

Finisar[®]

M7300CD Variable Gain EDFA

19.5 dBm Output, 10-30 dB

Specification / User Manual

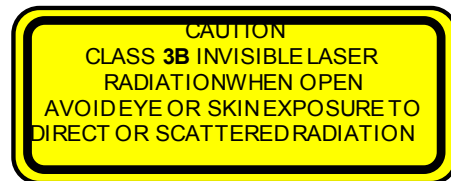
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Revision History

Date	Rev. №	Initiator	Comments
19-Jul-11	i	Mark Zaacks	Initial release
07-Feb-12	ii	Mark Zaacks	Updated product part number and description. Updated labels in section 3.1 accordingly. Updated mechanical section (increase of height to 16.5mm)
22-Apr-12	iii	Alex Surpin	Updated product labels in section 3.1 to reflect product description change.
21-Jul-12	iv	Alex Surpin	Updated part number to 50-11-0164-03R. Updated flat gain range to 10 – 24dB. Updated NF for every 1dB gain within the operating gain range. Updated Pre-Tilt and Output-Power-Dependent Tilt sections.
03-Jun-14	A00	Alex Surpin	Initial release - Finisar

Warnings

1. IT IS STRICTLY FORBIDDEN TO OPEN THE EDFA
2. OPENING THE EDFA MIGHT BE HARMFUL, MIGHT CAUSE SEVERE PHYSICAL INJURY AND MIGHT DAMAGE OR DISABLE THE MODULE. AN OPEN EDFA IS CLASSIFIED AS "CLASS 4" LASER PRODUCT.
3. IT IS STRICTLY FORBIDDEN TO ATTEMPT TO REPAIR, CHANGE, MODIFY OR OPERATE THE EDFA IN ANY WAY, WHICH IS NOT EXPLICITLY PERMITTED IN THIS USER GUIDE. ANY DEVIATION FROM THE INSTRUCTIONS IN THIS USER GUIDE MIGHT ENDANGER THE USER AND/OR THE EQUIPMENT INTERFACED WITH THE EDFA. ONLY FINISAR PERSONNEL ARE PERMITTED TO REPAIR THE EDFA OR MODIFY IT'S OPERATION
4. IT IS STRICTLY FORBIDDEN TO LOOK DIRECTLY OR THROUGH ANY OPTICAL MAGNIFYING INSTRUMENT (SUCH AS A MICROSCOPE) AT ANY OF THE EDFA'S OPTICAL CONNECTOR.
5. When connecting the EDFA to a fiber line, use only connectors having Mode Field Diameter (MFD) less than 11 μm (some non-standard special purpose connectors may have MFD larger than 11 μm).
6. Caution – Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure. For further information on laser safety, please refer to section 3.1.1. For more information on safety please refer to section 3.2.



Caution: Observe precautions for handling electromagnetic sensitive devices

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Chapter 1: Introduction

The M7300CD Variable Gain Erbium Doped Fiber Amplifier (VG EDFA, also referred to throughout this document as “the amplifier”) enables optimized and scalable operation in an evolving WDM network environment. This document describes the amplifier features, specifications and safety information.

1.1 Conventions

The following symbols are used in this document to indicate important information, a possible danger or a prohibition. Please pay careful attention and take adequate precautions where indicated.



This warning symbol indicates a prohibition.



This warning symbol means danger. You are in a situation that could cause either bodily injury or damage to the device.



Note: This symbol notes an important point of information requiring special attention.

The following abbreviations are standard throughout this document:

(A)	Test All amplifiers for this specification
(D)	Specification Guaranteed by design
(S)	Perform a sample test (3 units) for this specification
ASE	Amplified Spontaneous Emission
SOL	Start of Life
DCF	Dispersion Compensation Fiber
EDFA	Erbium Doped Fiber Amplifier
EOL	End of Life
EVOA	Electrically Controllable Variable Optical Attenuator
FIT	Failure in Time
GND	Ground
IL	Insertion Loss
ITU-T	International Telecommunications Union - Telecommunication
LOS	Loss of Signal
MSA	Mid Stage Access
MTBF	Mean Time Between Failure

OSA	Optical Spectrum Analyzer
PPC	Pump power control
SMT	Surface Mounted
TEC	Thermo-Electric Cooler

1.2 Finisar Contact Details

For assistance or any further information please contact:

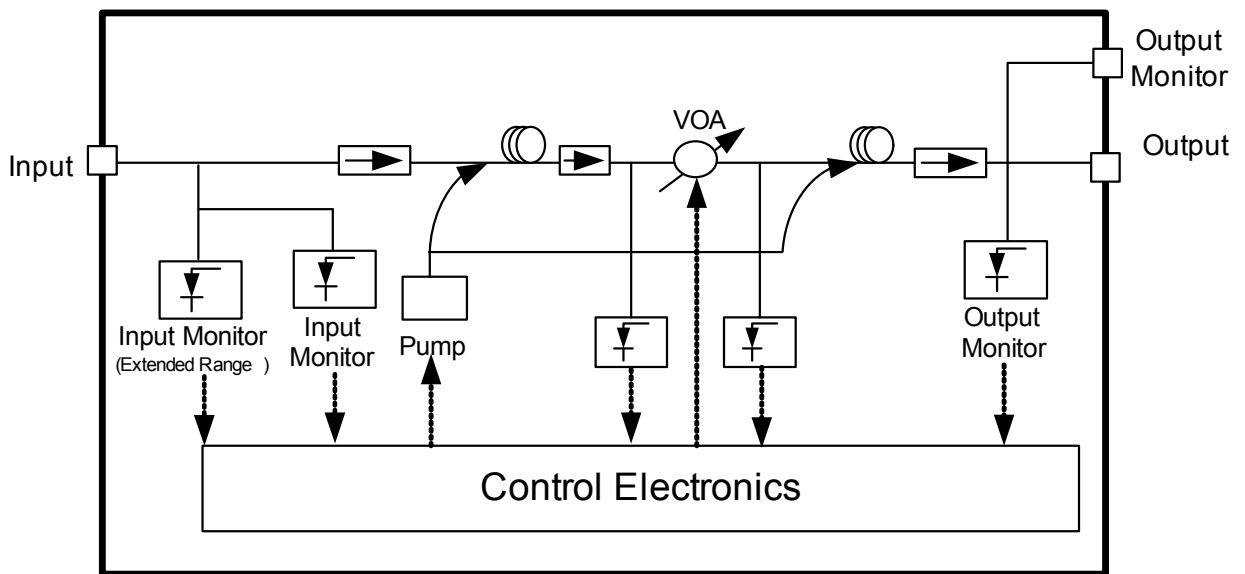
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Chapter 2: Product Overview

