

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

**Fibre optic active components and devices – Performance standards –  
Part 8: Seeded reflective semiconductor optical amplifier devices**

**Composants et dispositifs actifs à fibres optiques – Normes de performances –  
Partie 8: Dispositifs amplificateurs optiques à semiconducteurs réfléchissants  
répartis**





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**FIBRE OPTIC ACTIVE COMPONENTS AND DEVICES –  
PERFORMANCE STANDARDS –**
**Part 8: Seeded reflective semiconductor optical amplifier devices**

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The text of this standard is based on the following documents:

CDV	Report on voting
86C/1144/CDV	86C/1221/RVC

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 62149 series, published under the general title *Fibre optic active components and devices – Performance standards*, can be found on the IEC website.

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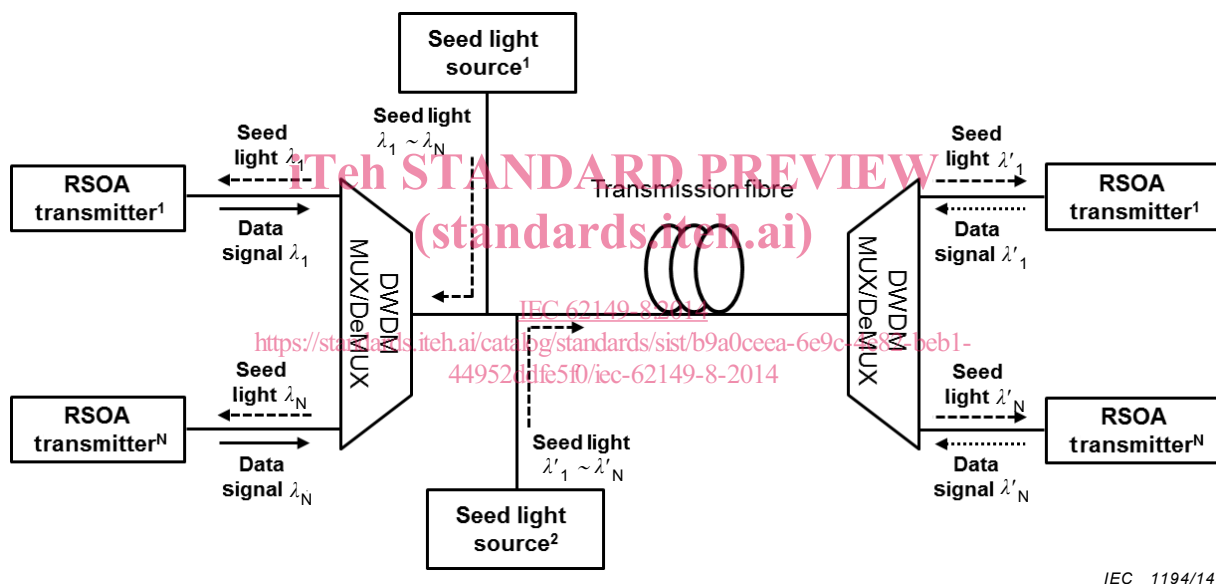
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## INTRODUCTION

Fibre optic laser devices are used to convert electrical signals into optical signals. This part of IEC 62149 covers the performance specification for seeded reflective semiconductor optical amplifier (RSOA) devices in fibre optic telecommunication and optical data transmission applications. The optical performance criteria are generally well specified for a number of internationally agreed applications areas such as ITU-T Recommendation G.698.3. This standard aims to provide optical interface specifications towards the realization of transversely compatible seeded dense wavelength division multiplexing (DWDM) systems.

In the seeded DWDM system, seed light sources are used to generate broadband seed lights in C-band or L-band. After passing through DWDM DeMUXs in the link, the broadband seed lights are spectrum sliced according to the transmission characteristics of DWDM DeMUXs. Each spectrum sliced seed light is injected into a RSOA transmitter based on a RSOA device. Consequently, an output signal wavelength of a RSOA transmitter can be determined by a wavelength of an injected seed light.



IEC 1194/14

Figure 1 – Seeded DWDM transmission based on RSOA devices

Seeded RSOA devices for seeded DWDM systems are supplied by different manufacturers, but do not guarantee operation of seeded RSOA devices. Manufacturers using the standards are responsible for meeting the required performance and/or reliability and quality assurance under a recognized scheme.

