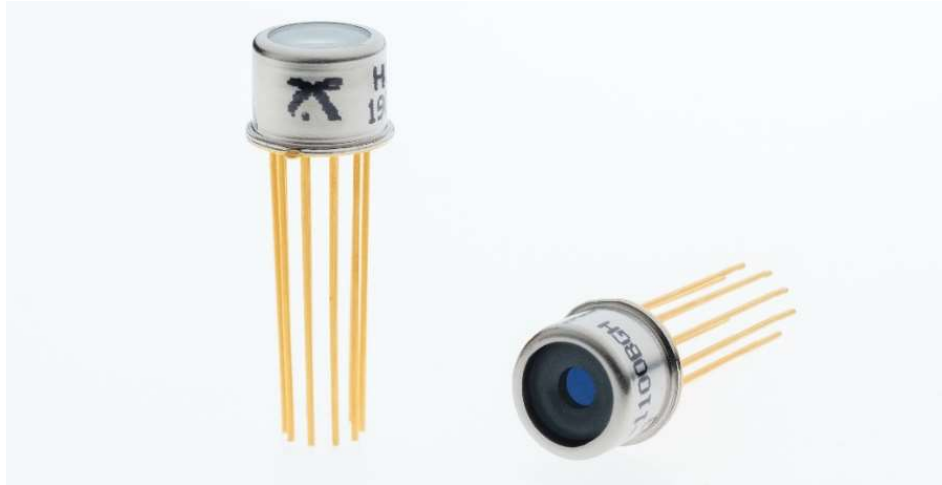


HPR series – HPR-1100BGH Hybrid PIN Receiver Module



Excelitas' HPR-1100BGH Hybrid PIN Receiver Module integrates our high speed Silicon PIN Photodiode, a low-noise J-FET Operational amplifier and an optical aperture to ease development of systems where weak signals with a high gain need to be amplified at low-bandwidth.

Key Features

- Built-in Low Noise Amplifier
- Shielded J-FET Amplifier for best SNR
- Large Active Area
- Wide Spectral Range
- RoHS compliant

Applications

- Low bandwidth, high-gain applications
- Optical Power Meter
- Fast laser trigger
- Instrumentation
- Simplified receiver for high-performance short-range communication links

All specifications are referring to an ambient temperature of $T_A = 23\text{ }^\circ\text{C}$, 0 V Photodiode Bias and $\pm 15\text{ V}$ Amplifier Bias, operated with a 200 M Ω feedback resistor.

Table 1: Key parameters

Parameter	Symbol	Min	Typ	Max	Unit
Photodiode Bias Voltage	V_{OP}		0		V
Spectral Range	$\Delta\lambda$	400		1150	nm
Peak Responsivity	λ_{peak}		900		nm
Responsivity ¹	R_{900}		130		MV/W

Note 1: The responsivity of the receiver depends on the selected feedback resistor. Please refer to Table 5 and Figure 2.

Hybrid PIN Receiver Module

Table 2: Ordering Information

Parameter	HPR-1100BGH	Units
Active Area Shape	Circular	
Useful Area	5.1	mm ²
Useful Diameter	80.6	mm

Table 3: Absolute Maximum Ratings

Parameter	Symbol	Value	Units
Photodiode Bias Voltage	V _{OP}	0	V
Operating Temperature	T _{Op}	0 ... 70	°C
Soldering Temperature ³	T _P	260	°C

Note 1: Stresses above those listed under “Absolute Maximum Ratings” may cause permanent damage to the device.

Note 2: Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Note 3: 5 seconds, leads only.

Table 4: Amplifier Specifications

Parameter	Symbol	Minimum	Typical	Maximum	Units
Bias Current ¹			30		pA
Offset Current			3		pA
Offset Voltage ²			3		mV
Offset Voltage Drift			5		μV/°C
Output Resistance			250		Ω
Slew Rate			12		V/μs
Amplifier Supply Voltage		±5		±18	V
Amplifier Supply Current			5		mA
Power Consumption			150		mW

Note 1: Doubles for every 10 °C increase in operating temperature.

Note 2: Can be adjusted to 0 V with external trim potentiometer, please refer to Figure 2.

Hybrid PIN Receiver Module

Table 5: Photodiode Specifications

Parameter	Symbol	Minimum	Typical	Maximum	Units
Peak Unity Responsivity ¹	R_{PD}	0.6			A/W
Bandwidth ²	f_{3dB}		1100		Hz
Rise Time / Fall Time ³	t_r / t_f		32		μs
Dark Noise ⁴	V_N		4.0		$\mu V/\sqrt{Hz}$
Noise Equivalent Power ^{2,5}	NEP		0.03		pW/ \sqrt{Hz}
Field of View ⁶	α		1		Degrees
	α'		104		

Note 1: Unity Responsivity is defined as the intrinsic Responsivity of the Photodiode. The final Responsivity is dependent on the used feedback resistor and can be obtained by $R(\lambda) = R_{PD}(\lambda)R_F$ with R the final responsivity, R_{PD} the unity responsivity and R_F the feedback resistor value. Please refer also to Figure 2.

