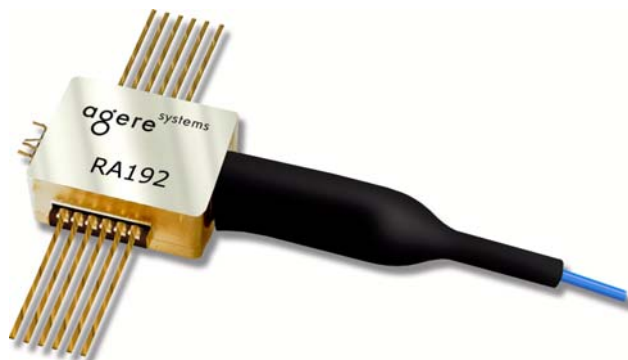


RA192 OC-192/STM-64 APD Lightwave Receiver



Featuring improved sensitivity for optimum performance in noisy, amplified systems, the RA192 Receiver is manufactured in a compact, 16-pin butterfly package (above), and is also available with a convenient mounting bracket (below).



Features

- High data rate capability, 10 Gbits/s
- APD photodetector
- Fully operational through the 1.3 μm to 1.6 μm wavelength range
- Typical sensitivity of -26 dBm, overload of -2 dBm
- Excellent group-delay performance for DWDM applications
- Single-mode fiber pigtail with SC, FC, LC, or MU optical connector
- Operating case temperature range: 0 $^{\circ}\text{C}$ to 70 $^{\circ}\text{C}$
- 50 Ω differential data output, with offset control
- Package options:
 - Space-sensitive package without mounting bracket (ideal for transponder and transceiver applications)
 - With mounting bracket

Applications

- Line terminal equipment
- High-speed networks up to 10 Gbits/s
- SONET/SDH OC-192/STM-64 telecommunications applications
- Extended-reach datacom and telecom applications

Description

Receiver Operation

The RA192 10 Gbits/s fiber-optic receiver consists of a high-speed APD photodetector and a wide-band linear preamp in a pigtailed, butterfly metal package. The fiber pigtail is internally beveled for low return loss and is available with SC, FC, LC, or MU optical connectors. It is designed for use in single-mode, high-speed telecommunication applications at the SONET OC-192 and the ITU-T SDH STM-64 data rate of 9.95328 Gb/s.

At 9.95328 Gbits/s, the typical room temperature sensitivity at a BER of 1×10^{-10} is -26 dBm, and the typical room temperature overload at a BER of 1×10^{-10} is -2 dBm. The operating case temperature range for the receiver is 0 °C to 70 °C.

The dc levels of the differential outputs can be adjusted relative to each other for optimum sensitivity in noisy, amplified systems. These outputs are centered around a dc level of typically -0.45 V when the two outputs are dc-coupled to 50Ω loads. The two outputs can also be ac coupled. If slice level control is not needed, the FBIN pin (pin 14) should be left open. The TIA requires only a -5.2 V power supply for operation. The APD photodiode requires a nominal bias voltage of 25 V to 36 V at less than 1 mA.

Pin Information

Table 1. Pin Descriptions

Pin Number	Name
1	APD Bias
2	GND
3	VEE
4	NC
5	NC
6	NC
7	GND
8	DATA
9	DATA
10	GND
11	NC
12	-OFF
13	+OFF
14	Feedback Input Threshold Control
15	GND
16	Thermistor