2.1 Product Features

The M7300CD is a Variable Gain EDFA in which gain variation is 10-30dB controlled by changing VOA attenuation. It is a micro processor-controlled module for C-Band (1529 – 1565 nm) amplification, also referred to throughout this document as “the amplifier”) enables optimized and scalable operation in an evolving WDM network environment. This document describes the amplifier features, specifications and safety information.

2.2 Amplifier Block Diagram



Chapter 3: Getting Started

3.1 Product Label


The following figure shows the product label affixed to the side panel of the EDFA. A laser aperture label is affixed to the out port of the EDFA, as shown in the photograph below.

The following pictures show the product labels affixed to the EDFA.







3.2 Safety Precautions

- ⊘ Modifications to the EDFA not authorized by Finisar may require additional compliance verification testing to ensure the modified product continues to comply with applicable regulations. Any person or organization performing unauthorized modifications to this product assumes the responsibility and liability for insuring the modified product conforms to the applicable regulations and legal requirements



-  Do not attempt to repair any malfunctioning of the EDFA device! If your EDFA is malfunctioning in any way, inform Finisar immediately for product replacement

3.2.1 Laser Safety

The EDFA is classified as a Class 1M laser product according to IEC 60825-1:2001 and CDRH 21 CFR 1040.10. This means that the product is safe under normal operating conditions, but could be hazardous when the output connector or fiber is viewed using optical instruments. The maximum accessible radiation is ensured to be less than 21.3 dBm in the wavelength range of 1525-1565nm




-  Invisible laser radiation may be emitted from the end of an un-terminated fiber cable or connector. Do not look into the beam or view it directly with optical instruments
-  To avoid potential damage to the eyes, do not look directly or through a magnifying instrument (e.g. microscope) into any optical fiber cable or connector.
-  It is prohibited to clean any optical connector while the amplifier is operational.
-  When an optical cable is not attached, place a protective cap over the cable's connector.

In order to achieve class 1M classification EDFA has two independent hardware circuits which limit output power and pump power in such a way that no single point of failure in hardware or software can cause the EDFA to emit higher power than 20.5dBm for a period higher than a few msec.

-  It is forbidden to open the EDFA for any purpose whatsoever.
-  Opening the EDFA may expose you to harmful laser radiation. An open EDFA is no longer classified as a Class 1M laser product. Opening the device is equivalent to changing the classification of the product to Class IV. A class IV laser product can be hazardous to eye or skin in the case of exposure to direct or scattered radiation. The internal laser radiation in an open EDFA can be in the wavelength of 970-1600 nm, with a maximum power of 800mW.

3.2.2 Electrical Safety

The amplifier should be installed in accordance with the National Electric Code.

-  Do not allow the device to come in contact with liquids. Keep the device dry.
-  Keep the device away from direct sources of heat. Maintain according to recommended environmental conditions.
-  Do not attempt to repair any electrical malfunctioning of the device! Inform your vendor immediately for product replacement.

3.3 Unpacking the Amplifier

The shipping package for the amplifier is engineered to reduce potential product damage caused by routine handling during shipment. To avoid potential damage to the amplifier, transport it in the Finisar-provided packaging. Failure to use Finisar-provided packaging may damage the amplifier or degrade its performance. Always transport or store the amplifier in an upright position (connector should be up), The pigtailed should be with caps and be placed in their proper grooves.



Do not remove the Amplifier from its shipping container until you are ready to install it. Keep the amplifier in the shipping container until you have determined where you will install it.



Wear an ESD-preventive strap and use an antistatic mat to avoid possible ESD damage to the amplifier.



Be sure to store the EDFA device in accordance with recommended environmental parameters.

3.4 Mechanical Assembly

Connect the amplifier module to the client motherboard PCB using specified screws. Use the stand offs (if required) to correctly align the optical amplifier and the connector location.

3.5 Amplifier Operation Modes

The amplifier supports three main operation modes: Each mode can be applied separately to the the two gain stages comprising the amplifier.

1. **Automatic Gain Control (AGC)** – Gain is kept at a constant level regardless of input power conditions. Gain at any wavelength is defined as the gain over a spectral line-width equivalent to a DFB laser.
2. **Automatic Optical Power Control (APC)** – output power is kept constant regardless of input power.
3. **Manual mode (PPC)** – the power of the pump(s) is kept constant.

