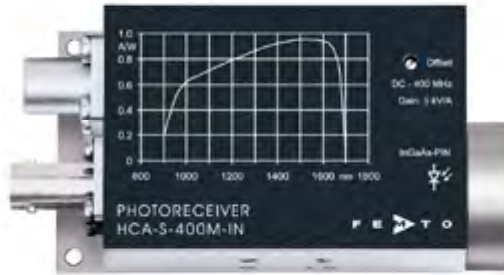




**Datasheet**

**HCA-S-400M-IN**

**400 MHz Photoreceiver  
with InGaAs-PIN Photodiode**



The picture shows model HCA-S-400M-IN-FST

Features	<ul style="list-style-type: none"> <li>• <b>InGaAs-PIN photodiode</b></li> <li>• <b>Bandwidth DC – 400 MHz</b></li> <li>• <b>Amplifier transimpedance gain <math>5.0 \times 10^3</math> V/A</b></li> <li>• <b>Max. conversion gain <math>4.8 \times 10^3</math> V/W @ 1550 nm</b></li> <li>• <b>Spectral range 900 – 1700 nm</b></li> <li>• <b>Free-space input 1.035"-40 threaded</b></li> <li>• <b>Fiber optic input available as permanently mounted FC-input</b></li> <li>• <b>UNC 8-32 and M4 tapped holes for mounting on standard posts with metric and imperial thread</b></li> </ul>
Applications	<ul style="list-style-type: none"> <li>• <b>Spectroscopy</b></li> <li>• <b>Fast pulse and transient measurements</b></li> <li>• <b>Optical triggering</b></li> <li>• <b>Optical front-end for oscilloscopes, A/D converters and HF lock-in amplifiers</b></li> </ul>
Block Diagram	<p style="text-align: right; font-size: small;">BS01-HCA-S_R02</p>





**Intended Use**

The HCA-S-400M-IN photoreceiver consists of an InGaAs photodiode and a subsequent low-noise fixed gain transimpedance amplifier. It is designed for fast 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](mailto:support@femto.de).

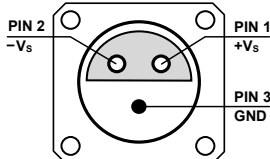
For safe operation, please refer to the damage thresholds specified in the "Absolute Maximum Ratings", "Temperature Range" and "Power Supply" sections of this document.