Electrical Schematic

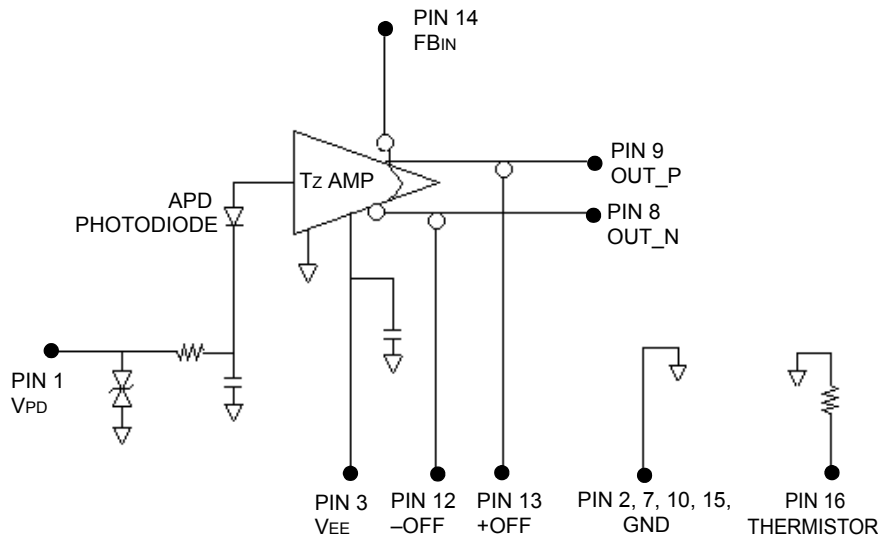


Figure 1. Electrical Schematic

Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operations section of the data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect device reliability.

Parameter	Symbol	Min	Max	Unit
Supply Voltages: Negative Supply	VEE	-4.7	-5.7	V
Photodiode Supply Current: Forward*	—	—	TBD	mA
Reverse	—	—	TBD	mA
APD Bias Voltage	VAPD	GND	VBR	V
Optical Input Power (biased)	P _{MAX}	—	0	dBm
Operating Case Temperature Range	T _C	0	70	°C
Storage Temperature Range	T _{stg}	-40	85	°C
Lead Soldering Temperature	—	—	250	°C
Lead Soldering Time	—	—	10	s

* Device is normally reverse biased. Forward biasing the photodiode can compromise device performance and reliability.

Optical Characteristics

Table 2. Optical Characteristics (T_C = 25 °C, λ = 1550 nm, V_{EE} = -5.2 V unless otherwise specified)

Parameter	Symbol	Min	Typ	Max	Unit
Optical Wavelength	λ	1.3	—	1.61	μm
Sensitivity (9.953 Gbits/s, 2 ³¹ - 1 PRBS, 1 x 10 ⁻¹⁰ BER, ER = 12 dB, NRZ, V _{APD} = V _{OP}): 25 °C 0 °C to 70°C	P _{LOW}	— —	-26.0 -25.5	-25.5 -25.0	dBm dBm
Overload (9.953 Gbits/s, 2 ³¹ - 1 PRBS, 1 x 10 ⁻¹⁰ BER, ER = 12 dB, NRZ): 25 °C 0 °C to 70°C	P _{HIGH}	-2 -3	— —	— —	dBm dBm
Optical Return Loss	RL	—	—	-27	dB
Responsivity (M = 1): λ = 1.55 μm λ = 1.3 to 1.61 μm	R	0.65 0.59	0.8 —	— —	A/W A/W
Total Dark Current (V _{APD} = V _{OP})	I _D	—	100	200	nA

Electrical Characteristics

Table 3. Electrical Characteristics ($T_C = 25\text{ }^\circ\text{C}$, $\lambda = 1550\text{ nm}$, $V_{EE} = -5.2\text{ V}$ unless otherwise specified)

Parameter	Symbol	Min	Typ	Max	Unit
dc Power Supply Voltages: Negative Supply	V_{EE}	-4.94	-5.2	-5.46	V
dc Power Supply Currents: Negative Supply	I_{EE}	—	140	155	mA
Power Dissipation	P_{DISS}	—	—	0.85	W
APD Bias Voltage ¹ : 25 °C 0 °C to 70 °C	V_{OP}	25 22	33 —	40 44	V
APD Breakdown Voltage: 25 °C 0 °C to 70 °C	V_{BR}	28 25	— —	43 47	V
Temperature Coefficient of V_{OP} and V_{BR}		0.05	0.06	0.07	V/°C
Thermistor Resistance at 25 °C ²	R_{TH}	9.5	10	10.5	kΩ
Transimpedance (Single-ended, -26 dBm optical input power)	Z_T	1	1.4	1.8	kΩ
Output Voltage (Single-ended, $V_{APD} = V_{OP}$, 9.953 Gbits/s, -26 dBm)	V_{SENS}	—	40	—	mVp-p
Output Voltage (Single-ended, $V_{APD} = V_{OP}$, 9.953 Gbits/s, -2 dBm)	$V_{OVERLOAD}$	600	800	1000	mVp-p
3 dB Bandwidth ($V_{APD} = V_{OP}$, -20 dBm)	BW	8.0	8.8	—	GHz
Peaking (0.13 GHz—10 GHz, $V_{APD} = V_{OP}$, -20 dBm)	—	—	0	1	dB
Group Delay Deviation (0.13 GHz—10 GHz, $V_{APD} = V_{OP}$, -20 dBm)	GD	—	—	50	ps _{p-p}
Output Return Loss (0.13 GHz—10 GHz, $V_{APD} = V_{OP}$, -20 dBm)	S_{22}	—	-14	-9	dB