3.5.1 AGC – Automatic Gain Control

In this mode the amplifier operates at a constant gain level. The system management supplies the required operation gain. The calculation of gain inside the amplifier is made according to the equation:

$G = (P_{OUT} - P_{ASE}) / P_{IN}$ where P_{IN} and P_{OUT} are the total power levels at the input and output of the amplifier and P_{ASE} is the excess Amplified Spontaneous Emission (ASE) created by the amplifier at the specific gain.

By subtracting P_{ASE} from P_{OUT} it is assured that the amplifier locks onto the exact desired gain.

3.5.2 APC – Automatic Power Control

In APC mode the total power at the output of the amplifier is kept constant regardless of the number of channels. Total power parameter is defined by user with software command (“APC_SW”) and can mean either a) Signals power + ASE produced in amplifier (APC_SW=1) or b) Signals Power without ASE (APC_SW=0). The reading of the detector Pout gives the signals power + ASE, thus if user chooses to keep constant the signals power in APC mode, this power will not be equivalent to the reading of the POUT detector.

3.5.3 Manual Control

In this mode of operation the current of each pump is kept constant at a specified value.

3.6 Amplifier Main Features

3.6.1 Spectrum Tilting

The output spectrum of the amplifier can be tilted by up to - 2dB. Tilt is measured relative to a linear regression of the spectrum at TILT = 0. This feature can be used to compensate for wavelength dependent loss of the line fibers or DCM and to compensate for the tilt due to Raman scattering.

3.6.2 Electronic Monitoring and Alarms

Relevant parameters in the amplifier, such as input and output optical power, pump currents and temperatures, including PCB temperature, are constantly monitored and can be displayed for viewing by the user. The parameters that can be displayed are listed in Chapter 5:.

The amplifier is equipped with a series of alarms that are supported both by hardware notification (a corresponding pin will turn on) and by software indication via the RS232 protocol. The events in which alarms are activated are listed and explained in chapter 4.2.3 (hardware) and Chapter 5: (Software).

3.6.3 Software Download

The operating software can be changed or upgraded while the amplifier is operative without any harm to traffic passing through the amplifier. The Software Download can be accomplished from a remote site via the system management station.

3.6.4 Environmental

The EDFA complies with the following environmental conditions:

OPERATION:

Case Temperature: -5°C to 70°C

Relative humidity: 5–85%

STORAGE:

Temperature: -40°C to 85°C

Relative Humidity: 5–95%

TRANSPORTATION:

Temperature: -40°C to 70°C

Relative Humidity: 5–95%

3.6.5 Eye Safety

Hardware based eye safety protection mechanism which assures output cannot surpass 20.7dBm and thus EDFA is categorized as Class 1M laser safety device.

Chapter 4: EDFA Specifications

4.1 General

The Amplifier shall meet all optical and electrical requirements over the entire life span of the amplifier

4.2 Optical Specifications

	Parameters		Min	Typ	Max	Unit	Notes
1	Minimum Wavelength range in vacuum (C-Band)		1529		1565	nm	
2	Input Power - two separate ranges	With transient suppression	-27		9.5	dBm	
3		Monitoring only	-38		-27	dBm	The lower 3dB range has detection accuracy of +/-1dB
4	Saturated output power		19.5			dBm	For single-channel minimum is 18.5dBm.
5	Minimum output power		-8			dBm	For strong pump (660mW) output power is limited to -8dBm
6	Pre-tilt		-0.75	-0.5	-0.25	dB	For gains 13 – 24dB
			-0.3	0	+0.3	dB	For gains 10 – 12.9dB
7	Output Power Dependent Tilt		-0.9		0	dB	Gain 10 – 13dB: For Pout > 13dBm Tilt = $-0.1 \times (\text{Pout} - 13) \pm 0.25$ Tilt is defined for full spectrum 1529-1565.
			-0.7		0	dB	Gain 14 – 30dB: For Pout > 15dBm Tilt = $-0.1 \times (\text{Pout} - 15) \pm 0.25$ Tilt is defined for full spectrum 1529-1565.
8	Gain Range	Flat spectrum	10		24	dB	Flatness as in spec
9		Tilted	24.1		30	dB	Tilt is 0.9dB for every 1dB of gain change above 24dB.

