

Product Specification

R9300TH Hybrid Raman-EDFA, Dual Raman Pump

PN: FOA-R9300TH-HBR3C-AA001

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Customer: General

Product Features

- Integrated Raman and EDFA design with unified gain control
- Supports two 14xx nm Raman pumps and one 980 nm EDFA pump
- Variable gain operation 19-37dB
- Output power up to 21dBm
- Exceptionally low effective noise figure for all gain values
- Superior gain flatness for all fiber types, independent on fiber losses.
- Class 1M* laser Safety classification
- Automatic restart and shut-down mechanisms



Applications

- Extending metro, regional, LH and ULH WDM links
- System upgrade to coherent 100 Gb/s
- Link extension beyond 1000 km without adding 3R O-E-O sites
- Dynamic ROADMs networks

The Hybrid Raman-EDFA module enables cost-effective deployment of ultra-long haul networks as well as the extension of existing long-haul, regional and metro networks, without the need for 3R O-E-O regeneration. The Hybrid module consists of a counter-propagating Raman pump unit and a variable gain (VG) EDFA. These two elements are integrated to provide exceptionally low noise figure and excellent gain flatness – two imperative parameters for ultra-long haul systems.

The very low effective noise figure allows the link reach to be approximately doubled in comparison to a system based on traditional EDFAs. The Hybrid control circuitry operates in advanced AGC mode, in which the actual Raman gain is automatically measured and then complemented using the EDFA gain. The required total gain is therefore constantly maintained.

The module also incorporates laser safety mechanisms, ensuring that both the Hybrid Raman-EDFA module itself and the network in which it is installed can be classified as Class 1M* products with respect to laser safety (according to IEC 60825, and CDRH 21 CFR §1040.10).

Optical Specification

Parameters	Min	Typ.	Max	Unit	Notes
Number of Pump Lasers	3				2X for Raman, 1X for EDFA
Wavelength range	1528		1567.2	nm	
Overall Gain Range for G.652	19		37	dB	
Gain flattening at G=27-40 dB at G=24-27 dB at G=19-23 dB			1.3 1.3 1.5	dB	Measured around Least mean square curve.
Saturated output Power	20.5			dBm	
Input Power (Raman off)	-40		1.5	dBm	
Output Power	-2		20.5	dBm	
Tilt	-2.5		0	dB	
Pre-tilt	-0.7	-1	-1.3	dB	Accuracy of 0.5dB includes Raman and EDFA spectrum tilting.
NF at G=37dB G.652			-0.1	dB	Includes padding of 3dB
NF at G=33dB G.652			0.1	dB	
NF at G=30dB G.652			0.9	dB	
NF at G=27dB G.652			1.9	dB	
NF at G=25dB G.652			2.6	dB	
NF at G=23dB G.652			3.8	dB	
NF at G=21dB G.652			4.8	dB	
NF at G=19dB G.652			5.4	dB	
PDG+PDL			0.5	dB	
PMD			0.5	ps	
Optical return loss	45			dB	For all connectors
Insertion loss OSC (IN LINE port to OSC DROP port.)			3.0	dB	
Modes of operation					AGC

Optical Connections

The Amplifier is equipped with 4 optical ports, as described in the following table

Port	Type	Description
Line Out Port	E2000	This port has an E2000 high power connector. Pump power is launched through this connector into the optical transmission line. The C-Band signal enters the Amplifier through this port
Out	LC/UPC	Output of the EDFA section of the amplifier.
OSC Drop	LC/UPC	OSC drop port
Mon	LC/UPC	A monitoring port for the Out port

Electrical Specification

Parameter	Units	Specification			Notes
		Min.	Typ.	Max.	
Supply voltage	V	4.75	5.0	5.25	Power supply is fully isolated and no surges or spikes are allowed at input voltage.
Steady State Current	A			8	
Power consumption	W			42	

