

## Product Specification

4.25Gbps 1310nm PIN + Preamp, LC ROSA

### HFD3141-203

#### PRODUCT FEATURES

- LC ROSA
- High performance InGaAs PIN photodiode with separate transimpedance amplifier
- Low electrical parasitic TO46 package
- Data rates from 155Mbps to 4.25Gbps
- A separate detector bias pin which can be used for receive power monitoring
- Low bias currents and voltages



The HFD3141-203 use a high-performance InGaAs PIN photo-detector packaged with a transimpedance amplifier designed to meet performance requirements for data rates up to 4.25Gbps data communication over single-mode optical fiber at 1200nm to 1600nm. Applications include Ethernet, Fiber Channel and ATM protocols. The PIN is RoHS compliant per Directive 2011/65/EU<sup>1</sup>.

#### PRODUCT SELECTION

Part Number	Description
HFD3141-203	LW 5 pin LC ROSA, with separate PD bias for RSSI

## I. Absolute Maximum Ratings

Parameter	Rating
Storage Temperature	-40 to +85°C
Case Operating Temperature	-40 to +85°C
Lead Solder Temperature	260°C, 10 sec.
Power Supply Voltage	-0.5V to 4V
Incident Optical Power	+3 dBm average, +6 dBm peak
ESD Exposure (Human Body Model)	225V <sup>1</sup>

<sup>1</sup>Heel and wrist straps must be used on a properly grounded workstation

### Notice

Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operations section for extended periods of time may affect reliability.

### Notice

The inherent design of this component causes it to be sensitive to electrostatic discharge (ESD). To prevent ESD-induced damage and/or degradation to equipment, take normal ESD precautions when handling this product

## II. Electro-Optical Characteristics

Parameters	Test Condition	Symbol	Min.	Typ.	Max.	Units	Notes
Data Rate		DR	0.15		4.25	Gbps	
Supply Voltage			3.0	3.3	3.6	V	
Supply Current	$P_R = 0\mu\text{W}$ , $R_L = 50\Omega$ AC coupled	$I_{CC}$		30	45	mA	1
Optical Return Loss	$P_R = -12\text{dBm}$	ORL	12			dB	1
Input Optical Wavelength		$\lambda_P$	1200	1310	1600	nm	
Maximum Input Power before Overload		$P_{MAX}$	-3.0	0		dBm	
Differential Output Voltage Swing	$P_{R,OMA} = -12\text{Bm}$ , AC Coupled to $R_L = 50\Omega$	$V_{o(pk-pk)}$	150	225	350	mV	1,2
Differential Responsivity	$P_{R,OMA} = -12\text{dBm}$ , AC Coupled to $R_L = 50\Omega$	R	2250	3750	5250	V/W	1,2
-3dB Optical/Electrical Bandwidth	$P_{R,OMA} = -12\text{dBm}$	BW	2		4	GHz	1,2,3
Low Frequency -3dB Cutoff	$P_{R,OMA} = -12\text{dBm}$	$BW_{LF}$			10	KHz	1,2,3
Output Impedance		$Z_{OUT}$	42	50	58	$\Omega$	
Output Return Loss	$F < 3\text{GHz}$	$S_{22}$	8	12		dB	
RMS Input Referred Noise Equivalent Power	3.2GHz, 4-pole BT Filter, $P_R = 0\mu\text{W}$ (Dark), BER $10^{-12}$	NEP			20	$\mu\text{W}$ , OMA	4
Sensitivity, OMA	DR = 1.0625, 1.25Gbps	S		-23	-20	dBm	5
	DR = 2.125, 2.5Gbps			-23	-20		
	DR = 3.125Gbps			-21	-18		
	DR = 4.25Gbps			-18	-16		
Rise/Fall Time	$P_{R,OMA} = -12\text{dBm}$ , (20%-80%)	$T_R/T_F$		80	120	ps	2,7
Pulse Width Distortion		PWD			5	%	
Power Supply Rejection Ratio	$P_R = 0\mu\text{W}$ (Dark), $5\text{MHz} < F < 2\text{GHz}$	PSRR	20			dB	1,8
Monitor Current Slope	$P_R = -12\text{dBm}$	$I_{MON}$	0.7	0.8	0.95	A/W	9
Monitor Current Offset	$P_R = 0\text{mW}$	$I_{OFFSET}$			10	nA	
PD Bias Voltage		$PD_{BIAS}$	2.5	$V_{CC}$	$V_{CC} + 0.5$	V	13
Group Delay	$P_{R,OMA} = -12\text{dBm}$ , AC Coupled to $R_L = 50\Omega$ $2\text{MHz} < F < 2\text{GHz}$	Delay	-50		50	ps	10
Deterministic Jitter	$P_{R,OMA} = -12\text{dBm}$ , AC Coupled to $R_L = 50\Omega$	$DJ_{TIA}$		30	40	ps	11
Random Jitter	$P_{R,OMA} = -12\text{dBm}$ , AC Coupled to $R_L = 50\Omega$	$RJ_{TIA}$		3	5	ps	12