# FIBRE OPTIC ACTIVE COMPONENTS AND DEVICES – PERFORMANCE STANDARDS –

## Part 8: Seeded reflective semiconductor optical amplifier devices

### 1 Scope

This part of IEC 62149 covers the performance specification for seeded reflective semiconductor optical amplifier (RSOA) devices used for fibre optic telecommunication and optical data transmission applications. The performance standard contains a definition of the product performance requirements together with a series of sets of tests and measurements with clearly defined conditions, severities, and pass/fail criteria. The tests are intended to be run on a “once-off” basis to prove any product’s ability to satisfy the performance standard’s requirements.

A product that has been shown to meet all the requirements of a performance standard can be declared as complying with the performance standard, but should then be controlled by a quality assurance/quality conformance program.

### 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60749-6, *Semiconductor devices – Mechanical and climatic test methods – Part 6: Storage at high temperature*

IEC 60749-7, *Semiconductor devices – Mechanical and climatic test methods – Part 7: Internal moisture content measurement and the analysis of other residual gases*

IEC 60749-10, *Semiconductor devices – Mechanical and climatic test methods – Part 10: Mechanical shock*

IEC 60749-11, *Semiconductor devices – Mechanical and climatic test methods – Part 11: Rapid change of temperature – Two-fluid-bath method*

IEC 60749-12, *Semiconductor devices – Mechanical and climatic test methods – Part 12: Vibration, variable frequency*

IEC 60749-25, *Semiconductor devices – Mechanical and climatic test methods – Part 25: Temperature cycling*

IEC 60749-26, *Semiconductor devices – Mechanical and climatic test methods – Part 26: Electrostatic discharge (ESD) sensitivity testing – Human body model (HBM)*

IEC 60825-1, *Safety of laser products – Part 1: Equipment classification and requirements*

IEC 60950-1, *Information technology equipment – Safety – Part 1: General requirements*



IEC 61300-2-4, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-4: Tests – Fibre/cable retention*

IEC 61300-2-19, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-19: Tests – Damp heat (steady state)*

IEC 61300-2-48, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-48: Tests – Temperature-humidity cycling*

IEC Guide 107, *Electromagnetic compatibility – Guide to the drafting of electromagnetic compatibility publications*

### 3 Terms, definitions, symbols and abbreviations

For the purposes of this document, the following terms, definitions, symbols and abbreviations apply.

NOTE Terminology concerning *physical concepts, types of devices, general terms*, and those related to *ratings and characteristics* of semiconductor devices can be found in IEC 60747-5-1. In addition, definitions for *essential ratings and characteristics* of semiconductor optoelectronic devices for fibre optic system applications can be found in IEC 62007-1.

#### 3.1 Terms and definitions

The following terms are defined for the specific characteristics of RSOA devices

##### 3.1.1

##### **central wavelength**

central wavelength of the seeded RSOA device when it is operated at the normal operating conditions which is specified in the sectional specification of the seeded RSOA devices

##### 3.1.2

##### **modulation speed**

digital modulation speed with an optimum modulation amplitude between the operating current and threshold current level

##### 3.1.3

##### **seed light**

light used to determine output wavelength of RSOA device

##### 3.1.4

##### **submount**

substrate upon which a RSOA is mounted for assembly into further packaging

#### 3.2 Symbols and abbreviations

$M_s$	modulation speed
$\lambda_{ce}$	central wavelength
$P_s$	seed light power
$P_o$	optical output power
$R$	reflectance
$I_{th}$	threshold current
$V_{th}$	threshold voltage
$\eta$	slope efficiency (at $I_{Op}$ in a TOSA and pigtailed package)
$P_O$	continuous laser output power (at $I_{Op}$ in a TOSA and pigtailed package)

$\Delta T$	TEC capability
$I_{TEC}$	TEC current
$V_{TEC}$	TEC voltage
$R_{therm}$	thermistor
$I_m$	monitor current
$I_{mR0}$	dark current
$C_{tot}$	capacitance

Abbreviation	Term
DWDM	dense wavelength division multiplexing
PDG	Polarization dependent gain
RSOA	reflective semiconductor optical amplifier

## 4 Product parameters

### 4.1 Absolute limiting ratings

Absolute limiting (maximum and/or minimum) ratings imply that no catastrophic damage will occur if the product is subject to these ratings for short periods, provided each limiting parameter is in isolation and all other parameters have values within the normal performance parameters. It should not be assumed that limiting value of more than one parameter can be applied at any one time. The absolute maximum ratings of 1,25 Gb/s modulation speed are listed in Annex A.