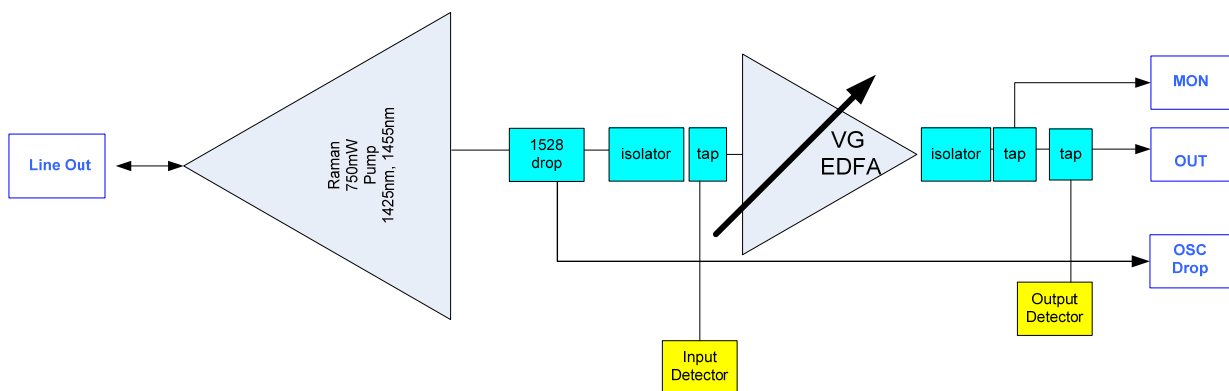
Electrical Pin Out

Connector type: SAMTEC: ZLTMM- 125-XX-L- D – XXX

Pin no.	Function	Description	Pin no.	Function	Description
1	+ 5.0 V	Power Supply	2	+ 5.0 V	Power Supply
3	+ 5.0 V	Power Supply	4	+ 5.0 V	Power Supply
5	+ 5.0 V	Power Supply	6	+ 5.0 V	Power Supply
7	Ground		8	Ground	
9	Ground		10	Ground	
11	N/C		12	N/C	
13	Ground		14	RESET Input	LVTTL Input, Idle High, P.U 10K (1)
15	1 RS-232 Input, Rx	LVTTL Level 4.75K P.U	16	1 RS-232 Output, Tx	LVTTL Level Output, 4.75K P.U
17	BIT	LVTTL Output, Active High	18	Loss of Input Alarm	LVTTL Output, Active High
19	Ground		20	Ground	
21	N/C		22	N/C	
23	N/C		24	N/C	
25	Ground		26	N/C	

Pin no.	Function	Description	Pin no.	Function	Description
27	Both Raman and EDFA pumps are ON	LVTTL Output, Active High	28	Raman pump back reflection alarm	LVTTL Output, Active High
29	Bypass Loss C Band (Relates to D12)	LVTTL Output, Active High	30	EDFA back reflection alarm	LVTTL Output, Active High
31	Ground		32	Ground	
33	LOP Alarm (Out 1)	LVTTL Output, Active High	34	OSC Loss alarm (When unit SD relates to CW power, when unit ON relates to modulated power)	LVTTL Output, Active High
35	Eye safe (Raman related)	LVTTL Output, Active High	36	Valid/ Absent module alarm	LVTTL Output, Active High, Pull Up 5K
37	Shutdown Input	LVTTL Input, Active High 10K P.U	38	Eye-safe Input	LVTTL Input, Active High, 10K pull-down
39	N/C		40	N/C	
41	Ground		42	Ground	
43	Ground		44	Ground	
45	+ 5.0 V		46	+ 5.0 V	
47	+ 5.0 V		48	+ 5.0 V	
49	+ 5.0 V		50	+ 5.0 V	