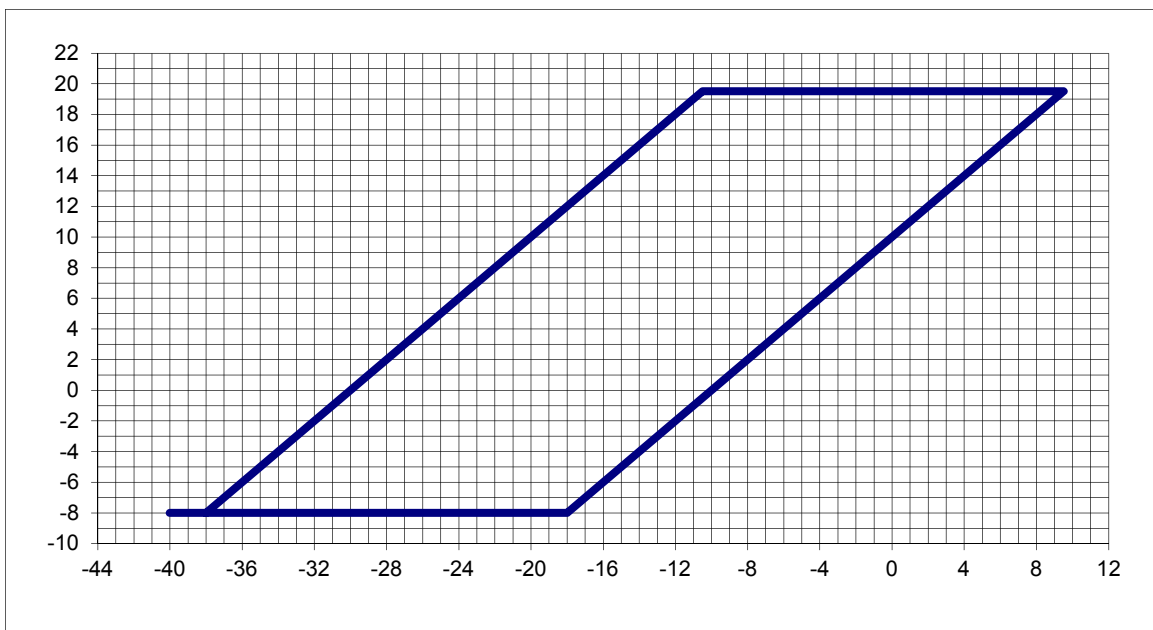
	Parameters	Min	Typ	Max	Unit	Notes
10	NF Pump=750mW	G≥24dB		5.2	dB	At tilt=0dB
11		G≥23dB		5.2	dB	
12		G≥22dB		5.2	dB	
13		G≥21dB		5.3	dB	
14		G≥20dB		5.5	dB	
15		G≥19dB		5.7	dB	
16		G≥18dB		5.9	dB	
17		G≥17dB		6.1	dB	
18		G≥16dB		6.3	dB	
19		G≥15dB		6.8	dB	
20		G≥14dB		7.5	dB	
21		G≥13dB		8.4	dB	
22		G≥12dB		9.4	dB	
23		G≥11dB		10.7	dB	
24	G≥10dB		12.1	dB		
25	Net gain overshoot/undershoot For 16dB Add/Drop in 100usec	-1		+1	dB	Fast transient control for Input power -27dBm to +9.5dBm. Monitoring for under -27dBm. Not including net gain offset due to tilt.
26	Transient suppression overshoot/undershoot For 16dB Add/Drop in 1usec	-2		+2	dB	
27	Transient setting time			400	μs	
28	Gain Setting Accuracy			0.5	dB	
29	Settable tilt (offset from pre-tilt)	-2		+2	dB	Actual tilt is offset by 0.5dB pre-tilt to range of (-2.5dB to 1.5dB) or gain 10-25dB X positive tilt possible for gains below: 25-XdB.
30	Gain Flatness over entire gain bandwidth (Pk-Pk)			1.0	dB	
31	Pump stabilization temperature	25		45	°C	Depending on pump manufacturer
32	Power Consumption EOL, 75C case 660mW pump			9.5	W	
33	Steady State Gain, Power Stability			±5	%	

	Parameters	Min	Typ	Max	Unit	Notes
34	Maximum ASE backward power out of input port			-30	dBm	
35	Residual Pump Power out of Input port			-30	dBm	
36	Maximum allowed input power for damage			15	dBm	
37	Residual Pump Power out of Output port			-30	dBm	
38	Optical Return Loss (any port, pump off)	40			dB	
39	Polarization Dependence Gain			0.3	dB	
40	Polarization Mode Dispersion			0.3	ps	
41	Multipath Interference			-40	dB	

Notes

1. Performance Over all temperature range (-5 to 65 degrees), gain and input power ranges unless otherwise specified.
2. Tilt definitions and capabilities:
 Negative Tilt – Gain of the long wavelengths is lower than the gain of the short wavelengths.
 Positive Tilt – Gain of short wavelengths is lower than the gain of the long wavelengths.
3. Gain accuracy definition – For steady state conditions, and for tilt = 0, required gain G can be defined as $G = (P_{out} - P_{ase}) / P_{in}$, where P_{in} and P_{out} are the total power levels at the input and output of the amplifier and P_{ase} is the excess Amplified Spontaneous Emission created by the amplifier at the specified gain. Gain accuracy means measurement accuracy for the defined gain value.

Power Mask



4.2.1 Optical Ports

The Variable Gain EDFA module is equipped with 3 Optical connections. The connectors are MU standard type single mode. The connecting fiber length is 50cm.

Connector	Type	Type/Labeled	Description
OUT	G657A	MU/White	Output optical port
IN	G657A	MU/Black	Input optical port
OUTPUT MONITOR	G657A	MU/Blue	0.7% - 1.55% of power at signal output port

4.2.2 Optical Detectors and Control Parameters

The following table represents the power monitor’s specification

The following tables represent the power monitor’s specification for each EDFA type

Parameter		Units	Specification			Notes
			Min.	Typ.	Max.	
Input power with Transients	Range	dBm	-27		9.5	
	Accuracy	dB	0.5	0.3		
Input power monitoring	Range	dBm	-38		-27	
	Accuracy	dB	0.5	0.3		
Input power monitoring	Range	dBm	-40		-38	
	Accuracy	dB	1.0	0.8		
Output power (without ASE)	Range	dBm	-8		+19.5	
	Accuracy	dB	0.5	0.3		
Output power (with ASE)	Range	dBm	-10		+20	
	Accuracy	dB	1.0	0.8		

4.2.3 Optics related alarms

4.8.3 Input loss Alarm

The following table represents the LOS alarm specification:

Parameter	Units	Specification			Notes
		Min.	Default	Max.	
Threshold	dBm	-40	-37	-5.0	Los value determined with user command: “ALRM_LOS_THR”.
Hysteresis	dB	1	2	2	Default=2dB

4.8.3 Temperature Alarm

The following table represents the Temperature alarm specification, with respect EDFA and Pump:

Parameter		Units	Specification			Notes
			Min.	Nominal	Max.	
EDFA(PCB) threshold		degC			85	1
Pump threshold	For pump=25C (depends on pump manufacturer)	degC	15	25	35	2
	For pump=45C (depends on pump manufacturer)	degC	35	45	55	
Hysteresis		degC		5		

Notes:

1. When temperature exceeds 80 degC PCB temperature will give an alarm and when it reaches PCB temperature that is equivalent to pump case 75C shut down occurs. When amplifier temperature will go 5C below the shutdown temperature it will automatically re-activate itself.
2. Beyond this range, pump will shut down. Re-activation at less than +/-5C from nominal value.

