

Ultra High Speed Photoreceiver  
with InGaAs-PIN Photodiode



The picture shows model HSA-X-S-2G-IN-FST

Features	<ul style="list-style-type: none"><li>• InGaAs-PIN photodiode</li><li>• Bandwidth 10 kHz – 2 GHz</li><li>• Amplifier transimpedance gain <math>5.0 \times 10^3</math> V/A</li><li>• Max. conversion gain <math>4.75 \times 10^3</math> V/W @ 1550 nm</li><li>• Spectral range 900 – 1700 nm</li><li>• Free-space input 1.035"-40 threaded</li><li>• Fiber optic input available as permanently mounted FC-input</li><li>• UNC 8-32 and M4 tapped holes for mounting on standard posts with metric and imperial thread</li></ul>
Applications	<ul style="list-style-type: none"><li>• Spectroscopy</li><li>• Ultra-fast pulse and transient measurements</li><li>• Optical triggering</li><li>• Optical front-end for oscilloscopes and ultra-fast A/D converters</li></ul>
Block Diagram	<p>The block diagram illustrates the internal circuitry of the photoreceiver. It begins with an InGaAs photodiode, represented by a triangle with two arrows pointing towards it, indicating incident light. The photodiode is connected to a bias voltage source, labeled 'Bias'. The output of the photodiode is connected to a node that also branches to a 'DC-path' to ground. This node is followed by a coupling capacitor, then a low-noise fixed gain amplifier (represented by a large triangle), and another coupling capacitor, leading to the 'VOLTAGE OUTPUT'.</p> <p>BS01-HSA-X-S_R01</p>
Intended Use	<p>The HSA-X-S-2G-IN photoreceiver consists of an InGaAs photodiode and a subsequent low-noise fixed gain amplifier. It is designed for ultra-fast conversion of small optical signals into equivalent output voltages. Operation is mostly self-explanatory. If in doubt, consult this document or contact <a href="mailto:support@femto.de">support@femto.de</a>.</p> <p>For safe operation, please refer to the damage thresholds specified in the "Absolute Maximum Ratings", "Temperature Range" and "Power Supply" sections of this document.</p> <p>The operating environment must be free of smoke, dust, grease, oil, condensing moisture, and other contaminants that could affect the operation or performance.</p>

## Ultra High Speed Photoreceiver with InGaAs-PIN Photodiode

### Available Versions

HSA-X-S-2G-IN-FST



1.035"-40 threaded flange with internally threaded coupler ring (outer diameter 30 mm) for free space applications. Compatible with many optical standard accessories and for use with various types of fiber connector adapters.

HSA-X-S-2G-IN-FC



Fix/permanent FC fiber connector for high coupling efficiency and excellent conversion gain accuracy.

### Related Models

HSA-X-S-1G4-SI-FST

Si-PIN, Ø 0.4 mm, 320 – 1000 nm, 1.4 GHz, free space input, 1.035"-40 threaded flange

HSA-X-S-1G4-SI-FC

Si-PIN, integrated ball lens, 320 – 1000 nm, 1.4 GHz, FC fiber connector (fix/permanent)

HSPR-X-I-1G4-SI-FST

Si-PIN, Ø 0.4 mm, 320 – 1000 nm, 1.4 GHz, inverting output, free space input, 1.035"-40 threaded flange

HSPR-X-I-1G4-SI-FC

Si-PIN, integrated ball lens, 320 – 1000 nm, 1.4 GHz, inverting output, FC fiber connector (fix/permanent)

HSPR-X-I-2G-IN-FST

InGaAs-PIN, Ø 0.1 mm, 900 – 1700 nm, 2 GHz, inverting output, free space input, 1.035"-40 threaded flange

HSPR-X-I-2G-IN-FC

InGaAs-PIN, integrated ball lens, 900 – 1700 nm, 2 GHz, inverting output, FC fiber connector (fix/permanent)

### Available Accessories

PS-15-25-L

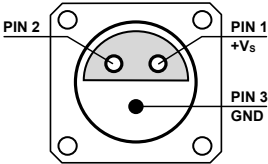
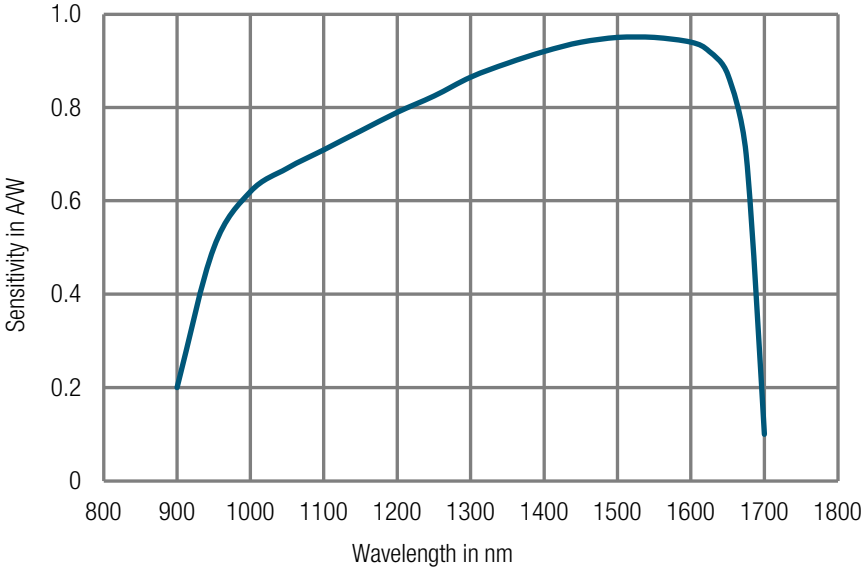