Block Diagram



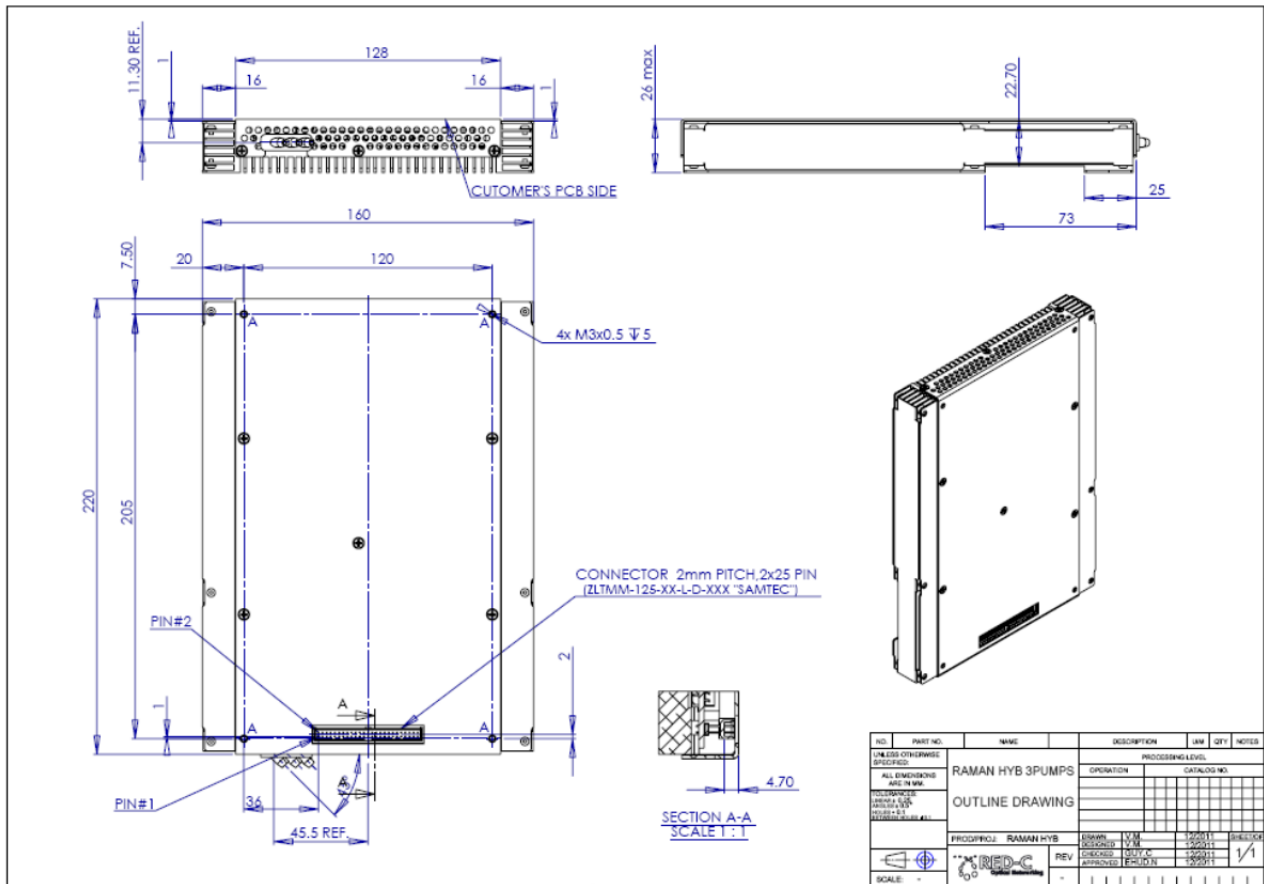
APR Detection Mechanisms

There are three different APR detection criteria. These criteria are used either independently or collectively to detect various scenarios, which indicate a potential safety hazard and consequently result in APR activation. The three APR criteria are:

1. **Pump power back-reflection** - The pump back reflection entering the Amplifier from the line port is continuously monitored and compared to the output pump power. If the value is above a threshold set by the user or if there is a sudden change of more than 2dB in back reflected power (with no change in pump power), an APR event will be triggered.
2. **Amplified Spontaneous Emission (ASE) in the 1500-1520nm band** - This mechanism continuously monitors the ASE in the 1500-1520nm band entering the Amplifier from the line port. Changes in ASE indicate an open or degraded line (high loss points).
3. **OSC loss** - This mechanism continuously monitors the OSC power entering the Amplifier from the line port. If OSC power is dropped below a threshold an APR event is triggered.

Mechanical Specifications

The following drawing shows the Hybrid Raman-EDFA's width, height and length dimensions.



Environmental and Qualification

Parameter	Value/Range
Operating Case Temperature	0°C to + 65°C
Operating Humidity	5 to 85%
Storage Temperature	-40°C to +85°C
Storage Humidity	5 to 95%
Laser Safety	Class 1M*

* Class 1M products are not hazardous under normal circumstances, but may pose an eye hazard when the laser output is viewed with certain optical instruments (for example eye loupes, magnifiers and microscopes) within a distance of 100 mm

Ordering Information:



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