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

## 400 MHz Photoreceiver with InGaAs-PIN Photodiode

<p>Available Versions</p>	<p>HCA-S-400M-IN-FST</p>  <p>HCA-S-400M-IN-FC</p> 	<p>1.035"-40 threaded flange with internally threaded coupler ring (outer diameter 30 mm) for free space applications, compatible with many optical standard accessories</p> <p>Fix/permanent FC fiber connector for high coupling efficiency and excellent conversion gain accuracy</p>			
<p>Related Models</p>	<p>HCA-S-400M-SI-FST</p> <p>HCA-S-400M-SI-FC</p>	<p>Si-PIN, <math>\varnothing</math> 0.8 mm, 320 – 1000 nm free space input, 1.035"-40 threaded flange</p> <p>Si-PIN, <math>\varnothing</math> 0.8 mm, 320 – 1000 nm FC fiber connector (fix/permanent)</p>			
<p>Available Accessories</p>	<p>PRA-PAP</p>  <p>PS-15-25-L</p> 	<p>Alternative mounting option: Post adapter plate, easy to mount on FEMTO photoreceiver series OE, FWPR, PWPR, HCA-S and LCA-S.</p> <p>Power Supply Input: 100 – 240 VAC Output: <math>\pm</math>15 VDC</p>			
<p>Specifications</p>	<table border="0"> <tr> <td style="vertical-align: top;"> <p>Gain</p> <p>Frequency Response</p> <p>Time Response</p> <p>Input</p> </td> <td style="vertical-align: top;"> <p>Test conditions</p> <p>Transimpedance gain</p> <p>Gain accuracy</p> <p>Conversion gain</p> <p>Lower cut-off frequency</p> <p>Upper cut-off frequency (-3 dB)</p> <p>Gain flatness</p> <p>Rise/fall time (10 % – 90 %)</p> <p>Noise equivalent power (NEP)</p> <p>Optical saturation power</p> <p>Input offset compensation range</p> </td> <td style="vertical-align: top;"> <p><math>V_S = \pm 15</math> V, <math>T_A = 25</math> °C, output load impedance 50 <math>\Omega</math>, warm-up 20 minutes (min. 10 minutes recommended)</p> <p><math>5.0 \times 10^3</math> V/A (@ output load 50 <math>\Omega</math>)</p> <p><math>\pm 1</math> % (electrical)</p> <p><math>4.8 \times 10^3</math> V/W typ. (@ 1550 nm, output load 50 <math>\Omega</math>)</p> <p>DC</p> <p>400 MHz (<math>\pm 15</math> %)</p> <p><math>\pm 1</math> dB</p> <p>1.0 ns</p> <p>24 pW/<math>\sqrt{\text{Hz}}</math> (@ 1550 nm, 100 MHz)</p> <p>200 <math>\mu</math>W (for linear amplification, @ 1550 nm)</p> <p><math>\pm 200</math> <math>\mu</math>A, adjustable by offset potentiometer</p> </td> </tr> </table>		<p>Gain</p> <p>Frequency Response</p> <p>Time Response</p> <p>Input</p>	<p>Test conditions</p> <p>Transimpedance gain</p> <p>Gain accuracy</p> <p>Conversion gain</p> <p>Lower cut-off frequency</p> <p>Upper cut-off frequency (-3 dB)</p> <p>Gain flatness</p> <p>Rise/fall time (10 % – 90 %)</p> <p>Noise equivalent power (NEP)</p> <p>Optical saturation power</p> <p>Input offset compensation range</p>	<p><math>V_S = \pm 15</math> V, <math>T_A = 25</math> °C, output load impedance 50 <math>\Omega</math>, warm-up 20 minutes (min. 10 minutes recommended)</p> <p><math>5.0 \times 10^3</math> V/A (@ output load 50 <math>\Omega</math>)</p> <p><math>\pm 1</math> % (electrical)</p> <p><math>4.8 \times 10^3</math> V/W typ. (@ 1550 nm, output load 50 <math>\Omega</math>)</p> <p>DC</p> <p>400 MHz (<math>\pm 15</math> %)</p> <p><math>\pm 1</math> dB</p> <p>1.0 ns</p> <p>24 pW/<math>\sqrt{\text{Hz}}</math> (@ 1550 nm, 100 MHz)</p> <p>200 <math>\mu</math>W (for linear amplification, @ 1550 nm)</p> <p><math>\pm 200</math> <math>\mu</math>A, adjustable by offset potentiometer</p>
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## 400 MHz Photoreceiver with InGaAs-PIN Photodiode

Specifications (continued)			
Detector	Detector Active area (FST version) Active area (FC version)	InGaAs-PIN photodiode Ø 0.3 mm integrated ball lens suitable for fibers up to 62.5 µm core diameter	
	Spectral range Max. sensitivity	900 – 1700 nm 0.95 A/W typ. (@ 1550 nm)	
Output	Output voltage range  Max. output voltage range Output impedance Output noise	±1.0 V (@ 50 Ω output load) for linear operation and low harmonic distortion ±1.5 V (@ 50 Ω output load) 50 Ω (terminate with 50 Ω load) 3 mV RMS (20 mV peak-peak) typ. (@ 50 Ω load, no signal on detector, measurement bandwidth 1.5 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 V (±14.5 V ... ±16.5 V) ±55 mA (depends on operating conditions, recommended power supply capability min. ±150 mA)	
Case	Weight  Material	209 g (0.46 lbs) HCA-S-400M-IN-FST incl. coupler ring 188 g (0.41 lbs) HCA-S-400M-IN-FC AlMg4.5Mn, nickel-plated	
Temperature Range	Storage temperature Operating temperature	–30 °C ... +85 °C 0 °C ... +60 °C	
Absolute Maximum Ratings	Optical input power (CW) Power supply voltage	10 mW ±20 V	
Connectors	Input   Output Power supply	HCA-S-400M-IN-FST  HCA-S-400M-IN-FC  BNC jack (female) LEMO® series 1S, 3-pin fixed socket (mating plug type: FFA.1S.303.CLAC52)	1.035"-40 threaded flange for free space applications and for use with various types of optical standard accessories  FC fiber optic connector (fix/permanent, FC/PC and FC/APC compatible)  Pin 1: +15 V Pin 2: –15 V Pin 3: GND
			
Scope of Delivery	HCA-S-400M-IN, internally threaded coupler ring (FST version only), LEMO® 3-pin connector, datasheet, transport package		