Note 2: Operational performance with recommended feedback resistor of 200 M Ω , use of different feedback resistor values will modify system NEP and bandwidth.

Note 3: As estimated by $t_{r/f} = \frac{0.35}{f_{3dB}}$

Note 4: Due to the natural fluctuations of charge carriers the PIN diode will also generate noise when not illuminated. Since the noise characteristics and hence the signal-to-noise ratio (SNR) are dependent on the bandwidth (f_{3dB}) and operating wavelength (λ) inside the final system the illuminated noise

$$V_{ill} = \sqrt{2qf_{3d} R(\lambda)P + V_N}$$

needs to be considered. Hence the SNR is defined as

$$SNR = \frac{V_p^2}{V_{ill}^2} = \frac{(R(\lambda)P)^2}{V_{ill}^2}$$

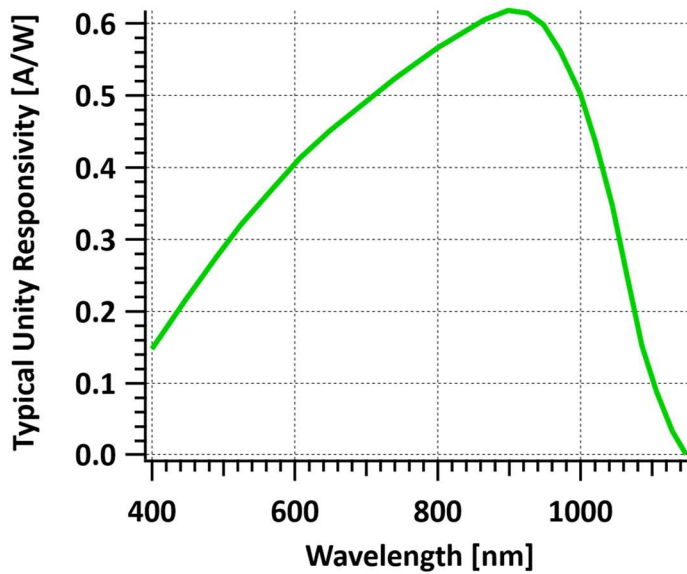
with q the charge carrier and P the incident optical power in W.

Note 5: The NEP is specified in dark conditions and defined as $NEP = \frac{V_N}{R(\lambda)}$

Note 6: Please refer to Figure 4

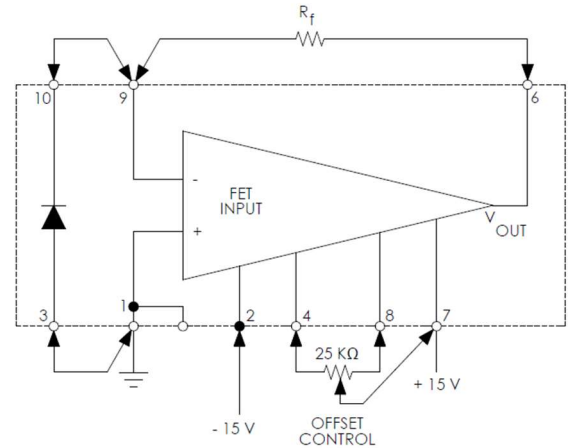
Hybrid PIN Receiver Module

Figure 1: Typical Photodiode Unity Responsivity



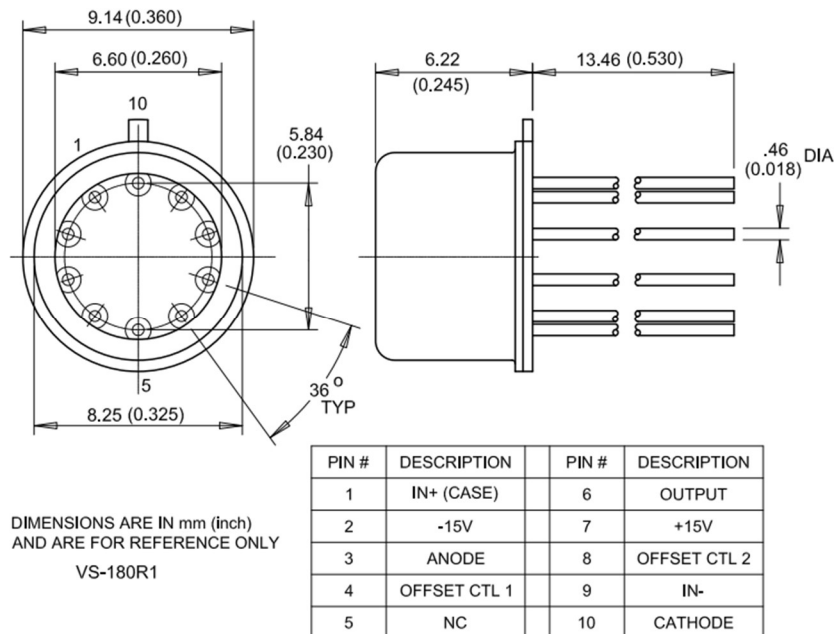
Note: Refer to Note 1 of Table 5

Figure 2: Recommended electrical layout



Note: 25 kΩ offset voltage control through external trim potentiometer remains optional.

