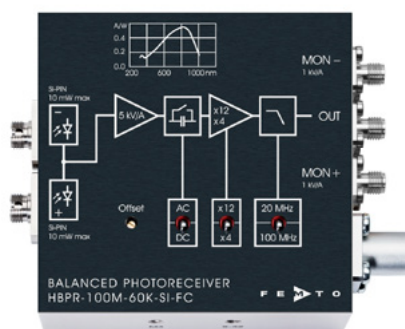


Datasheet

HBPR-100M-60K-SI-FC

High-Speed Balanced Photoreceiver



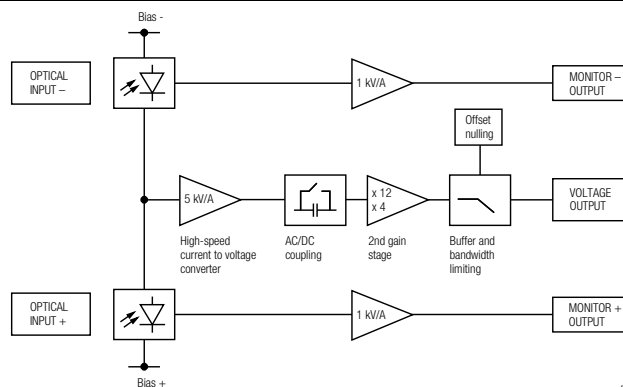
Features

- Bandwidth DC to 100 MHz
- Common-Mode Rejection Ratio (CMRR) 50 dB typ.
- Si-PIN photodiodes
- FC fiber optic inputs
- Spectral range 320 – 1000 nm
- Very low NEP, down to 6.5 pW/√Hz
- Transimpedance gain switchable 20×10^3 V/A, 60×10^3 V/A
- High dynamic input range up to 2×10 mW balanced optical power
- Fast monitor outputs with 10 MHz bandwidth and 1×10^3 V/A gain
- Switchable low pass filter for minimizing wideband noise
- UNC 8-32 and M4 tapped holes for mounting on standard posts with metric and imperial thread

Applications

- Spectroscopy
- Heterodyne detection
- Optical coherence tomography (OCT)
- Optical delay measurement
- Differential optical front-end for oscilloscopes, spectrum analyzers, A/D converters and RF lock-in amplifiers

Block Diagram



SOPHISTICATED TOOLS FOR SIGNAL RECOVERY

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HBPR-100M-60K-SI-FC_R3/TH_JMa/06MAY2024