4.8.3 LOP Alarm

The following table represents the conditions for Loss of output alarm. It relates both to wrong gain (AGC) and wrong Output power (APC). For AGC mode, LOP alarm threshold is dynamic and is increased as a function of locking algorithm error. Actual LOP threshold is gain lock error + 0.5dB.

Parameter	Units	Specification			Notes
		Min.	Typ.	Max.	
Threshold	dB		0.5		Loss value can be determined with user command: "ALRM LOP THR". Default: 0.5db above or below expected value.
Hysteresis	dB		0.3		Default value. Can be set by user command

4.8.3 Pump Current EOL Alarm

The following table represents the pump current EOL alarm specification, with respect EDFA and Pump:

Parameter	Units	Specification			Notes
		Min.	Typ.	Max.	
EOL Threshold	mA	1.2x IBOL		$0.95 \times I_{\max}$	
EOL Hyshteresis	mA			$0.01 * I_{\max}$	

4.3 Electrical Specifications

4.3.1 Electrical Interface

The following table describes the electrical interface specifications.

Pin#	Function	Pin#	Function
1	NC	2	NC
3	+5V	4	+5V
5	Ground	6	Ground
7	Serial Input	8	Serial Output
9	Ground	10	Ground
11	NC	12	RESET Input
13	Amplifier Disable Input	14	Output Power Mute Input
15	EDFA Case (>75C) or Pump Temperature Alarm (T<15C or T>35C)	16	NC
17	Pump Temperature Alarm	18	Pump Bias Alarm
19	Loss of Input Power Alarm	20	Loss of Output Alarm
21	NC	22	NC
23	Dedicated Serial Channel (input)	24	Dedicated Serial Channel (output)
25	Ground	26	Ground
27	+5V	28	+5V
29	NC	30	NC

4.3.2 Electrical Connector Specifications

The Amplifier has one electrical connector:

Connector Type: MALE: MTMM-115-XX-X-D-XXX to mate with MMS-115-01-X-DV.

4.3.3 Electrical Parameters and Maximum Ratings

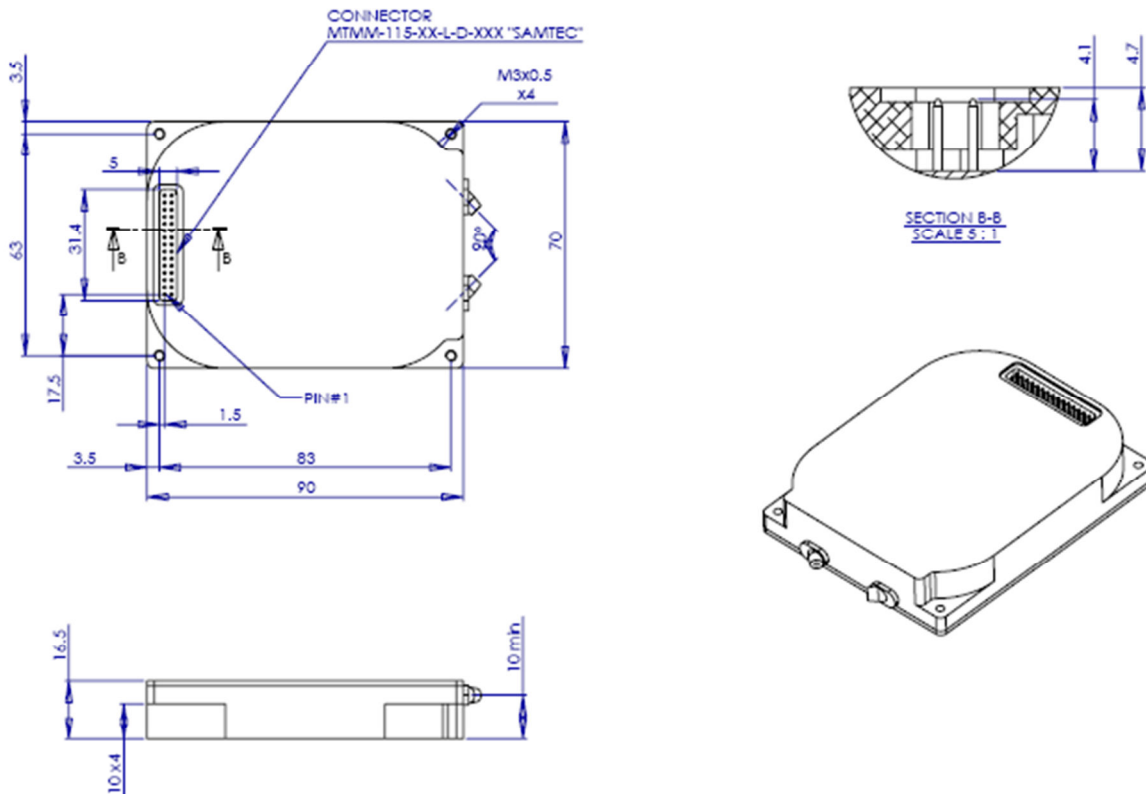
The following table summarizes the maximum electrical ratings of the amplifier