1. APD optimum bias voltage (V_{OP}) differs from device to device and is provided with each device.

2. The resistance of the thermistor is inversely proportional to the temperature. The temperature can be calculated from the resistance value using the Steinhart-Hart equation: $1/T = A + B \ln(R) + C \ln(R)^3$; where T is the temperature in Kelvin degrees, R is the thermistor resistance value in Ohms, and A, B, and C are constants: $A = 1.0267 \times 10^{-3}$, $B = 2.565 \times 10^{-4}$, $C = -4.5421 \times 10^{-8}$.

Characteristic Curves

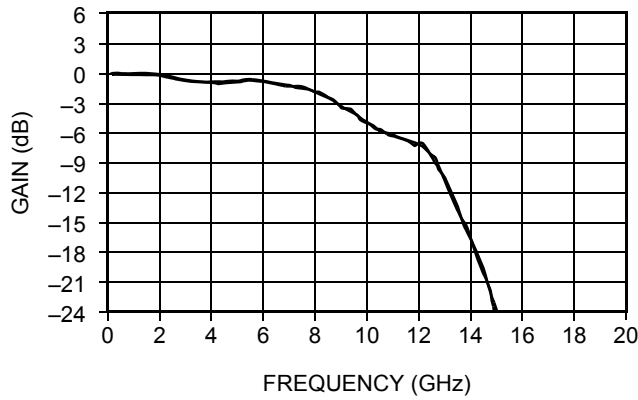


Figure 2. RA192 Typical Transfer Function

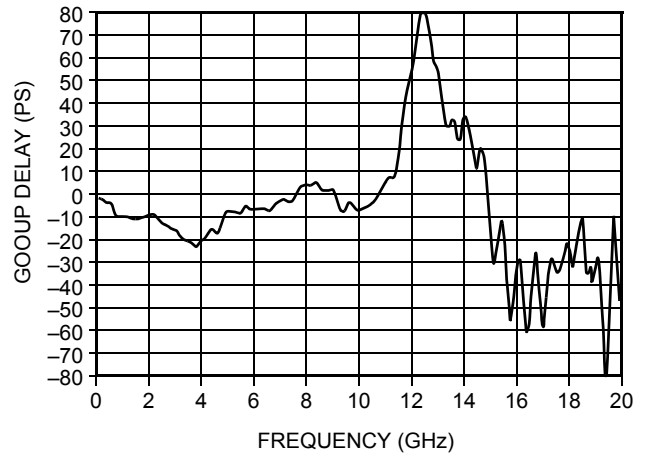


Figure 4. RA192 Typical Group Delay Deviation (5% Smoothing)

