td><td>LOW</td></tr><tr><td>AC</td><td>HIGH</td></tr></table> Low pass filter setting <table><tr><th>Upper cut-off freq. limit</th><th>Pin 15</th><th>Pin 16</th></tr><tr><td>full bandwidth</td><td>LOW</td><td>LOW</td></tr><tr><td>10 MHz</td><td>HIGH</td><td>LOW</td></tr><tr><td>1 MHz</td><td>LOW</td><td>HIGH</td></tr></table> High speed / low noise setting <table><tr><th>Mode</th><th>Pin 14</th></tr><tr><td>low noise mode</td><td>LOW</td></tr><tr><td>high speed mode</td><td>HIGH</td></tr></table>	Low noise Gain (V/A)	High speed Gain (V/A)	Pin 12	Pin 11	Pin 10	Pin 14=LOW	Pin 14=HIGH	MSB		LSB	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	Coupling	Pin 13	DC	LOW	AC	HIGH	Upper cut-off freq. limit	Pin 15	Pin 16	full bandwidth	LOW	LOW	10 MHz	HIGH	LOW	1 MHz	LOW	HIGH	Mode	Pin 14	low noise mode	LOW	high speed mode	HIGH	
Low noise Gain (V/A)	High speed Gain (V/A)	Pin 12	Pin 11	Pin 10																																																														
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Scope of Delivery	OE-300-IN-03, internally threaded coupler ring, LEMO® 3-pin connector, datasheet, transport package																																																																	

SOPHISTICATED TOOLS FOR SIGNAL RECOVERY
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OE-300-IN-03
200 MHz Variable Gain Photoreceiver

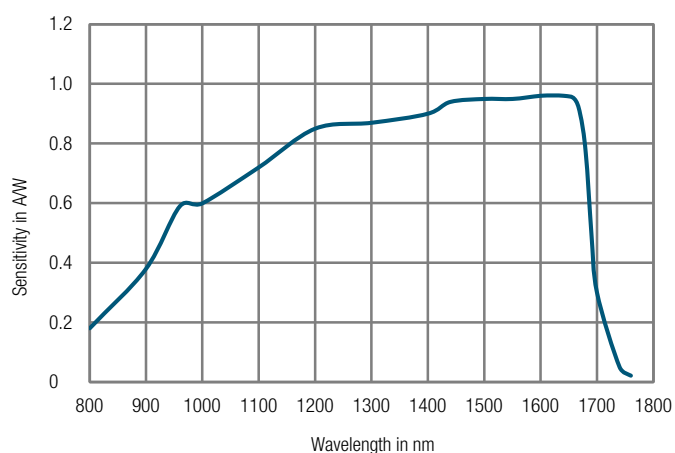
Ordering Information

OE-300-IN-03-FST

1.035"-40 threaded flange for free space applications and for use with various types of optical standard accessories

Spectral Responsivity

OE-300-IN-03-FST



DB Sens-OE-300-IN-03-FST_R2

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Datasheet

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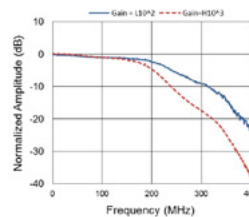
200 MHz Variable Gain Photoreceiver

