Data Sheet
March 2019

High Speed Uncooled 2.2 Micron Wavelength InGaAs PIN-TIA Optical Receivers to 6 GHz

Description:

The 2.2 micron cutoff, uncooled, DSC-R202 is a linear and versatile PIN + transimpedance amplifier suited for a variety of upcoming applications at 2.05 micron wavelength. The R202 offers a linear response to > 0 dBm optical input, 1.8Vp-p of linear output voltage, +10dBm of RF output power, up to 6 GHz of RF bandwidth and a conversion gain of 400 V/W at 2.05 micron. The R202 is available in both a K or SMA-connector package, and a miniature surface mount package with CPW (coplanar waveguide) RF output, as well as Lab Buddy O/E Instrument.

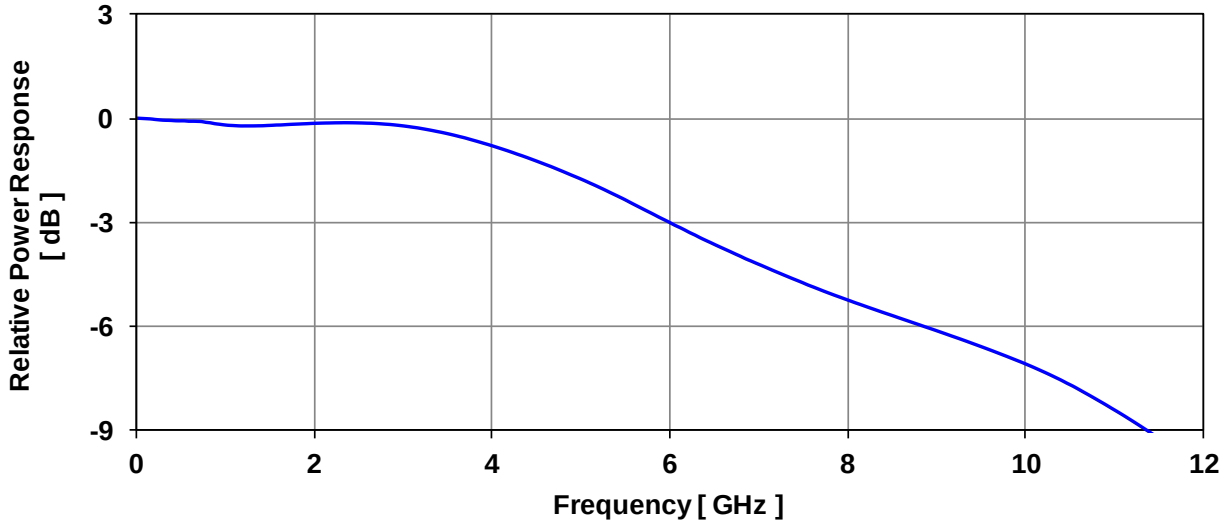
Salient Features:

- Up to 6 GHz RF bandwidth
- Linear gain to > 0 dBm optical input
- Linear output voltage of 1.8Vp-p
- Useable spectral wavelength 1200 - 2200 nm
- Low optical PDL (typically 0.05dB)
- K or SMA connector, or surface mount package options

Applications:

- Fiber Laser Systems at 2.05 Micron
- High Dynamic Range, Analog RF Links over Fiber
- Rapid Doppler-Shift LIDAR Measurements
- Coherent Lightwave Systems
- Ideal Front-End O/E Converter for Test Instruments
- Environmental Sensing
- Time Resolved Spectroscopy
- Free Space Communications

Typical Frequency Response



Electrical / Optical Specifications:

{Conditions unless otherwise noted : $T_{AMBIENT}$ = 25°C, V_{bd} = +10V, V_{dd} = +8V}