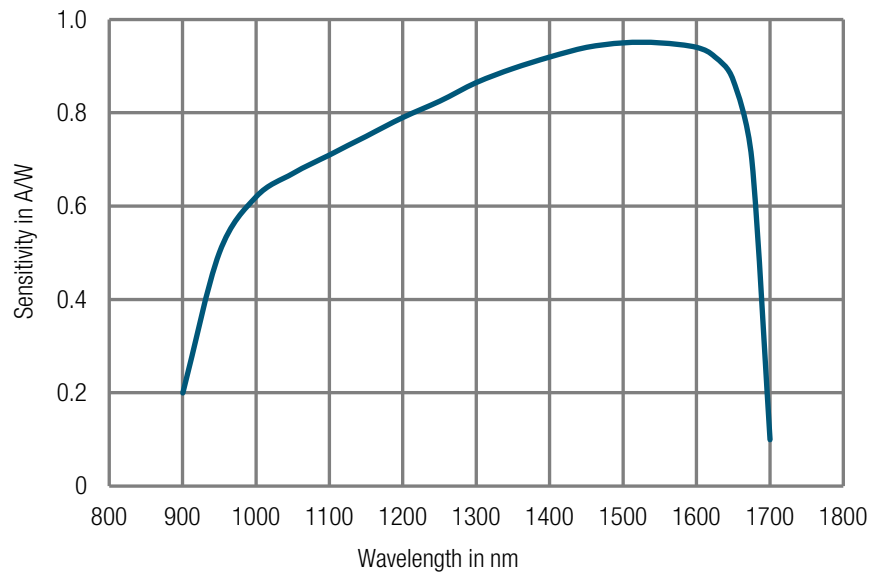
# 400 MHz Photoreceiver with InGaAs-PIN Photodiode

Ordering Information

HCA-S-400M-IN-FST      1.035"-40 threaded flange for free space applications and for use with various types of optical standard accessories.

HCA-S-400M-IN-FC      FC fiber optic connector (fix/permanent, FC/PC and FC/APC compatible).