Typical Performance
Characteristic

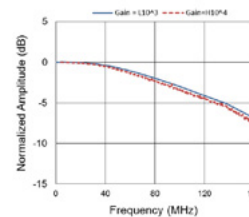
Frequency response

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

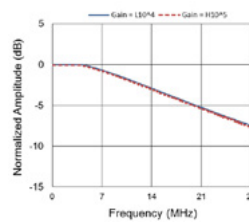
Gain setting: $L10^2$, $H10^3$



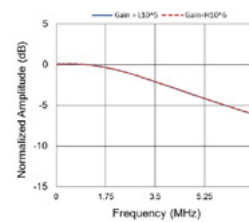
Gain setting: $L10^3$, $H10^4$



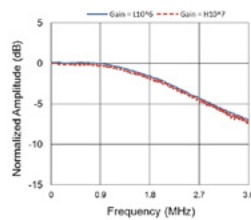
Gain setting: $L10^4$, $H10^5$



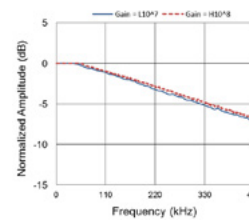
Gain setting: $L10^5$, $H10^6$



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



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



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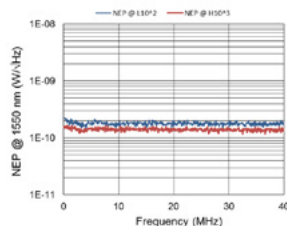
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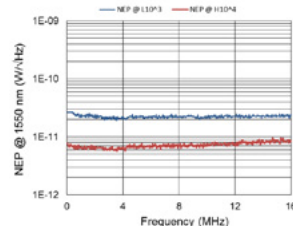
Typical Performance
Characteristic (continued)

Input noise equivalent power (NEP)

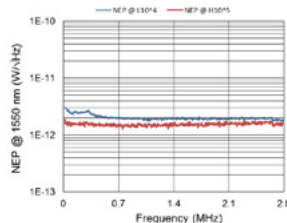
Gain setting: L10², H10³



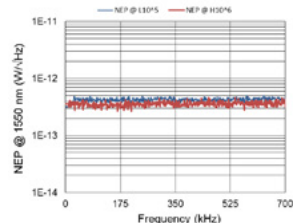
Gain setting: L10³, H10⁴



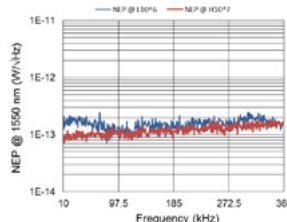
Gain setting: L10⁴, H10⁵



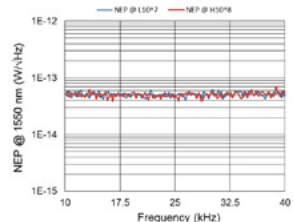
Gain setting: L10⁵, H10⁶



Gain setting: L10⁶, H10⁷



Gain setting: L10⁷, H10⁸



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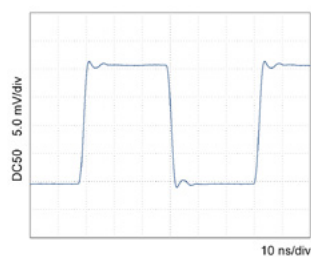
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Typical Performance
Characteristic (continued)

