



JAPANESE
INDUSTRIAL
STANDARD

Translated and Published by
Japanese Standards Association

JIS C 5942 : 2010

(OITDA/JSA)

**General rules of laser diodes used for
recording and playback**

ICS 31.260;33.180.01

Reference number : JIS C 5942 : 2010 (E)

PROTECTED BY COPYRIGHT

 **Documents**
Document Sharing Hub

13 S

Date of Establishment: 1990-01-01

Date of Revision: 2010-05-20

Date of Public Notice in Official Gazette: 2010-05-20

Investigated by: Japanese Industrial Standards Committee
Standards Board

Technical Committee on Electronics Technology

JIS C 5942 : 2010, First English edition published in 2011-09

Translated and published by: Japanese Standards Association
4-1-24, Akasaka, Minato-ku, Tokyo, 107-8440 JAPAN

In the event of any doubts arising as to the contents,
the original JIS is to be the final authority.

© JSA 2011

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the publisher.

Printed in Japan

PROTECTED BY COPYRIGHT

Contents

	Page
Introduction	1
1 Scope	1
2 Normative references	1
3 Terms and definitions	3
4 Classification and outline	7
4.1 Classification	7
4.2 Outline and electrode connection	7
5 Performance and test	8
5.1 Maximum ratings	8
5.2 Electrical characteristics and optical characteristics	9
5.3 Performance and test for environment and durability	11
6 Safety of laser	13
7 Measurement	13
8 Marking	13
9 Precaution for handling	13
Annex JA (informative) Marking on electrostatic sensitive device	14
Annex JB (informative) Comparison table between JIS and corresponding International Standards	16

Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by Optoelectronics Industry and Technology Development Association (OITDA)/Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

Consequently **JIS C 5942 : 1997** is replaced with this Standard.

This **JIS** document is protected by the Copyright Law.

Attention is drawn to the possibility that some parts of this Standard may conflict with a patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have technical properties. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying the patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have the said technical properties.

General rules of laser diodes used for recording and playback

Introduction

This Japanese Industrial Standard has been prepared based on the first edition of **IEC 60747-5-4** published in 2006, and the first edition of **IEC 60747-5-2** published in 1997 and Amendment 1 published in 2002 with some addition, modification and deletion of the technical contents due to the limitation of the scope to the laser diodes used for recording and playback. The amendment has been compiled in this Standard.

The portions given sidelines or dotted underlines are the matters in which the contents of the original International Standards have been modified. A list of modifications with the explanations is given in Annex JB.

1 Scope

This Standard specifies general matters such as terms, symbols, classification and performances of laser diodes for recording and playback used as the light source (excluding those accommodated in electronic circuit or those accommodated in optical element ; hereafter referred to as “laser diodes”).

NOTE : The International Standards corresponding to this Standard and the symbol of degree of correspondence are as follows.

IEC 60747-5-4 : 2006 *Semiconductor devices—Discrete devices—Part 5-4 : Optoelectronic devices—Semiconductor lasers*

IEC 60747-5-2 : 1997 *Discrete semiconductor devices and integrated circuits—Part 5-2 : Optoelectronic devices—Essential ratings and characteristics* and Amendment 1 : 2002 (Overall evaluation : MOD)

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standards and **JIS** are IDT (identical), MOD (modified), and NEQ (not equivalent) according to **ISO/IEC Guide 21-1**.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. For standards with the year indication, only the editions of the indicated year shall be applied and any revisions (including amendments) made thereafter shall not be applied. For those without the indication of the year, the most recent edition (including amendments) shall be applied.

JIS C 0025 *Basic environmental testing procedures Part 2 : Tests Test N : Change of temperature*

NOTE : Corresponding International Standards : **IEC 60068-2-14** : 1984 *Environmental testing—Part 2 : Tests — Test N: Change of temperature and*
IEC 60068-2-33 : 1971 *Environmental testing—Part 2 : Tests—Guidance on change of temperature tests* (Overall evaluation : MOD)

JIS C 5943 *Measuring methods of laser diodes used for recording and playback*

JIS C 6802 *Safety of laser products*

JIS C 60068-2-1 *Environmental testing—Part 2-1 : Tests—Test A : Cold*

NOTE : Corresponding International Standard : **IEC 60068-2-1** : 1990 *Environmental testing—Part 2 : Tests—Test A : Cold* (IDT)