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		1	2	
Startup Current	A			3	First seconds

Parameter	Units	Specification			Notes
		Min.	Typ.	Max.	
Power consumption	W			9.5	
Supply voltage ripple	mV			50	
Voltage rise time	ms			50	
Voltage fall time	ms			50	

4.4 Mechanical Specification

Parameter	Value/Range
Physical dimensions (without Heat sink)	90x70x16.2 mm
Package material	AL 6061-T6
Package weight	0.1Kg
Surface roughness	N8
Coating	AMS-C-5541 CLASS 3(CLEAR).
Primer coating	Epoxy polyamide per MIL-P-53022 TYP II CLASS 1
Top coating	Polyurethane PER MIL-C-83286 COLOR RAL 9005,20-30µm SMOOTH.
Mounting box	4 M3.4 Through holes



Note: The label shall be placed on the reverse side compared the electrical connector.

4.5 Deliverables

For each EDFA an internal ATR exist (see software commands) that can be read with software command.

4.6 FIT

The FIT for the M7300 EDFA is <1200.

Chapter 5: Communication Commands

This chapter describes the wide variety of communication commands used to configure, control, and receive information from the EDFA.

The commands are available using an RS232 communication protocol set to 8 bits, no parity, 1 stop bit, no handshaking, and programmable baud rate (factory set to 19200 bps).

The commands are of two types, either Read (**Get**) commands or Write (**Set**) commands.

Set commands use the following format:

[Parameter Name][][New Value][Press ENTER]

Get commands are used to acquire information about the amplifier settings. These commands can also be used to acquire the current values of parameters that have been defined using the **Set** commands.

The following format is returned by the EDFA:

[Parameter Name]: [Value][Real Units]

Each Get or Set command will be followed by a > prompt on the following line.

Floating numbers in the response are X.X

5.1 Detailed Command List

5.1.1 Module Type

Purpose: Returns module type, firmware version and serial number

Type: Get

RS232 Command: **Ver [ENTER]**

Answer: Example:

```
VER:  
Configuration: M7300  
Firmware Vers: 572.3  
Serial Number: 27308  
Hardware Vers: 01A  
Firmware Date: Mar 16 2011  
Monitor IL : 20.3  
Boot Version: 21.1  
>
```

5.1.2 ECHO

Purpose: If echo is “ON” line echoing exists (command, parameters and values are echoed to user).

Type: Set / Get

RS232 Set Command: **ECHO ON (or OFF) [ENTER]**

Answer: >

RS232 Get Command: **ECHO [ENTER]**

Answer: **ECHO: ON (or ECHO: OFF)**
>

5.1.3 Baud Rate

Purpose: Defines the communication Baud rate of the module.
Values: 9600, 19200, 38400, 57600, 115200.

Type: Set / Get

RS232 Set Command: **BAUD 19200 [ENTER]**

Answer: >

RS232 Get Command: **BAUD [ENTER]**

Answer: **BAUD: 19200**
>

5.1.4 Operation Mode and Gain/Power Setting

Purpose: Sets (or Gets) amplifier mode of operation. Operation Modes are:

- a. Automatic Gain Control (AGC) where signals gain is kept constant. **MODE G**
- b. Automatic Optical Power Control (APC) where total optical power at amplifier output is kept constant. **MODE P**
- c. Manual mode where pumps current is set manually. **MODE M**.
- d. Disable mode. The pump shuts down. **MODE D**.

Type: Get / Set

RS232 Get Command: **MODE [ENTER]**

Answer: **MODE: Z XX.X dB** for AGC
>

Where Z is either **G** or **P** or **M** or **D**

(XX.X value is only for G and P modes. For G the value is in dB, whereas for P the value is in dBm, and a sign “-“ can precede signified value)

RS232 Set Command: **MODE G XX.X [ENTER]** for AGC, where XX.X is gain in dB

Answer: >

RS232 Set Command: **MODE P XX.X** [ENTER] for APC, where XX.X is total output power in dBm

Answer: >

RS232 Set Command: **M** or **D** [ENTER]

Answer: >

5.1.5 Pump Current Setting

Purpose: The command Reads/Sets each of the pumps current.



This command is operative only in Manual operation mode

Type: Get / Set

RS232 Set Command: **PUMP ISP ZZZZ.Z** [ENTER]
 ZZZZ.Z is pump current in mA.

Example: PUMP ISP 500.0 [ENTER]
 (Set current of first pump to 500mA)

Answer: >

RS232 Get Command: **PUMP ISP** [ENTER]

Answer: **PUMP ISP: ZZZZ.Z mA**

Remark: Command **PUMP AUTO** introduces Automatic Pump control in which previous values of pump current according to the operation mode are kept. These values are kept until the next PUMP ISP command is given.

5.1.6 VOA Attenuation Value

Purpose: Gets the attenuation value of the EVOAs that are located in the EDFA. VOA1 is the VOA related to Pre-amp (or first amplifier in package) and VOA2 to VOA in Booster (or second amplifier in same package).

Type: Get

RS232 Command: For reading EVOA number X attenuation:
VOA X [ENTER]

Answer: Answer will contain three lines:
VOA X SET: XX.XX dB
 (Where SET shows attenuation requested by software)
VOA X ACT: XX.XX dB
 (Where ACT shows actual VOA loss)
VOA X STA: YYY
 (Where status is either:
OK: VOA ACT=VOA SET

ERR: VOA ACT not equal VOA SET

PWR: VOA setting failed due to low power or unstable signal.