Power Supply  
Input: 100 – 240 VAC  
Output: ±15 VDC

## Ultra High Speed Photoreceiver with InGaAs-PIN Photodiode

Specifications	Test conditions	$V_S = +15\text{ V}$ , $T_A = 25\text{ }^\circ\text{C}$ , output load impedance $50\text{ }\Omega$ , warm-up 20 minutes (min. 10 minutes recommended)
Gain	Transimpedance gain Conversion gain	$5.0 \times 10^3\text{ V/A}$ (@ output load $50\text{ }\Omega$ ) $4.75 \times 10^3\text{ V/W typ.}$ (@ $1550\text{ nm}$ , output load $50\text{ }\Omega$ )
Frequency Response	Lower cut-off frequency ( $-3\text{ dB}$ ) Upper cut-off frequency ( $-3\text{ dB}$ )	$10\text{ kHz}$ $2\text{ GHz } (\pm 15\%)$
Time Response	Rise/fall time ( $10\text{ }\% - 90\text{ }\%$ )	$180\text{ ps } (\pm 15\%)$
Input	Noise equivalent power (NEP) Optical saturation power	$16\text{ pW}/\sqrt{\text{Hz}}$ (@ $1550\text{ nm}$ , $100\text{ MHz}$ ) $200\text{ }\mu\text{W AC}$ (for linear amplification, @ $1550\text{ nm}$ ) $10\text{ mW CW}$ (to prevent saturation, @ $1550\text{ nm}$ )
Detector	Detector Active area (FST version) Active area (FC version)  Spectral range Max. sensitivity	InGaAs-PIN photodiode $\varnothing 100\text{ }\mu\text{m}$ integrated ball lens, suitable for fibers up to $62.5\text{ }\mu\text{m}$ core diameter $900 - 1700\text{ nm}$ $0.95\text{ A/W typ.}$ (@ $1550\text{ nm}$ )
Output	Output voltage range  Output reflection S22 Output impedance Output noise	$1.9\text{ V}_{PP}$ (@ $50\text{ }\Omega$ output load) for linear operation and low harmonic distortion $-7.3\text{ dB}$ (@ $f < 2.5\text{ GHz}$ ) $50\text{ }\Omega$ (terminate with $50\text{ }\Omega$ load) $3.6\text{ mV RMS}$ ( $24\text{ mV peak-peak}$ ) typ. (@ $50\text{ }\Omega$ load, no signal on detector, measurement bandwidth $4\text{ GHz}$ )
Optical Input Connector	Material FST flange Material FST coupler ring Material FC receptacle	$1.4305$ stainless steel, nickel-plated $1.4305$ stainless steel, glass bead blasted nickel silver
Power Supply	Supply voltage Supply current	$+15\text{ V}$ $130\text{ mA}$ (depends on operating conditions, recommended power supply capability min. $200\text{ mA}$ )
Case	Weight  Material	$133\text{ g}$ ( $0.29\text{ lbs}$ ) HSA-X-S-2G-IN-FST incl. coupler ring $110\text{ g}$ ( $0.24\text{ lbs}$ ) HSA-X-S-2G-IN-FC AlMg4.5Mn, nickel-plated
Temperature Range	Storage temperature Operating temperature	$-30\text{ }^\circ\text{C} \dots +85\text{ }^\circ\text{C}$ $0\text{ }^\circ\text{C} \dots +60\text{ }^\circ\text{C}$
Absolute Maximum Ratings	Optical input power (CW) Power supply voltage	$12\text{ mW}$ (averaged) $20\text{ V}$