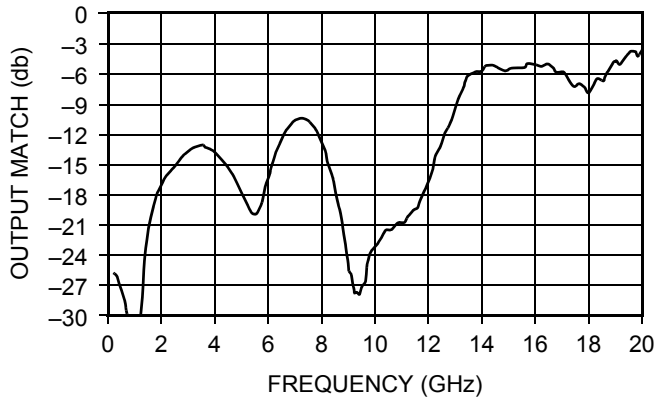


Figure 3. RA192 Typical Output Return Loss

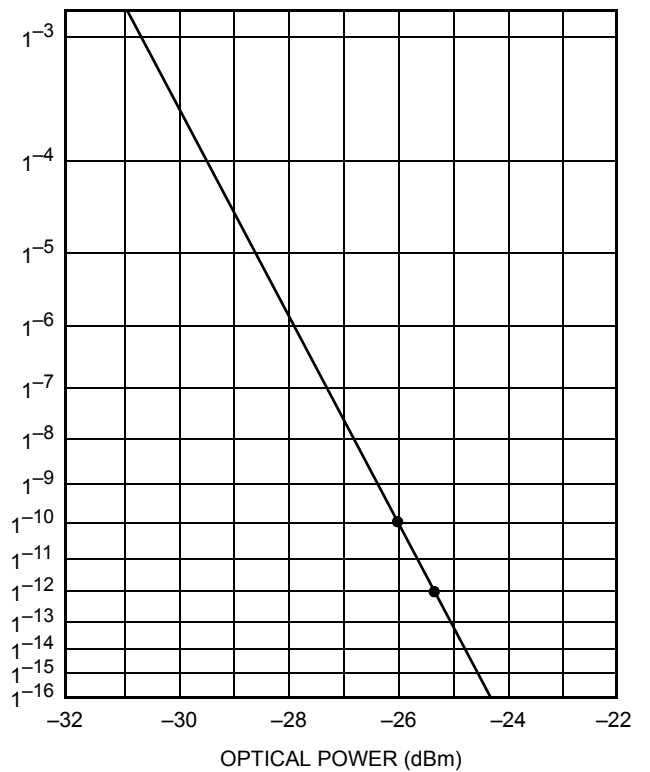


Figure 5. RA192 Typical BER CURVE

Characteristic Curves (continued)