### Notes:

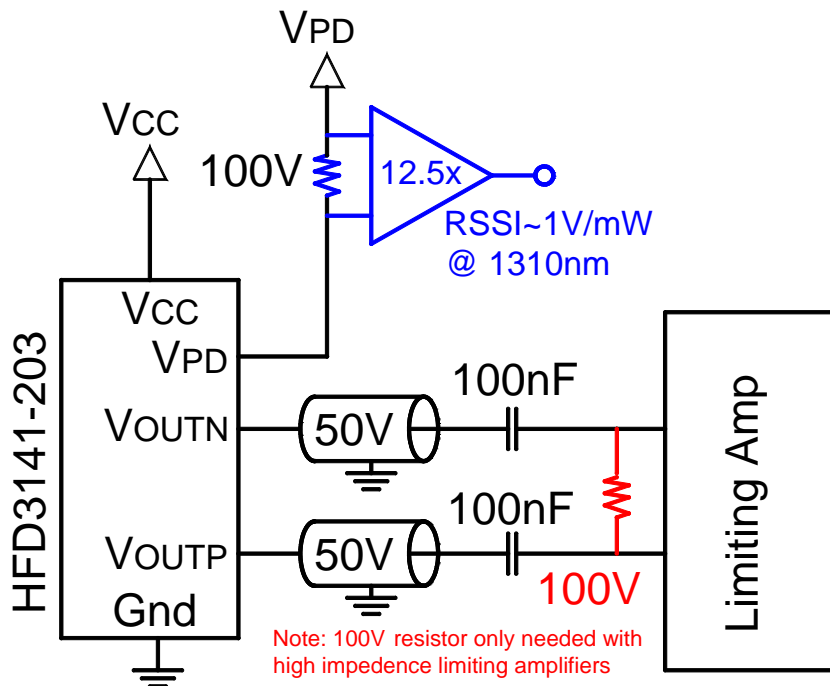
- $P_R$  is the average optical power at the fiber face.
- $P_{R,OMA}$  is the peak to peak optical power at the fiber face (Optical Modulation Amplitude)

$$P_{R,OMA} \equiv \frac{2P_R(ER-1)}{ER+1} \text{ where } ER \text{ is the extinction ratio (linear) of the optical source.}$$

- Bandwidth and Low Frequency Cutoff are measured with a small signal sinusoidal light source with -12dBm average power
- RMS input referred optical noise equivalent power is obtained by measuring the RMS output noise into a 3200 MHz, 4-pole Bessel-Thompson filter then dividing by the responsivity. A scaling factor of 14 is used to predict a BER of  $10^{-12}$ .
- Sensitivity is measured with an optical source with an extinction ratio of 3dB.

6. Stressed receiver sensitivity is measured with 3.5dB vertical eye closure (intersymbol interference) and with 0.3UI of jitter added. The measurement technique is defined in IEEE 802.3ae.
7. Rise/Fall times are corrected for optical source Rise/Fall times.  $T_{TIA}^2 = T_{MEASURED}^2 - T_{OPTICAL}^2$
8. Value shown is with no external power supply filtering.
9. The monitor current slope is measured as the current into the PD<sub>BIAS</sub> connection.
10. Group delay is a sensitive measurement to package interface, and includes the effects of PD, TIA and package. Measurement is made with TO leads as short as possible.
11. DJ<sub>TIA</sub> is specified as contributed DJ by the TIA, obtained from  $DJ_{TIA}^2 = DJ_{TOTAL}^2 - DJ_{OPTICAL}^2$
12. RJ<sub>TIA</sub> is specified as contributed DJ by the TIA, obtained from  $RJ_{TIA}^2 = RJ_{TOTAL}^2 - RJ_{OPTICAL}^2$
13. If external bias voltage is applied to Vpd while Vcc is externally unbiased, internal biasing of the TIA will occur, resulting in erroneous RSSI current.