BSY: VOA loss still varying.

Remark: If only VOA command is given information regarding all VOAs in the module will be displayed.

5.1.7 Gain Tilt Setting

Purpose: Reads/sets gain tilt (relevant only for modes AGC and APC). Tilt is linear. Negative tilt means that longer wavelengths have higher attenuation, whereas positive tilt means longer wavelengths have lower attenuation.

Type: Get / Set

RS232 Get Command: **TILT [ENTER]**

Answer: **TILT: YX.X dB** (Where Y designates blank for the sign + or - for -). For example if TILT is -1dB the response for this command is **TILT: -1.0 dB**

>

RS232 Set Command: **TILT YX.X [ENTER]** (Where Y designates a blank for a positive value + or - for a negative value) and X.X the tilt.

Answer:

>

Remark: To set tilt of -1dB the command is:
TILT -1.0

5.1.8 Maximal Operative Gain

Purpose: Sets Gain limit for EDFA. When module is in APC mode, output power value is automatically reduced so maximum gain value is not above the set value.

Type: Get / Set

RS232 Set Command: **GLIM XX.X [ENTER]**
(Where XX.X is the value of maximum gain in dB).

Answer:

>

RS232 Get Command: **GLIM [ENTER]**

Answer: **GLIM: XX.X dBm**

>

Remark: Setting XX.X value to **D** disables limitation

5.1.9 Maximal Operative Power

Purpose: Sets Power limit for EDFA. When module is in AGC mode, output power value is automatically reduced to reach this value.

Type: Get / Set

RS232 Set Command: **PLIM XX.X [ENTER]**
(Where XX.X is the value of maximum gain in dB).

Answer: >

RS232 Get Command: **PLIM [ENTER]**

Answer: **PLIM: XX.X dBm**
>

Remark: Setting XX.X value to **D** disables limitation

5.1.10 Optical Power/Gain Monitoring

Purpose: Used for monitoring:
a. Input power (**PIN**)
b. Total Output power (**POUT**)
c. Total Output Power minus ASE (**PSIG**)
d. Gain (**GAIN**)

Type: Get

RS232 Command: **PIN [ENTER] or POUT [ENTER] or PSIG [ENTER] or GAIN [ENTER]**

Answer: **PIN : YXX.X dBm**
>
Or
POUT: YXX.X dBm
>
Or
PSIG: YXX.X dBm
>
Or
GAIN: XX.X dB
>

(Where Y designates sign, blank for + and “-“ for -)

5.1.11 Optical Power Setting in APC Mode with no Input Power

Purpose: Setting output power in LOSS N mode (when amplifier remains operative when no input power exists).

Type: Set

RS232 Command: **MODE P XX.X [ENTER] where XX.X is total output power in dBm
(Signal + ASE power is kept constant)**

Answer: >

5.1.12 APC Mode Definition

Purpose: In APC mode it is possible to either keep constant the output power with ASE or the signal power. The operation is defined with the command: "APC_SW".

Type: Get/Set

RS232 Get Command: **APC_SW [ENTER]**

Answer: **APC_SW: X**
>

Remark: If X=1, signal + ASE power is kept constant, If X=0 signal power is kept constant.

RS232 Set Command: **APC_SW=X [ENTER]**

Answer: >

5.1.13 Nominal Laser Temperature

Purpose: Displays the nominal laser temperature: 25C or 45C

Type: Get

RS232 Command: **NomLasTemp [ENTER]**

Answer: **NomLasTemp: XX.X C**
>

5.1.14 Case Temperature Monitoring

Purpose: Gets the case temperature.

Type: Get

RS232 Command: **MT [ENTER]**

Answer: **MT: YXX.X C**
>

(Where Y designates blank for the sign + or - for the sign -).

5.1.15 Pump Status

Purpose: Gets the pump status.

Type: Get

RS232 Command: **PUMP Y [ENTER]**

Y is one of the following:

e. ILD – LD current in mA

f. EOL – LD EOL current in mA

g. TMP – LD temperature

h. ISP – LD current set point in mA (or AUTO)

Answer: For parameters 1,2 and 4:

PUMP Y: XXXX.X mA

>

For parameter 3:

PUMP TMP: XX.X C

>

Remark: If Y is not specified the command will display all possible statuses, if X is not specified both pumps statuses are displayed.

5.1.16 Alarm Information

Purpose: Displays values in which alarm will be declared. Values are related for the following amplifier parameters:

- i. Max current of pump (**ILD**)
- j. Max pump temperature (**TMP**)
- k. PCB temperature higher then 85C (**MTH**)
- l. Low case temperature (**MTL**)
- m. Out of range coil temp. (**CT**)
- n. Loss of input signal for n stage/amplifier (**LOS**)
- o. Wrong output power in APC and wrong Gain in AGC (**LOP**)

For each parameter the alarm value can relate for the following:

- p. Current status can be On or OFF (**STA**)
- q. Latched alarm (**SST**)
- r. Threshold (**THR**)
- s. Hysteresis (**HYS**)

Type: Get

RS232 Command: **ALRM Y [ENTER]**
 Where Y is the current status or Threshold or Hysteresis or latched.

Answer: **ALRM Y: XXX.X** with appropriate units following.
 >

Example Command: **ALRM LOS THR [ENTER]**

Example Answer: **ALRM LOS THR: -21.0dB**
 >

Remark: If the Y parameter is not given then all Y parameters are displayed. If Both the X and Y parameters are not given then all parameters for all alarms are given.