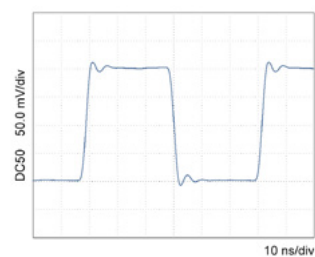
Signal pulse response

Gain setting L10²



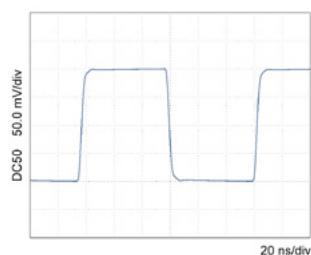
Rise: 1.92 ns Fall: 1.93 ns

Gain setting H10³



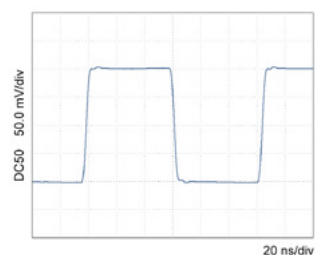
Rise: 2.28 ns Fall: 2.30 ns

Gain setting L10³



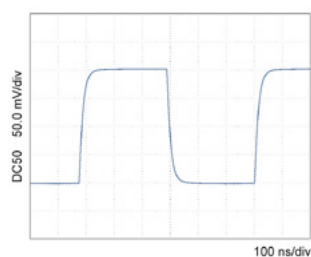
Rise: 3.45 ns Fall: 3.49 ns

Gain setting H10⁴



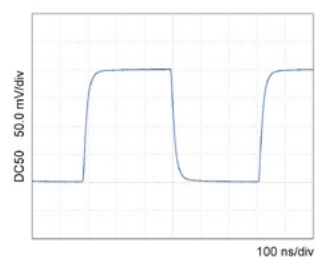
Rise: 3.59 ns Fall: 3.61 ns

Gain setting L10⁴



Rise: 25.98 ns Fall: 26.90 ns

Gain setting H10⁵



Rise: 27.24 ns Fall: 27.11 ns

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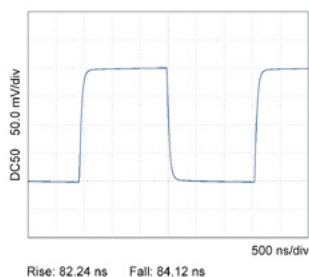
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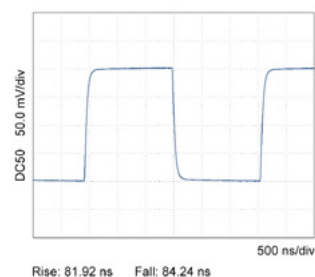
200 MHz Variable Gain Photoreceiver

Typical Performance
Characteristic (continued)

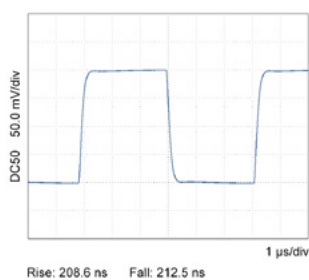
Gain setting L10⁵



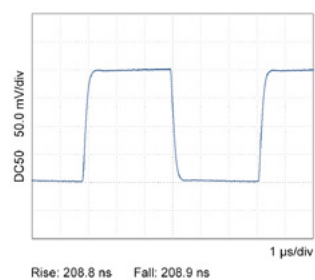
Gain setting H10⁶



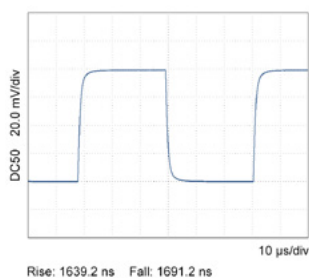
Gain setting L10⁶



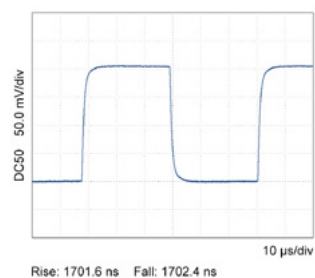
Gain setting H10⁷



Gain setting L10⁷



Gain setting H10⁸



SOPHISTICATED TOOLS FOR SIGNAL RECOVERY

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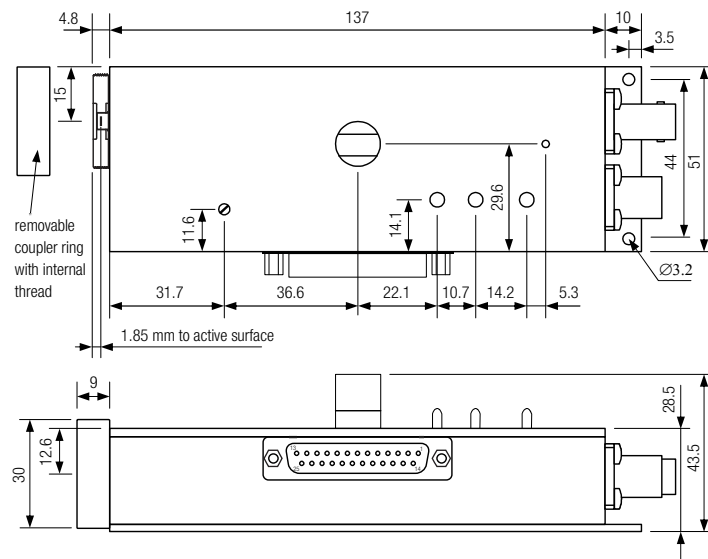
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200 MHz Variable Gain Photoreceiver

Dimensions

OE-300-IN-03-FST



all dimensions in mm unless otherwise noted

DZ-OE-300-FST_R1

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