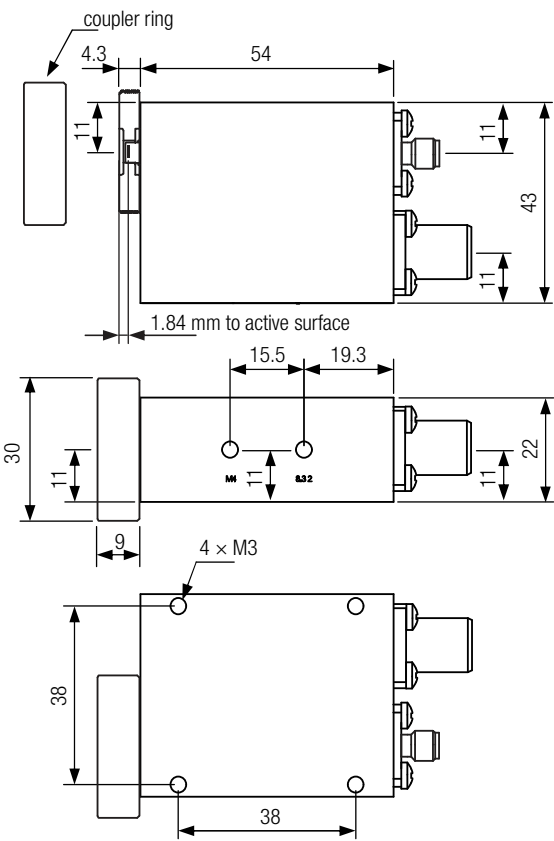
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Connectors	<div>Input<div>HSA-X-S-2G-IN-FST1.035"-40 threaded flange for free space applications and for use with various types of optical standard accessories</div><div>HSA-X-S-2G-IN-FCFC fiber optic connector (fix/permanent, FC/PC and FC/APC compatible)</div></div> <div>Output<div>SMA jack (female)</div></div> <div>Power supply<div>LEMO® series 1S, 3-pin fixed socket (mating plug type: FFA.1S.303.CLAC52)</div><div><div>Pin 1: +15 V Pin 2: NC Pin 3: GND</div></div></div>																				
Scope of Delivery	HSA-X-S-2G-IN, internally threaded coupler ring (FST version only), LEMO® 3-pin connector, datasheet, transport package																				
Ordering Information	<div>HSA-X-S-2G-IN-FST1.035"-40 threaded flange for free space applications and for use with various types of optical standard accessories.</div> <div>HSA-X-S-2G-IN-FCFC fiber optic connector (fix/permanent, FC/PC and FC/APC compatible).</div>																				
Spectral Response	<div><table border="1"><caption>Spectral Response Data (Approximate)</caption><thead><tr><th>Wavelength (nm)</th><th>Sensitivity (AW)</th></tr></thead><tbody><tr><td>900</td><td>0.2</td></tr><tr><td>1000</td><td>0.6</td></tr><tr><td>1100</td><td>0.75</td></tr><tr><td>1200</td><td>0.85</td></tr><tr><td>1300</td><td>0.9</td></tr><tr><td>1400</td><td>0.95</td></tr><tr><td>1500</td><td>0.95</td></tr><tr><td>1600</td><td>0.9</td></tr><tr><td>1700</td><td>0.1</td></tr></tbody></table></div> <div>DB-Sens-HSA-X-S-2G-IN_R01</div>	Wavelength (nm)	Sensitivity (AW)	900	0.2	1000	0.6	1100	0.75	1200	0.85	1300	0.9	1400	0.95	1500	0.95	1600	0.9	1700	0.1
Wavelength (nm)	Sensitivity (AW)																				
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Dimensions

HSA-X-S-2G-IN-FST (1.035"-40 threaded free space input)



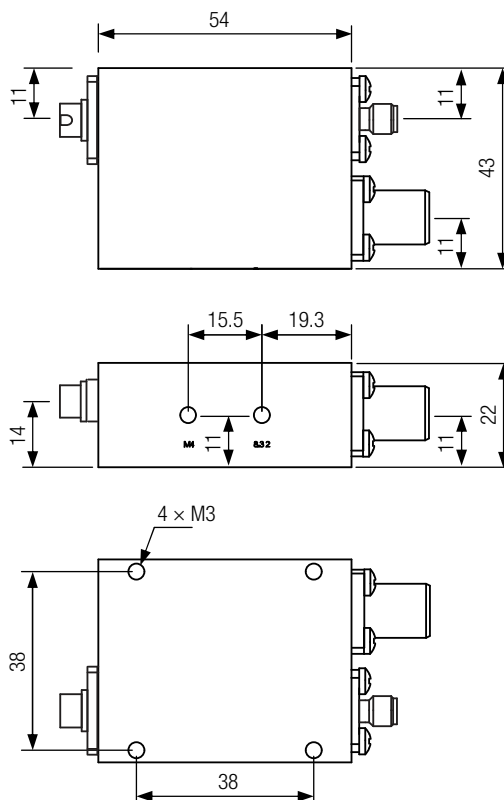
DZ-HS-FST\_R1

all dimensions in mm unless otherwise noted

# Ultra High Speed Photoreceiver with InGaAs-PIN Photodiode

Dimensions (continued)

HSA-X-S-2G-IN-FC (FC fiber optic connector)



DZ-HS\_FC\_R1

all dimensions in mm unless otherwise noted

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