### III. Interface Connection

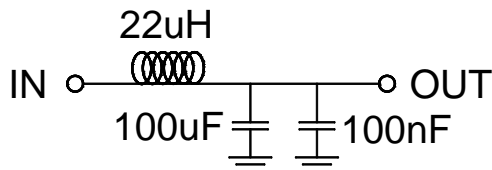


Optional RSSI implementation is shown in blue.

Optional 100Ω differential termination for high impedance limiting amplifiers is shown in red.

#### Recommended bias filter network

Note, better performance will be obtained if a ferrite bead is used in place of the inductor.

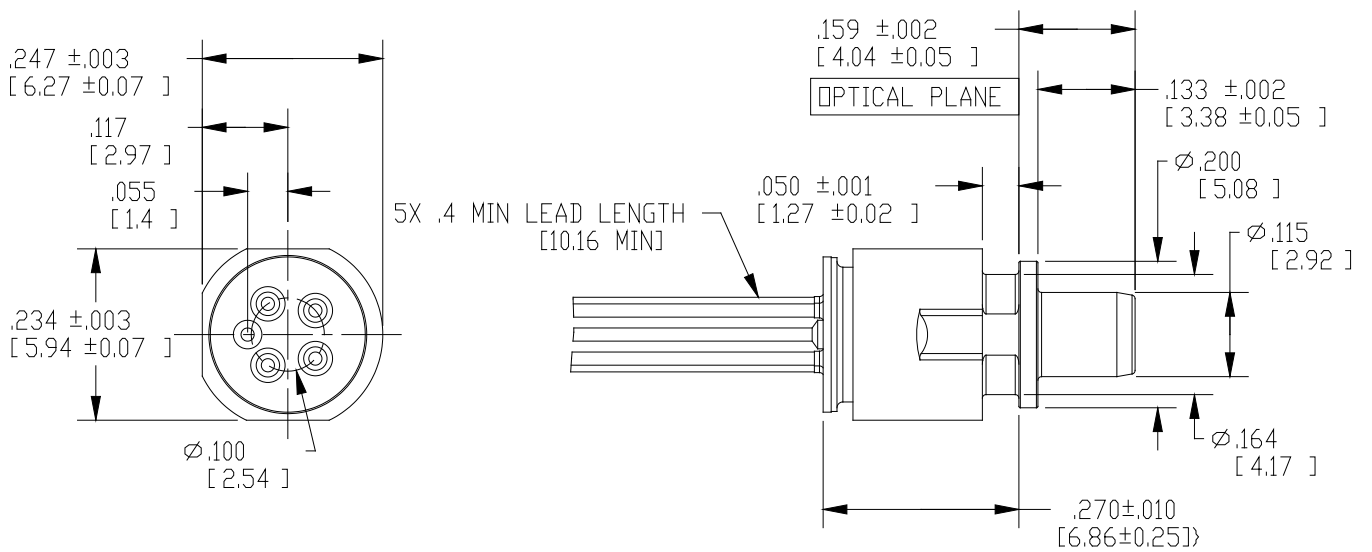


### IV. Environmental Specifications

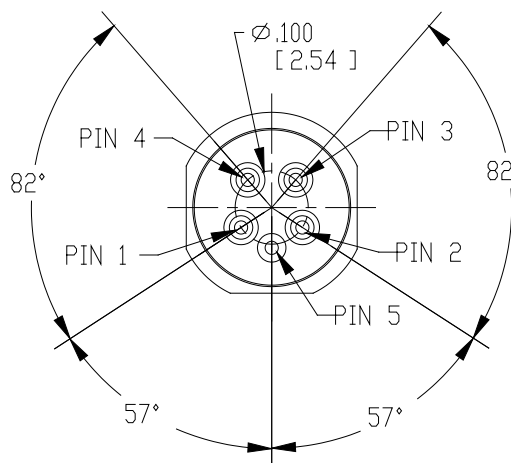
Parameter	Symbol	Min	Typ	Max	Units	Ref.
Case Operating Temperature	T <sub>op</sub>	-40		85	°C	
Storage Temperature	T <sub>sto</sub>	-40		85	°C	

### V. Mechanical Specifications

(dimensions are in mm)



PIN #	FUNCTION
1	VOUT+
2	VOUT-
3	VPD
4	VCC
5	GND (CASE)



**VI. References**

1. Directive 2011/65/EU of the European Parliament and of the Council, “on the restriction of the use of certain hazardous substances in electrical and electronic equipment”. Certain products may use one or more exemption as allowed by the Directive.

**VII. Revision History**

Revision	Date	Description
A1	4/26/2013	Document created.
B1	10/20/2015	Updated logo and RoHS statement.

**VIII. For More Information**

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