Table summing up all alarms:

Alarm		EDFA Action
CT Coil temperature is lower than 45C or higher than 65C.	Set	No action
	Clear	No action
LOS Input LOS Alarm	Set	Stage shifts to disable mode. This behavior is configurable.
	Clear	Returns to previous mode
LOP Correct gain in AGC or correct power in APC cannot be achieved	Set	n/a
	Clear	
ILD One of pump currents > 0.95EOL	Set	No action
	Clear	No action

Alarm		EDFA Action
MTH Block Temperature bigger then 80C(TBD) alarm	Set	No action
MTL Block Temperature smaller then threshold alarm	Clear	No action
TMP If pump temp >35 or < 15 (for NomLasTemp=25C) OR >55 or < 35 (for NomLasTemp=45C) alarm is lit	Set	Configurable: No change Module shifts to disable mode Default: Module shifts to disable.
	Clear	Returns to previous mode

5.1.17 Alarms Threshold and Hysteresis Setting

Purpose: Setting values in which alarm is declared and hysteresis for turning on and off the alarm.

Type: Set

RS232 Command: **ALR M X THR Y [ENTER]**
Or
ALRM X HYS Y [ENTER]
(Where X value is same as in paragraph 21 and Y value is given according to user requirements)

Answer: >

Example Command: **ALRM LOS THR -21 [ENTER]**

Example Answer: >

Remark: ALRM X CLR clears Alarm from latched status, ALRM CLR clears all alarms from latched status.

5.1.18 Alarms With ON status

Purpose: Gets all alarms which are ON

Type: Get

RS232 Command: **AST [ENTER]**

Answer: **AST: X1 X2 Xn**

>

(Where list of alarms is given in paragraph 21)

If all alarms are off answer is:

AST: OK

>

5.1.19 Alarms Latching Information

Purpose: In case an alarm was declared and immediately shut off before management system received the alarm notification, the state of alarms can be latched till status reading is performed. The latching mode is designated as **S** mode. In this mode the **AST** command displays only latched alarms. In Normal mode (designated as **N** mode), the **AST** command displays only current alarms.

Type: Set / Get

RS232 Set Command: **ASTM N [ENTER]**
(Where **N** switches to normal mode).

Answer: >

RS232 Get Command: **ASTM [ENTER]**

Answer: **ASTM: N**
>

Remark: Command is also affective to hardware PIN alarms.

5.1.20 Module Operation When Loss of Input Power Occurs

Purpose: Indicate module mode of operation when input power to module is below designated threshold. Four modes of operation are available:

- t.** Pumps are disabled in AGC, APC and Manual modes (**A**)
- u.** In AGC mode the EDFA operates as APC mode with power in "pout_n" value. In APC and Manual modes there is no effect to input loss. (**N**)

Type: Set / Get

RS232 Set Command: **LOS X [ENTER]**
(Where **X** is one of the four options specified)

Answer: >

RS232 Get Command: **LOS [ENTER]**

Answer: **LOS: X**
>

5.1.21 Module Operation For LOS N

Purpose: Determines the pout when no input signal and the mode of operation is AGC LOS N

Type: Set / Get

RS232 Set Command: **POUT_N X [ENTER]**

Answer: >

RS232 Get Command: **POUT_N [ENTER]**

Answer: **POUT_N: X**
 >

5.1.22 Reset to Factory Default

Purpose: Reset all setting to factory settings (defaults). Micro controller has to be re-booted in order for the command to take effect.

Type: Set

RS232 Command: **RST [ENTER]**

Answer: >

5.1.23 Boot

Purpose: Reboots the firmware.

Type: Set

RS232 Command: **BOOT [ENTER]**

Answer: >

5.1.24 Software Download

Purpose: Downloads operating software from system management.

Type: Set

RS232 Command: **RECV FW [ENTER]**
 (Where **FW** is new firmware)


Answer: >

Appendix A Limited Product Warranty

Finisar (the “Company” or “Finisar”) hereby warrants and undertakes the following to the purchaser (the “Purchaser”) of the product which this Limited Warranty Certificate accompanies or refers to (the “Product”):

1. The Company warrants to Purchaser that the Product will be free of defects in material and workmanship under normal use and service for a period of 12 months following the date of delivery of the Product to Purchaser (the “Warranty Period”).
2. If, during the Warranty Period, the Product becomes defective by reason of material or workmanship, and Purchaser immediately notifies the Company of such defect, the Company, as its sole obligation and liability, shall, at its option (i) supply a replacement Product; (ii) request return of the defective Product to its plant for repair; or (iii) if neither of the two foregoing options is reasonably available, the Company may refund to the Purchaser the purchase price paid for the defective Product. All Products that are replaced will become the property of the Company. Any replaced or repaired Product shall be covered by this Limited Warranty Certificate hereunder for a period of ninety (90) days from delivery thereof or for the remainder of the Warranty Period, whichever is longer.
3. Return of a defective Product must be pre-authorized by the Company. Once authorized, the defective Product must be accompanied by a Return of Materials Authorization (RMA) number, to be marked on the outside of the package containing the defective Product and sent prepaid and packaged appropriately for safe shipment to the Company. It is recommended that the returned Product be insured or sent by a method that provides for tracking of the package. In no event will the Company be liable for any loss or damage to the Product, occurring during or as a result of the return shipment of the Product to the Company. The repaired or replaced Product will be shipped to the Purchaser, at the Company's expense not later than twenty one (21) days after the Company receives the defective Product.
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9. No trouble found with Finisar provided Product.
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