Parameter		Min	Typical	Max	Units
Bandwidth (-3 dB)		5.0	6.0	-	GHz
Responsivity	@ 1550 nm	0.7	0.9	-	A / W
	@ 2050 nm	0.8	1.2	-	A / W
Wavelength Response Range at 25°C		1200	-	2200	nm
Optical Sensitivity (5Gb/s, 2^{31}-1 PRBS, BER 10^{-12})	@ 1550 nm 13dB Ext. Ratio	-19	-21	-	dBm
	@ 2050 nm 10dB Ext. Ratio	-20	-22	-	dBm
Noise Equivalent Power (NEP) @ 2050 nm, 300 K		-	10	-	pW/√Hz
Optical Overload (BER < 10^{-12}) (1)		-	+ 4	-	dBm
Input Linear Range (1) (2)		-	+ 1	-	dBm
Output 3rd Order Intercept Point (OIP3)		+ 30	+ 35	+ 40	dBm
Power Gain of Amplifier		-	20	-	dB
Transimpedance		400	500	650	Ω
Conversion Gain at 2050 nm (3)		320	550	-	V/W
Low Frequency Cut-off (AC coupled)		-	30	-	KHz
Gain Flatness (Relative to mean)(4)		-	± 0.75	-	dB
Group Delay (4)		-	± 10	-	ps
Input Noise Density @ 300 K		-	12	16	pA / √Hz
Noise Figure		-	3	-	dB
Electrical Return Loss		-	- 10	-	dB
Optical Return Loss @ 1550 nm		27	30	-	dB
Optical PDL @ 1550 nm (5)		-	0.05	0.12	dB
V_{bd} Bias (Photodiode)		+ 7	+ 10	+ 11	V
V_{dd} Bias (Amplifier)		+ 7.5	+ 8	+ 8.4	V
Power Dissipation		710	800	925	mW
Logic Sense		-	Non-inverting	-	-

Absolute Maximum Ratings:

Operating Temperature Range (6)	0 to + 70	°C
Storage Temperature Range	- 40 to + 85	°C
Photodiode Bias V_{bd}	+ 12	V
Amplifier Bias V_{dd}	+ 8.4	V
Optical Input Power Damage Threshold (1)	+ 6	dBm Peak
Lead Soldering Temperature (10 s)	250	°C

(1) Assumes 50% duty cycle.
(2) At 1dB gain compression.
(3) Measured with 5 Gb/s eye diagram at -3 dBm average optical power.
(4) Flatness & group delay are measured from DC to 70% of –3 dB bandwidth.
(5) Optical PDL is measured by scanning all states of polarization.
(6) Heat Sink Required.

Female K-Connector Version:

Operating Procedure:

Always follow these steps:

1. **Connect ground first**
2. **Use current-limited power supplies**
3. **Apply stabilized bias: V_{bd} then V_{dd}**
4. **Then apply optical power.**

Always shutdown with these steps:

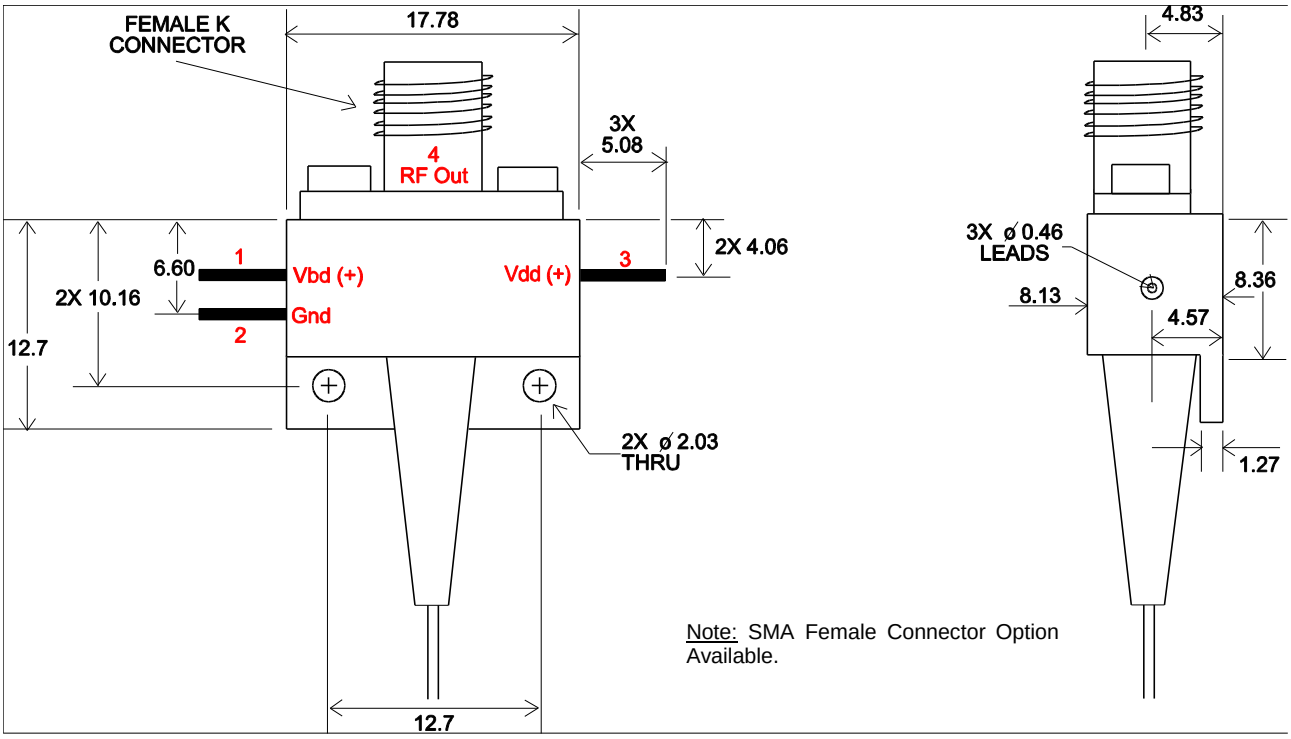
1. **Remove optical power before removing bias**
2. **Power down V_{dd} first and then V_{bd}**
3. **Disconnect device.**

Pin Connections (Observe Polarities):

1.	Bias Voltage Photodiode V_{bd}
2.	Case Ground - Gnd
3.	Bias Voltage Amplifier V_{dd}
4.	RF Signal Out (std: AC coupled, opt: DC coupled)

Dimensioned Outline Drawing:

{Dimensions are in mm}



Note: SMA Female Connector Option Available.

***Note:**

The R202AC has an AC coupled RF output via an internal capacitor. This is to isolate the approximate +4V DC operating point from the external circuitry. This AC coupled version can easily drive a 50Ω terminated load and provide the peak to peak output voltage as shown in the "Linearity vs Optical Input Power" plot on page 6. The -3 dB low frequency cut off is normally below 50KHz.

The R202DC (assembled without any internal coupling capacitor) can directly drive a high impedance load, for example a 1 MΩ input to an oscilloscope. Load impedance down to 1 kΩ could be driven directly with minimal effect on performance.

The model R202DC normally requires an external DC block to drive a 50Ω load. If an R202DC is terminated into a 50Ω load without a DC block, the normal operating point will be disturbed and will result in high distortion.

Surface Mount Version:

Operating Procedure:

Always follow these steps:

1. **Connect ground first**
2. **Use current-limited power supplies**
3. **Apply stabilized bias: V_{bd} then V_{dd},**
4. **Then apply optical power.**

Always shutdown with these steps:

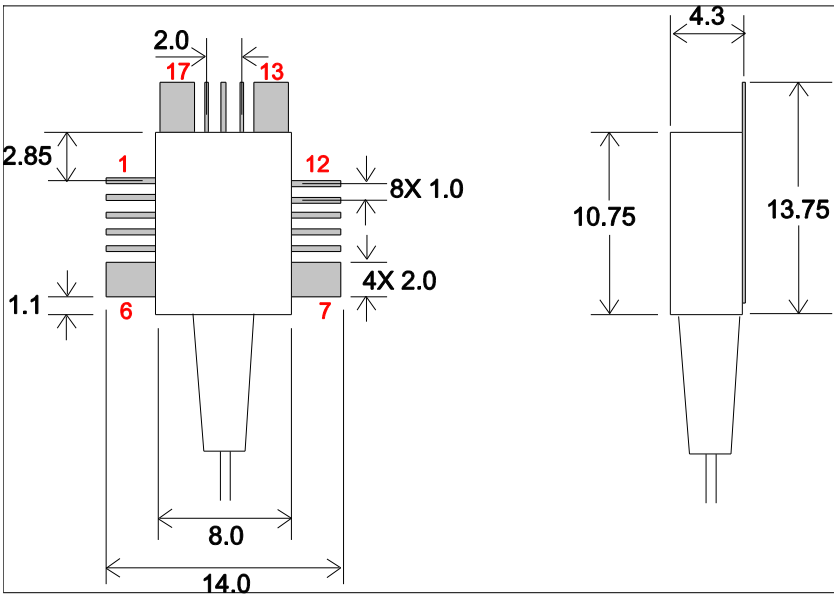
1. **Remove optical power before removing bias**
2. **Power down V_{dd} first and then V_{bd}**
3. **Disconnect device.**

Pin Connections (Observe Polarities):

1.	Case Ground - Gnd
2.	No Connection
3.	No Connection
4.	No Connection
5.	Bias Voltage Amplifier V_{dd}
6.	Case Ground - Gnd
7.	Case Ground - Gnd
8.	Bias Voltage Photodiode V_{bd}
9.	No Connection
10.	No Connection
11.	No Connection
12.	Case Ground - Gnd
13.	Case Ground - Gnd
14.	Case Ground - Gnd
15.	Case Ground - Gnd
16.	RF Signal Out (std: AC Coupled, opt: DC Coupled)
17.	Case Ground - Gnd

Dimensioned Outline Drawing:

{Dimensions are in mm}



Optical Input:

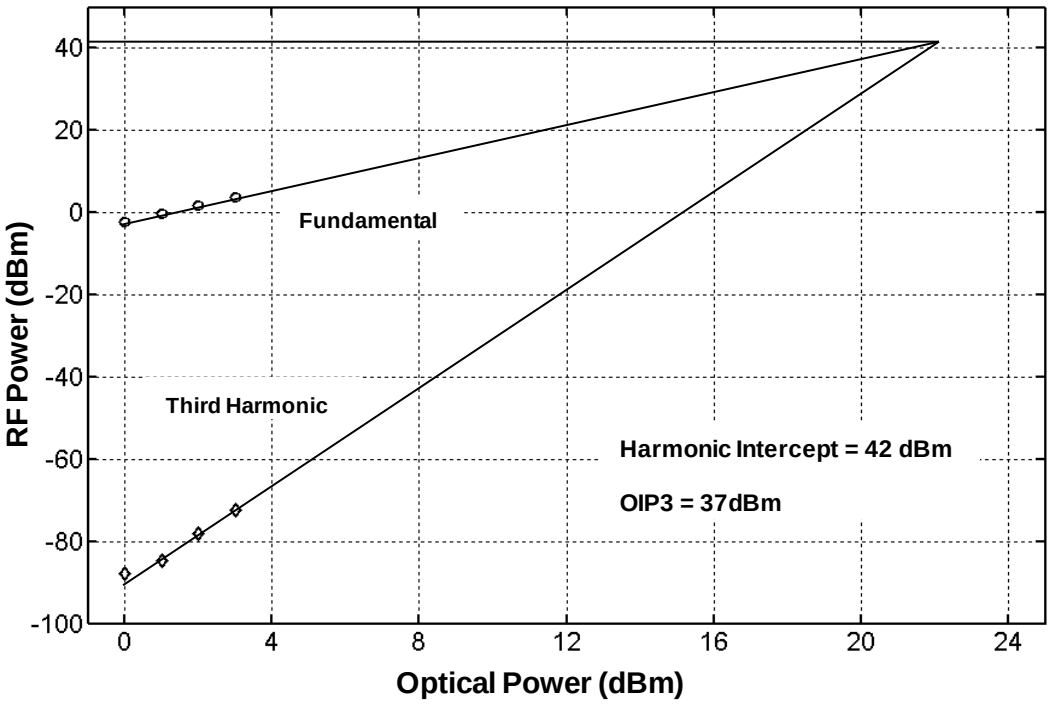
Connector	Polish	Fiber	Buffer	Length
FC,SC or LC	PC, UPC or APC	SMF28 or PM	900 μm (std)	1 meter typical
FC	PC, UPC	50/125 μm MM		
FC	PC, UPC	62.5/125 μm MM		