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HBPR-100M-60K-SI-FC

High-Speed Balanced Photoreceiver

Intended Use	The HBPR-100M-60K-SI-FC photoreceiver consists of a combination of two anti-parallel connected photodiodes with a subsequent low-noise transimpedance amplifier. It is designed for fast conversion of the tiny difference of two optical signals into an equivalent output voltage. 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.											
Application Notes	The damage threshold of 12 mW for each photodiode mentioned in the "Absolute Maximum Ratings" section applies to reasonably homogeneous illumination of the photodiodes. Extreme focusing of the light beam can lead to damage to the photodiodes, even at significantly lower light power. To achieve optimum performance, it is recommended that the CW light intensity at both inputs be well balanced. The monitor outputs can be used for continuous balance control. For setups with arbitrarily varying CW offset, the photoreceiver's AC mode can be helpful. Using AC mode increases the CW offset range to 450 µW (@ 850 nm), regardless of the gain setting.											
Available Version	HBPR-100M-60K-SI-FC 	fix/permanent FC fiber connectors for high coupling efficiency, excellent conversion gain accuracy and common mode rejection ratio (CMRR)										
Related Models	Various free space or fiber coupled HBPR models, with bandwidth up to 500 MHz, in the spectral range from 320 nm to 1700 nm are available.											
Si Versions	Fiber-coupled with fix/permanent FC fiber connectors <table><tr><td>HBPR-200M-30K-SI-FC</td><td>Si-PIN Ø 0.8 mm, DC – 200 MHz, 320 – 1000 nm, CMRR 45 dB, gain $1.0 \times 10^4 / 3.0 \times 10^4$ V/A switchable</td></tr><tr><td>HBPR-500M-10K-SI-FC</td><td>Si-PIN Ø 0.4 mm, DC – 500 MHz, 320 – 1000 nm, CMRR 40 dB, gain $5.0 \times 10^3 / 10.0 \times 10^3$ V/A switchable</td></tr></table> Free space versions with 1.035"-40 threaded flanges <table><tr><td>HBPR-100M-60K-SI-FST</td><td>Si-PIN Ø 0.8 mm, DC – 100 MHz, 320 – 1000 nm, CMRR 50 dB, gain $2.0 \times 10^4 / 6.0 \times 10^4$ V/A switchable</td></tr><tr><td>HBPR-200M-30K-SI-FST</td><td>Si-PIN Ø 0.8 mm, DC – 200 MHz, 320 – 1000 nm, CMRR 45 dB, gain $1.0 \times 10^4 / 3.0 \times 10^4$ V/A switchable</td></tr><tr><td>HBPR-500M-10K-SI-FST</td><td>Si-PIN Ø 0.4 mm, DC – 500 MHz, 320 – 1000 nm, CMRR 40 dB, gain $5.0 \times 10^3 / 10.0 \times 10^3$ V/A switchable</td></tr></table>		HBPR-200M-30K-SI-FC	Si-PIN Ø 0.8 mm, DC – 200 MHz, 320 – 1000 nm, CMRR 45 dB, gain $1.0 \times 10^4 / 3.0 \times 10^4$ V/A switchable	HBPR-500M-10K-SI-FC	Si-PIN Ø 0.4 mm, DC – 500 MHz, 320 – 1000 nm, CMRR 40 dB, gain $5.0 \times 10^3 / 10.0 \times 10^3$ V/A switchable	HBPR-100M-60K-SI-FST	Si-PIN Ø 0.8 mm, DC – 100 MHz, 320 – 1000 nm, CMRR 50 dB, gain $2.0 \times 10^4 / 6.0 \times 10^4$ V/A switchable	HBPR-200M-30K-SI-FST	Si-PIN Ø 0.8 mm, DC – 200 MHz, 320 – 1000 nm, CMRR 45 dB, gain $1.0 \times 10^4 / 3.0 \times 10^4$ V/A switchable	HBPR-500M-10K-SI-FST	Si-PIN Ø 0.4 mm, DC – 500 MHz, 320 – 1000 nm, CMRR 40 dB, gain $5.0 \times 10^3 / 10.0 \times 10^3$ V/A switchable
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High-Speed Balanced Photoreceiver