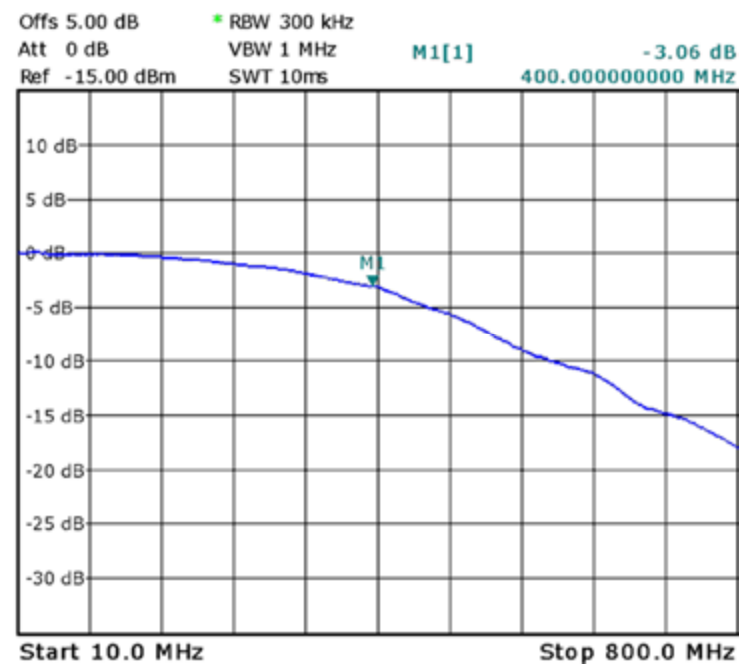
Spectral Response



DB-Sens-HCA-S-400M-IN\_R01

Typical Performance Characteristics

Frequency response

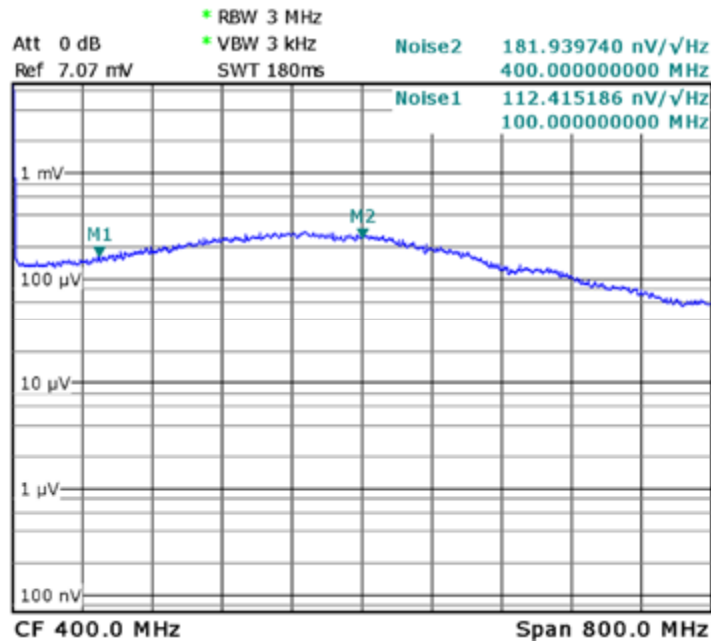


PD-HCA-S-400M-IN-bw\_R01

# 400 MHz Photoreceiver with InGaAs-PIN Photodiode

Typical Performance  
Characteristics (continued)

Noise spectrum



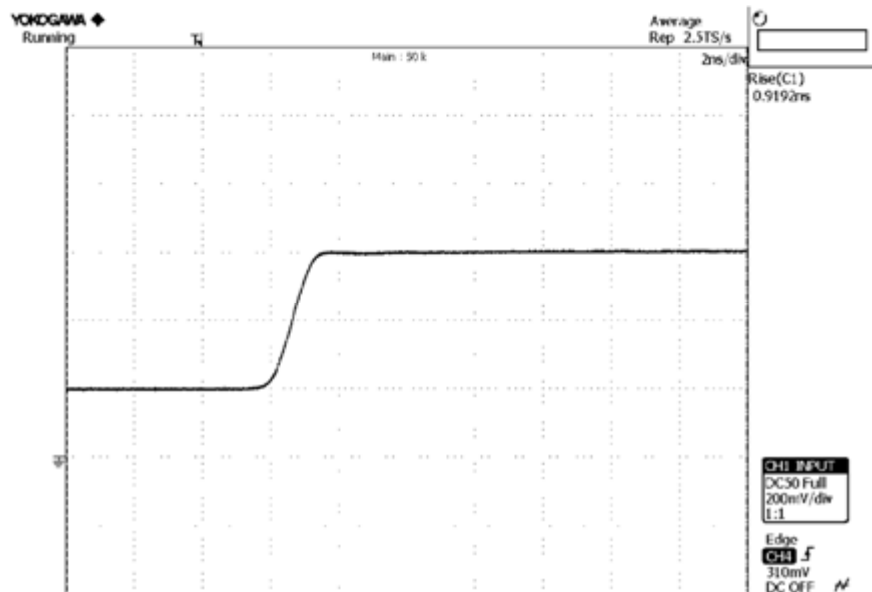
PD-HCA-S-400M-IN-noise\_R01

Note: spectral noise data is measured at the amplifier output with no signal on the photodiode. To determine the spectral input noise divide the measured output noise by the amplifier conversion gain.

Conversion gain (V/W) = amplifier gain (V/A) × photo sensitivity (A/W).

Marker	frequency	output noise	resulting input noise (NEP)
1	100 MHz	112 nV/√Hz	24 pW/√Hz (@ 1550 nm)

Pulse response to square wave input signal  
(with 16 times averaging)