Electrical Output:

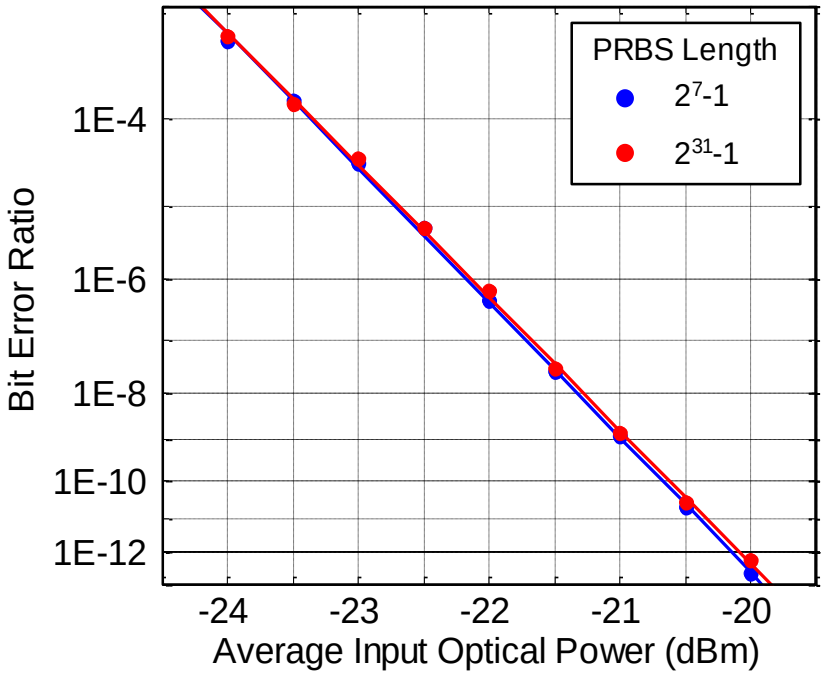
Model	Coupling	Standard	Option
DSC-R202	AC	"K" or SMA type female coax connector "CPW" Coplanar waveguide output in surface mount package.	"KM" [+] type male coaxial (extra cost)
DSC-R202DC*	DC		

[+] K type RF connector is a trademark of Anritsu Company with barrel diameter of 2.92 mm RF (compatible with 3.5 mm SMA).