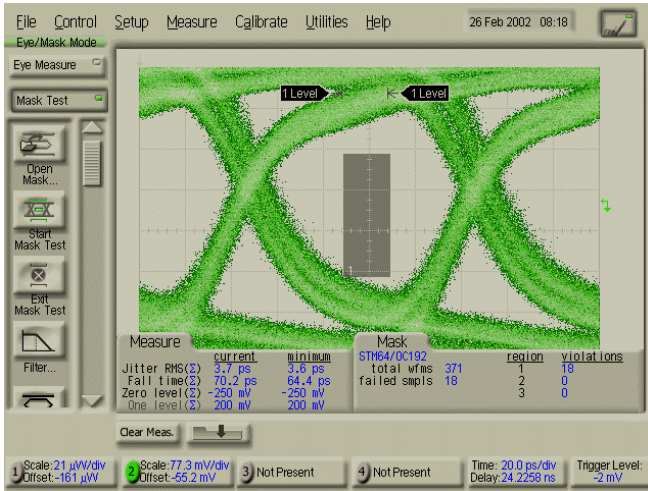


Figure 6. RA192 Eye Pattern at -1.4 dBm Input Power

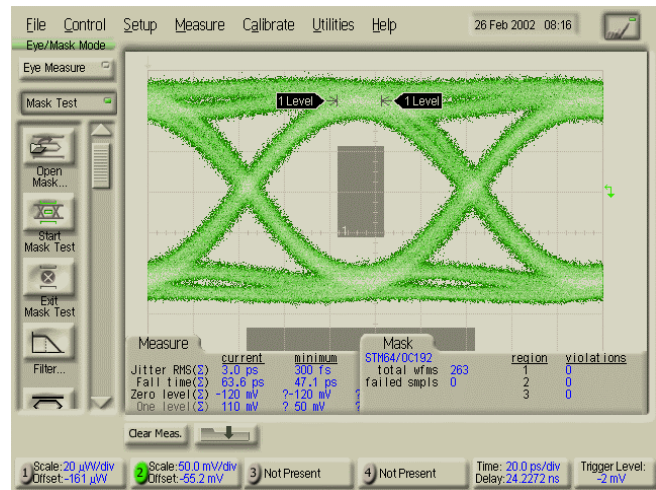


Figure 7. RA192 Eye Pattern at -15 dBm Input Power

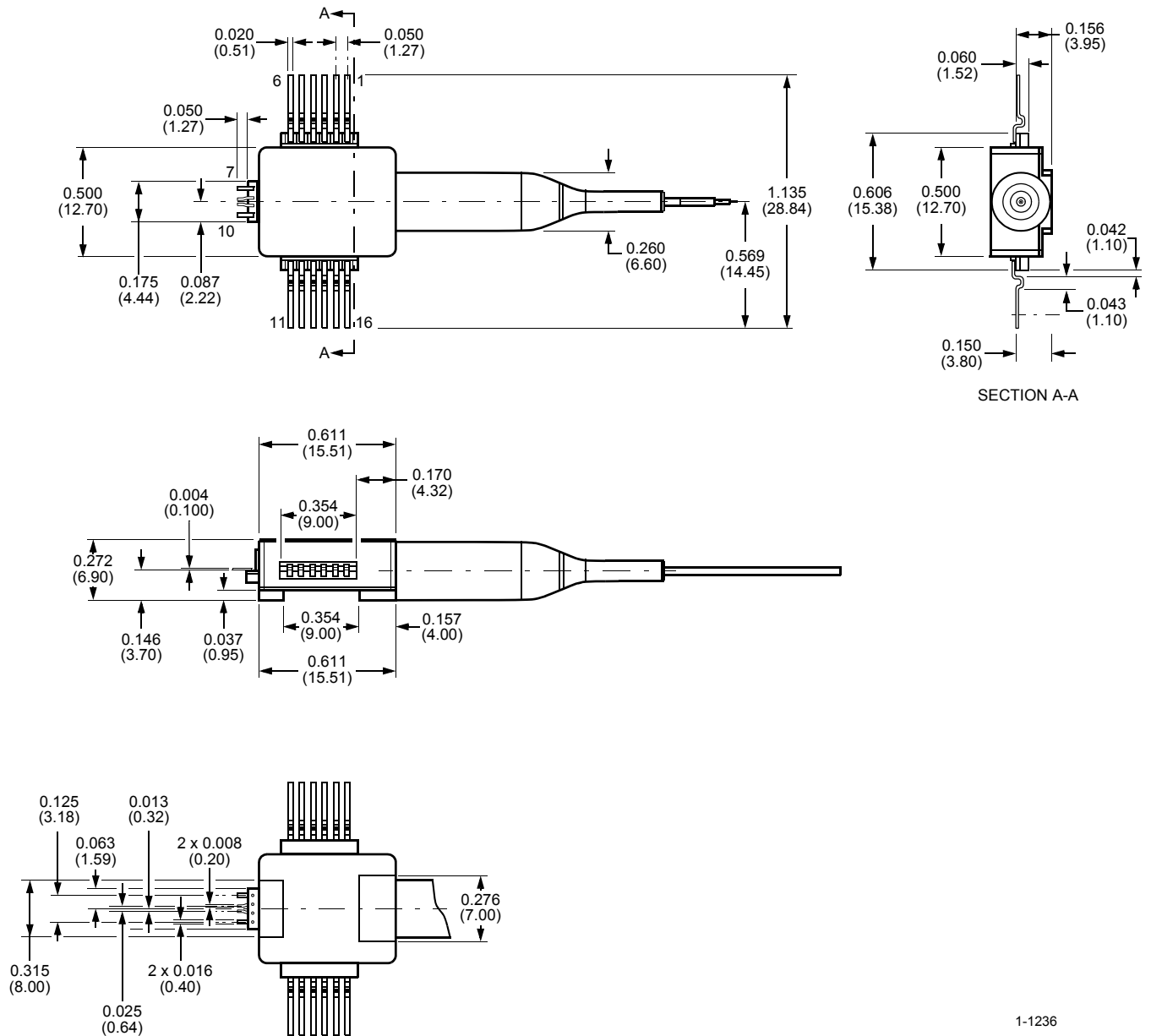


Figure 8. RA192 Eye Pattern at -26.2 dBm Input Power

Outline Diagrams (continued)

Outline Drawing, Package Style N

Dimensions are in inches and (millimeters).