Related Models (continued)	Fiber-coupled with fix/permanent FC fiber connectors (ball lense coupled)	
InGaAs Versions	HBPR-100M-60K-IN-FC	InGaAs-PIN $\varnothing$ 0.08 mm, DC – 100 MHz, 900 – 1700 nm, CMRR 55 dB, gain $2.0 \times 10^4 / 6.0 \times 10^4$ V/A switchable
	HBPR-200M-30K-IN-FC	InGaAs-PIN $\varnothing$ 0.08 mm, DC – 200 MHz, 900 – 1700 nm, CMRR 50 dB, gain $1.0 \times 10^4 / 3.0 \times 10^4$ V/A switchable
	HBPR-500M-10K-IN-FC	InGaAs-PIN $\varnothing$ 0.08 mm, DC – 500 MHz, 900 – 1700 nm, CMRR 45 dB, gain $5.0 \times 10^3 / 10.0 \times 10^3$ V/A switchable
	Free space versions with 1.035"-40 threaded flanges	
	HBPR-100M-60K-IN-FST	InGaAs-PIN $\varnothing$ 0.3 mm, DC – 100 MHz, 800 – 1700 nm, CMRR 50 dB, gain $2.0 \times 10^4 / 6.0 \times 10^4$ V/A switchable
	HBPR-200M-30K-IN-FST	InGaAs-PIN $\varnothing$ 0.3 mm, DC – 200 MHz, 800 – 1700 nm, CMRR 45 dB, gain $1.0 \times 10^4 / 3.0 \times 10^4$ V/A switchable
	HBPR-450M-10K-IN-FST	InGaAs-PIN $\varnothing$ 0.3 mm, DC – 450 MHz, 800 – 1700 nm, CMRR 35 dB, gain $5.0 \times 10^3 / 10.0 \times 10^3$ V/A switchable
Available Accessory	PS-15-25-L	 Power Supply Input: 100 – 240 VAC Output: ± 15 VDC
Specifications	Test conditions	$V_S = \pm 15$ V, $T_A = 25$ °C, output load impedance 50 Ω , warm-up 20 minutes (min. 10 minutes recommended), monitor outputs terminated with 1 M Ω
Gain	Transimpedance gain	20×10^3 V/A (@ 2 nd gain $\times 4$, 50 Ω load), 60×10^3 V/A (@ 2 nd gain $\times 12$, 50 Ω load)
	Gain accuracy	± 1 % electrical
	Conversion gain	10.8×10^3 V/W typ. (@ 2 nd gain $\times 4$, 850 nm, 50 Ω load) 32.4×10^3 V/W typ. (@ 2 nd gain $\times 12$, 850 nm, 50 Ω load)
	Common mode rejection ratio (CMRR)	50 dB typ. ($f \leq 100$ MHz)
Frequency Response	Lower cut-off frequency	DC / 10 Hz, switchable
	Upper cut-off frequency (–3 dB)	100 MHz / 20 MHz, switchable
Time Response	Rise/fall time (10 % – 90 %)	3.3 ns 17.5 ns (@ bandwidth set to 20 MHz)
Input	Noise equivalent power (NEP)	minimum 6.5 pW/ $\sqrt{\text{Hz}}$ (@ 850 nm) 7.4 pW/ $\sqrt{\text{Hz}}$ (@ 850 nm, 20 MHz) 12.0 pW/ $\sqrt{\text{Hz}}$ (@ 850 nm, 50 MHz) 19.0 pW/ $\sqrt{\text{Hz}}$ (@ 850 nm, 100 MHz)
	Maximum differential CW power (for linear amplification)	93 μW (@ 2 nd gain $\times 4$, DC-coupled, 850 nm) 31 μW (@ 2 nd gain $\times 12$, DC-coupled, 850 nm) 450 μW (@ AC-coupled, 850 nm)
	Max. optical CW balanced power (common mode power)	10 mW (on each photodiode, @ 850 nm)
	Monitor optical saturation power (limited by maximum ratings)	12 mW (@ 850 nm)
Detector	Detector type	Si-PIN photodiode in FC fiber connector
	Active area	$\varnothing$ 800 μm , suitable for fibers up to 400 μm core diameter
	Spectral range	320 – 1000 nm
	Sensitivity	0.54 A/W typ. (@ 850 nm)

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HBPR-100M-60K-SI-FC

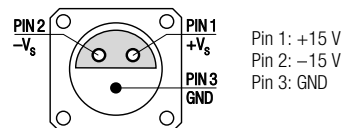
High-Speed Balanced Photoreceiver

Specifications (continued)

Output	Output voltage range Max. output voltage Offset voltage compensation Output impedance Slew rate Max. output current Output reflection S22 Output noise (typ.)	± 1.0 V (@ 50 Ω load) for linear operation and low harmonic distortion ± 2.0 V (@ 50 Ω load) ± 100 mV typ., adjustable by offset potentiometer 50 Ω (terminate with 50 Ω load) 2000 V/ μ s 70 mA -30 dB @ < 100 MHz -20 dB @ < 800 MHz 2.1 mV RMS (14 mV peak-peak) (@ 2 nd gain $\times 4$) 5.8 mV RMS (38 mV peak-peak) (@ 2 nd gain $\times 12$) 0.5 mV RMS (3.2 mV peak-peak) (@ 2 nd gain $\times 4$, BW 20 MHz) 1.3 mV RMS (8.8 mV peak-peak) (@ 2 nd gain $\times 12$, BW 20 MHz) (@ 50 Ω load, no signal on detectors, measurement bandwidth 2 GHz)
Monitor Outputs	Gain Voltage range Output impedance Max. output current Bandwidth Output noise	1×10^3 V/A (@ ≥ 100 k Ω load) 0 ... +10 V (@ ≥ 100 k Ω load) 50 Ω (terminate with ≥ 100 k Ω load) 30 mA typ. DC – 10 MHz 0.6 mV RMS (4 mV peak-peak) (@ 100 k Ω load, no signal on detectors, measurement bandwidth 200 MHz)
Power Supply	Supply voltage Supply current	± 15 V (± 14.5 V ... ± 16.5 V) -90 / $+120$ mA typ. (depends on operating conditions, recommended power supply capability min. ± 200 mA)
Optical Input Connector	Material FC receptacle	nickel silver
Case	Weight Material	350 g (0.77 lbs) AlMg3Mn, nickel-plated
Temperature Range	Storage temperature Operating temperature	-40 °C ... $+85$ °C 0 °C ... $+60$ °C