Typical Third Order Harmonic Intercept

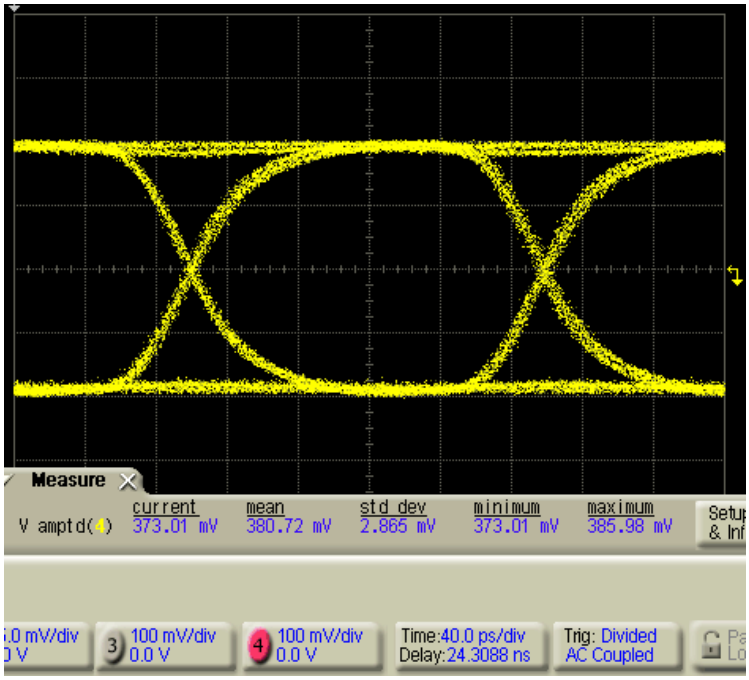


Typical 5 Gb/s BER Curves at 1550 nm



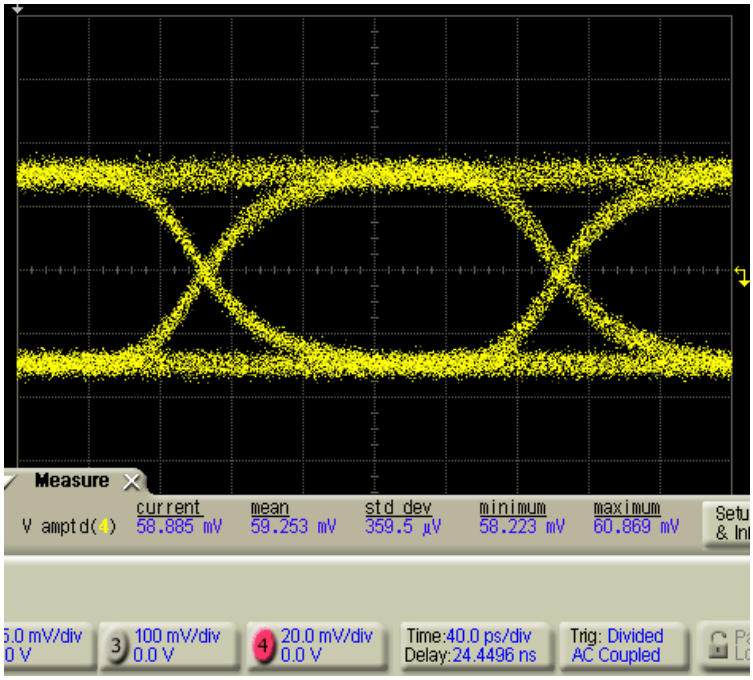
5 Gb/s Eye Diagram at 1550 nm

{SMF externally modulated transmitter with 100% modulation, -3dBm average optical power, 2^{31}-1 PRBS}



5 Gb/s Eye Diagram at 2050 nm

{SMF externally modulated transmitter with 30% modulation, -7dBm average optical power, 2^{31}-1 PRBS}



Ordering Information:

Parts should be ordered as DSC-R202XX-YT-ZZ/UUU-Ψ-W where the code characters:

XX specifies coupling option (AC or DC),
Y is '3' for standard optical return loss single mode fiber optimized at 1550 nm, '4' for single mode fiber optimized at 2050 nm, '5' for >40 dB ORL, '6' for 50 um multimode fiber, '7' for 62.5 um multimode fiber, '8' for PM fiber at 1550 nm, '9' for PM fiber at 2050 nm.
T "3" for 3 mm and "9" for 0.9 mm diameter buffer (standard),
ZZ specifies the fiber optic connector (FC, SC, LC),
UUU specifies the ferrule finish (APC, UPC),
Ψ specifies the female 'K' or SMA coaxial output, or 'CPW' for coplanar waveguide output in surface mount package, (KM for male connector option),
W '1' specifies 3 pin K or SMA connector package or surface mount package , '2' specifies Lab Buddy as shown.

Lab Buddy:

"Lab Buddy" is a versatile O/E Converter Instrument as shown.

- Height: 1.75 in.
- Width: 3.125 in.
- Length: 5.25 in.
- Weight: 0.6 lb.

- 110/220V Plug-in
- Eliminates accidental damage and biasing errors
- Saves up to 3 power supplies
- Robust and compact

Notice:
This product is EU directive 2015/863 (RoHS) compliant, with exemptions.

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