[IEC 62149-8:2014](http://standards.iteh.ai/catalog/standards/sist/b9a0ccea-6e9c-4e82-beb1-44952ddf5f0/iec-62149-8-2014)

### 4.2 Operating environment

<http://standards.iteh.ai/catalog/standards/sist/b9a0ccea-6e9c-4e82-beb1-44952ddf5f0/iec-62149-8-2014>

The operating environment of seeded RSOA devices is specified in Table 1.

**Table 1 – Operating environment**

Parameter	Symbol	Value		Unit
		Minimum	Maximum	
Operating temperature	$T_{op}$	-10	+80	°C

### 4.3 Functional specification

Functional specifications of 1,25 Gb/s signalling speed and application area are listed in Annex A.

## 5 Testing

### 5.1 General

Qualification maintenance is carried out using periodic testing programs. Test conditions for all tests, unless otherwise stated, are 25 °C ± 2 °C.

### 5.2 Characterization testing

Characterization shall be carried out on at least 20 products taken from at least three different manufacturing lots. The characteristics and conditions of an RSOA diode are tested at the

operating temperature and the operating current to satisfy the functional specifications defined in 4.3.

### 5.3 Performance testing

Performance testing is undertaken when characterization testing is complete. The performance test plan and recommended performance test failure criteria are specified in Annex A.

## 6 Environmental specifications

### 6.1 General safety

All products meeting this standard shall conform to IEC 60950-1.

### 6.2 Laser safety

Fibre optic transmitters and transceivers using the laser diode specified in this standard shall be class 3R laser certified under any condition of operation. This includes single fault conditions, whether coupled into a fibre or out of an open bore. Fibre optic transmitters and transceivers using the laser diode specified in this standard shall be certified to be in conformance with IEC 60825-1.

Laser safety standards and regulations require that the manufacturer of a laser product provide information about the product's laser, safety features, labelling, use, maintenance and service. This documentation shall explicitly define requirements and usage restrictions on the host system necessary to meet these safety certifications.

### 6.3 Electromagnetic compatibility (EMC) requirements

Products defined in this standard shall comply with suitable requirements for electromagnetic compatibility (in terms of both emission and immunity), depending on the particular usage/environment in which they are intended to be installed or integrated. Guidance to the drafting of such EMC requirements is provided in IEC Guide 107. Guidance for electrostatic discharge (ESD) is still under study.

**Annex A**  
(normative)

**Specifications for seeded RSOA devices**

**A.1 Absolute limiting ratings**

Absolute limiting (maximum and/or minimum) ratings imply that no catastrophic damage will occur if the product is subject to these ratings for short periods, provided each limiting parameter is in isolation and all other parameters have values within the normal performance parameters. It should not be assumed that limiting value of more than one parameter can be applied at any one time.

**Table A.1 – Absolute limiting ratings**

Parameter	Symbol	Value		Unit
		Minimum	Maximum	
Storage temperature	$T_{stg}$	-40	+85	°C
Soldering condition	$T_{sol}$		260 °C, 10 s	
<b>Laser diode</b>				
Forward bias voltage	$V_{FB}$		3	V
Continuous forward current	$I_{FLD}$		120	mA
<b>Monitor photodiode</b>				
Reverse bias voltage	$V_{mRB}$		3,3	V
Forward current	$I_{mF}$		2	mA

**A.2 Operating environment**

The requirements of 4.2 shall be met.

**A.3 Functional specification**

Tables A.2 and A.3 contain the operating conditions for functional specifications and the functional specifications of 1,25-Gbit/s seeded RSOA devices with a monitor photodiode at the operating conditions.

**Table A.2 – Operating conditions for functional specification**

Parameter	Symbol	Value		Unit
		Minimum	Maximum	
Operating forward current	$I_{op}$		50	mA
Operating forward bias voltage	$V_f$	1,6	2,5	V