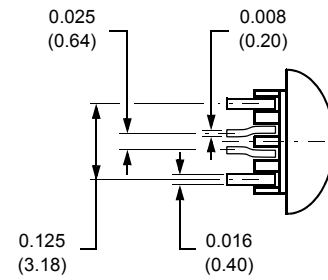
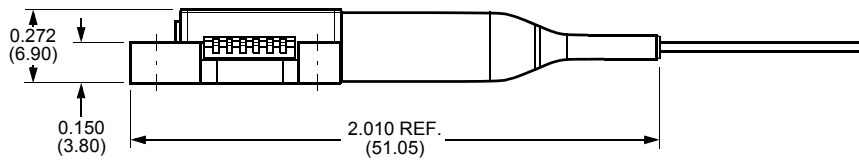
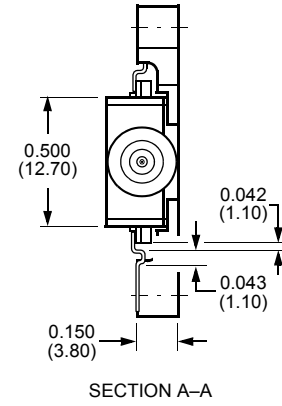
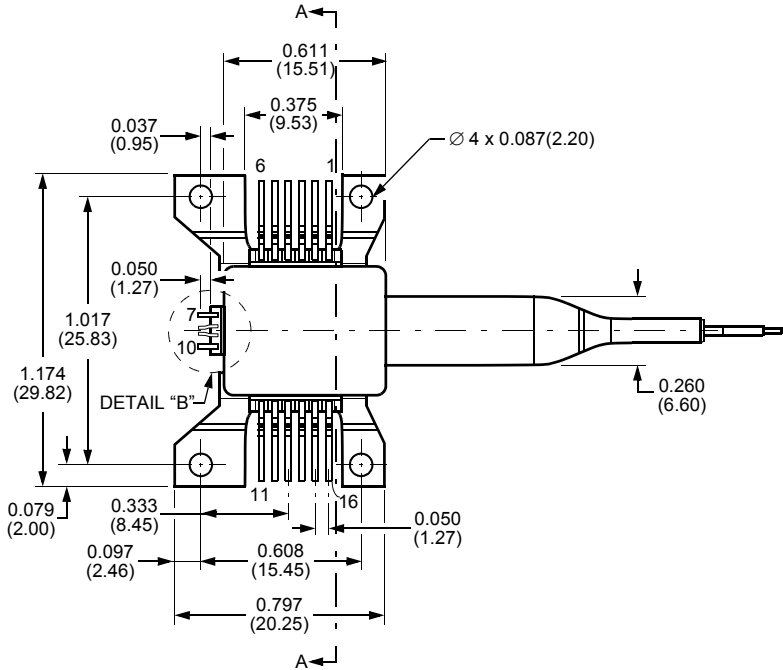


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Outline Diagrams

Outline Drawing, Package Style A

Dimensions are in inches and (millimeters).



1-1237

Ordering Information

Table 4. Ordering Information

Description	Product Code	Package Style	Connector	Comcode
RA192-Type OC-192/STM-64 APD Lightwave Receiver	RA192WDAA	A	SC	700022259
	RA192WGAA	A	FC	700022260
	RA192WSAA	A	LC	700022261
	RA192WYAA	A	MU	700022262
	RA192WDAN	N	SC	700022263
	RA192WGAN	N	FC	700022264
	RA192WSAN	N	LC	700022265
	RA192WYAN	N	MU	700022266

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