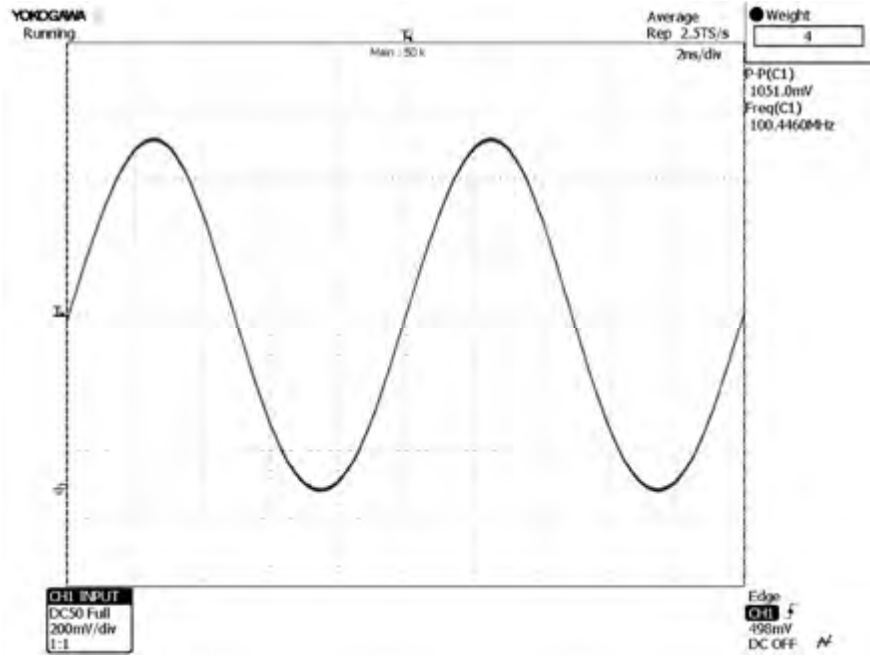


PD-HCA-S-400M-IN-pulse-2ns\_R01

# 400 MHz Photoreceiver with InGaAs-PIN Photodiode

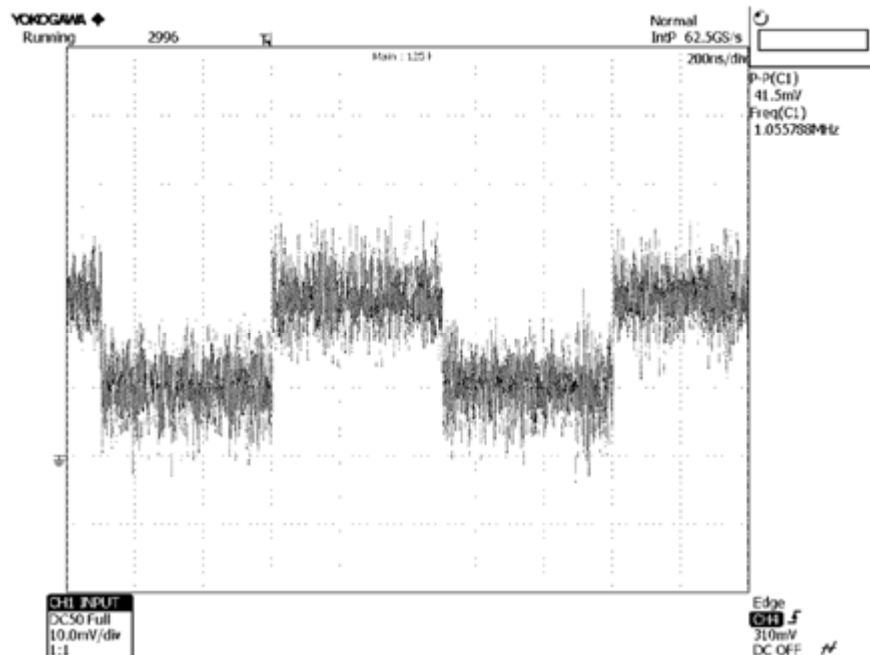
Typical Performance  
Characteristics (continued)

Large signal response  
output signal for 100 MHz, 210  $\mu$ W modulated optical input signal  
(with 4 times averaging)



PD-HCA-S-400M-IN-large-sinus\_R01

Small signal response  
output signal for 3  $\mu$ W modulated optical input signal, 1 MHz square wave, without averaging

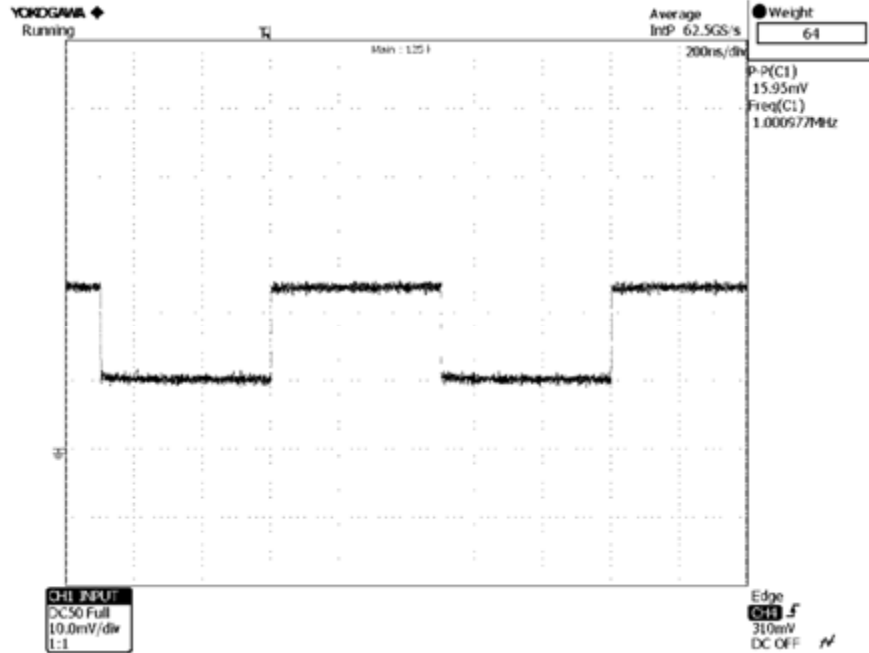


PD-HCA-S-400M-IN-noise-square\_R01

# 400 MHz Photoreceiver with InGaAs-PIN Photodiode

Typical Performance  
Characteristics (continued)