Absolute Maximum Ratings	Optical input power (CW) Power supply voltage	12 mW (on each photodiode) ± 20 V
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Connectors	Inputs Outputs Power supply	FC fiber optic connectors (FC/PC and FC/APC compatible) SMA jacks (female) LEMO® series 1S, 3-pin fixed socket (mating plug type: FFA.1S.303.CLAC52)
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Scope of Delivery	HBPR-100M-60K-SI-FC, Lemo® 3-pin connector, 3 $\times$ adapter SMA (male) to BNC (female), datasheet
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Ordering Information	HBPR-100M-60K-SI-FC FC fiber optic connectors (FC/PC and FC/APC compatible)
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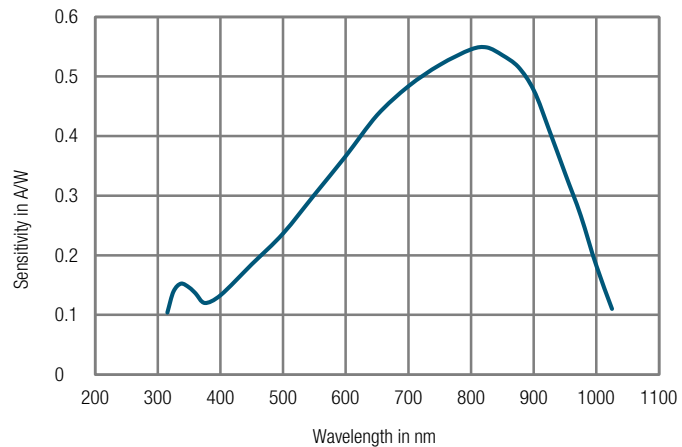
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Spectral Response

HBPR-100M-60K-SI-FC (FC fiber optic input)



DB-Sens-HBPR-100-200-SI_R2

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HBPR-100M-60K-SI-FC_R3/TH.JMa/06MAY2024

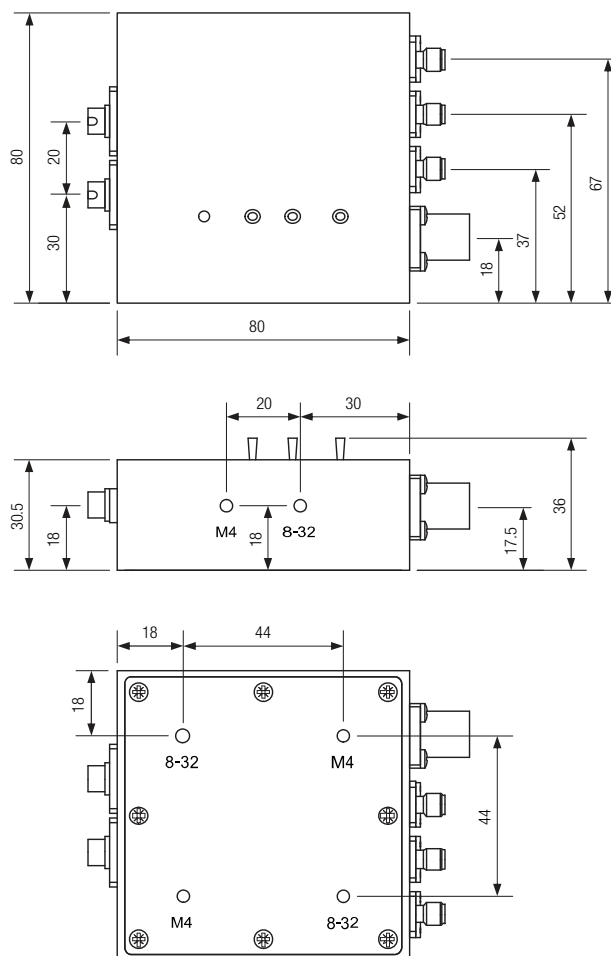
Datasheet

HBPR-100M-60K-SI-FC

High-Speed Balanced Photoreceiver

Dimensions

HBPR-100M-60K-SI-FC



DZ-HBPR_FC_R2

all dimensions in mm unless otherwise noted

The base plate can be rotated if necessary. To do this, loosen the 8 screws.

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