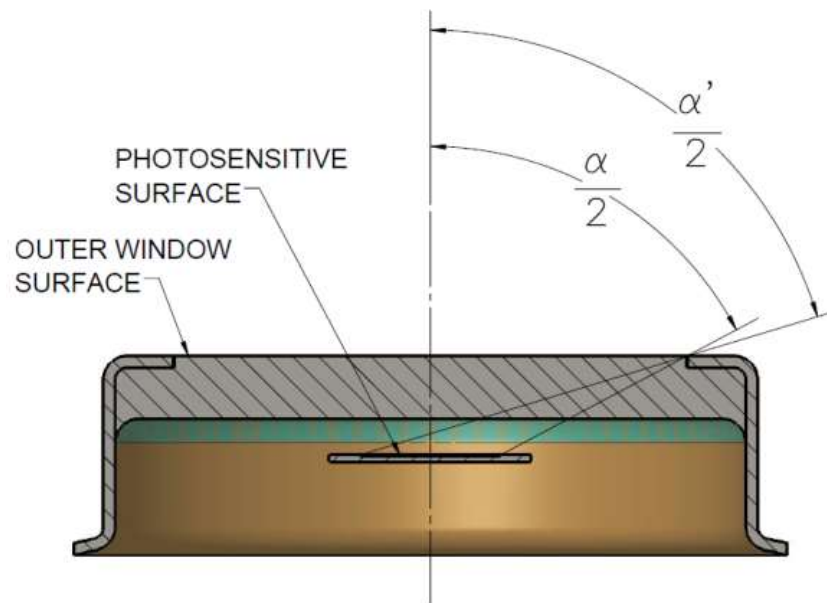
Figure 3: HPR-1100BGH Mechanical and Electrical Data



Note: Distance of outer window to active photodiode surface is nominally 1.98 mm.

Hybrid PIN Receiver Module

Figure 4: Approximate field of view



VS-383

Note 1: For incident radiation at angles $\leq \alpha/2$, the photosensitive surface is totally illuminated.

Note 2: For incident radiation at angles $> \alpha/2$, but $\leq \alpha'/2$, the photosensitive surface is partially illuminated.

Hybrid PIN Receiver Module

Information

Excelitas Technologies' Hybrid PIN Receiver Module HPR-1100BGH provides high output signals at highest signal-to-noise-ratio (SNR). Specially designed with integrated components as a J-FET operational amplifier and our high-speed Silicon PIN Photodiode it is well suited for systems where weak signals with a high gain need to be amplified at low-bandwidth.

Recognizing that different applications have different performance requirements, Excelitas offers a wide range of customization of these photodiodes to meet your design challenges. Responsivity and noise screening, custom device testing, TEC cooled devices and incorporating band pass filters are among many of the application-specific solutions available.

Storage and handling

Excelitas highly recommends to follow the below notes:

- Keep devices in an ESD controlled environment until final assembly.
- Keep package trays closed until final assembly.
- Remove Devices from their trays by using a vacuum pick-up tool (if applicable)
- If a manual picking method is necessary, use a vacuum pick or non-metallic tweezer.
- Do not make contact to the window surface

Testing methods

Excelitas verifies the electro optical specifications on every device. Visual inspection during fabrication is performed as per our quality standard and failed devices are removed.

Excelitas Technologies is certified to meet ISO-9001 and the photodiode are designed to meet MIL-STD-883 and/or MIL-STD-750 specifications.

Packaging and shipping

All Hybrid PIN Receivers are shipped in ESD safe plastic trays.

HPR Series – HPR-1100BGH

Hybrid PIN Receiver Module

RoHS Compliance

This series of Hybrid PIN Receivers modules are designed and built to be fully compliant with the European Union Directive on restrictions of the use of certain hazardous substances in electrical and electronic equipment.



Warranty

A standard 12-month warranty following shipment applies. Any warranty is null and void if the photodiode window has been opened.

About Excelitas Technologies

Excelitas Technologies is a global technology leader focused on delivering innovative, customized solutions to meet the lighting, detection and other high-performance technology needs of OEM customers.

Excelitas has a long and rich history of serving our OEM customer base with optoelectronic sensors and modules for more than 45 years beginning with PerkinElmer, EG&G, and RCA. The constant throughout has been our innovation and commitment to delivering the highest quality solutions to our customers worldwide.

From aerospace and defense to analytical instrumentation, clinical diagnostics, medical, industrial, and safety and security applications, Excelitas Technologies is committed to enabling our customers' success in their specialty end-markets. Excelitas Technologies has approximately 7,000 employees in North America, Europe and Asia, serving customers across the world.

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