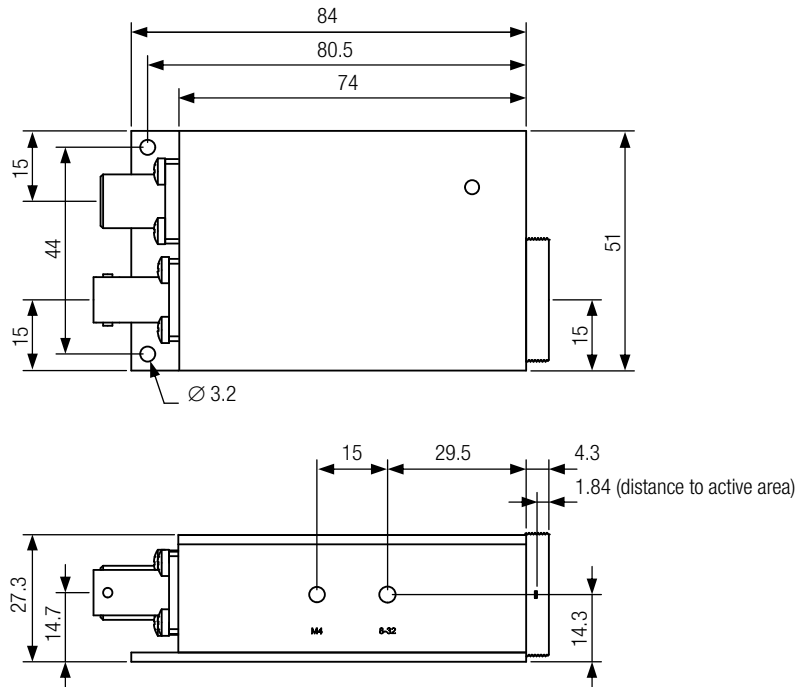
Small signal response  
output signal for 3  $\mu$ W modulated optical input signal, 1 MHz square wave,  
with 64 times averaging



PD-HCA-S-400M-IN-noise-square\_average\_R01

Dimensions

HCA-S-400M-IN-FST (1.035"-40 threaded free space input)



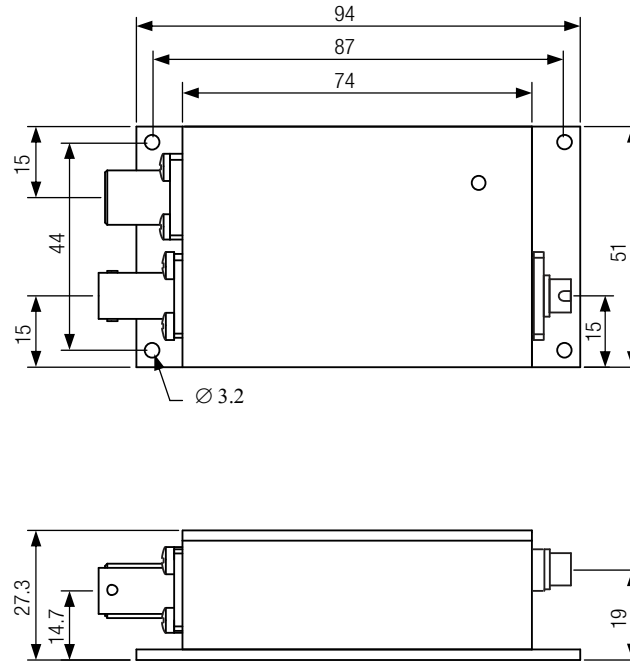
all dimensions in mm unless otherwise noted

DZ-HCA-S\_FST\_R1

# 400 MHz Photoreceiver with InGaAs-PIN Photodiode

Dimensions (continued)

HCA-S-400M-IN-FC (FC fiber optic connector)



DZ-HCA-S\_FC\_R1

all dimensions in mm unless otherwise noted

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