JIS C 60068-2-2 *Environmental testing—Part 2-2 : Tests—Test B : Dry heat*

NOTE : Corresponding International Standard : **IEC 60068-2-2** : 1974 *Environmental testing—Part 2 : Tests—Test B : Dry heat* (IDT)

JIS C 60068-2-6 *Environmental testing—Part 2-6 : Tests—Test Fc : Vibration (sinusoidal)*

NOTE : Corresponding International Standard : **IEC 60068-2-6** : 1995 *Environmental testing—Part 2 : Tests—Test Fc : Vibration (sinusoidal)* (IDT)

JIS C 60068-2-7 *Basic environmental testing procedures Part 2 : Tests—Test Ga and guidance : Acceleration, steady state*

JIS C 60068-2-11 *Basic environmental testing procedures Part 2 : Tests—Test Ka : Salt mist*

JIS C 60068-2-17 *Basic environmental testing procedures—Part 2 : Tests—Test Q : Sealing*

NOTE : Corresponding International Standard : **IEC 60068-2-17** : 1994 *Basic environmental testing procedures—Part 2 : Tests—Test Q : Sealing* (IDT)

JIS C 60068-2-20 *Environmental testing—Part 2-20 : Tests—Test T : Test methods for solderability and resistance to soldering heat of devices with leads*

JIS C 60068-2-21 *Environmental testing—Part 2-21 : Tests—Test U : Robustness of terminations and integral mounting devices*

JIS C 60068-2-27 *Basic environmental testing procedures—Part 2 : Tests, Test Ea and guidance : Shock*

NOTE : Corresponding International Standard : **IEC 60068-2-27** : 1987 *Environmental testing—Part 2 : Tests—Test Ea and guidance : Shock* (IDT)

JIS C 60068-2-32 *Environmental testing Part 2 : Tests. Test Ed : Free fall*

JIS C 60068-2-38 *Basic environmental testing procedures Part 2 : Tests Test Z/AD : Composite temperature/humidity cyclic test*

JIS C 60068-2-78 *Environmental testing—Part 2-78 : Tests—Test Cab : Damp heat, steady state*

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

3 Terms and definitions

For the purposes of this Standard, the following terms and definitions apply.

3.1 absolute maximum ratings

the limit value which shall not be exceeded even for an instant

Any one of the specified values shall not be exceeded.

3.2 storage temperature T_{stg}

the allowable ambient temperature of storage of laser diodes to which the power supply voltage and input signals are not applied

3.3 operating temperature

the temperature at which the operation of laser diodes is ensured under the specified voltage or current

It shall be expressed by the ambient temperature (T_{amb}) or the case temperature (T_{case}).

3.4 radiant power or optical output power P_o

the optical power taken out from the optical output end

In this case, the numerical aperture NA of optical measurement may sometimes be specified.

3.5 operating voltage V_{op}

the forward voltage at which the specified radiant power is obtained

3.6 operating current I_{op}

the forward current at which the specified radiant power is obtained

3.7 threshold current I_{th}

the forward current at which the laser emission is activated due to the stimulated emission

3.8 radiant power at threshold P_{th}

the radiant power at the threshold current

3.9 differential efficiency η_d

the quotient of the difference in radiant power between two points such that the radiant power at the operating current is taken as one point and the radiant power at the threshold current, or the threshold current or higher but sufficiently lower than the operating current is taken as the other point divided by the difference in current

3.10 longitudinal mode

mode of the electromagnetic field that exists in the optical axis direction of a laser resonator

Many laser diodes have multiple emission modes called as the multimode emission, while the emission especially in a single longitudinal mode is called as the single mode emission.

3.11 peak emission wavelength λ_p

the wavelength at which the laser emission is the maximum

3.12 central emission wavelength λ_c

the wavelength of the centre of an emission spectrum

The central emission wave length shall be obtained by any of the following measurement methods.

- a) **Envelope method** The average wavelength of the wavelength on the longest side and the wavelength on the shortest side when peaks of each longitudinal mode are connected by an envelope and the envelope becomes the specified value to the peak of the longitudinal mode.
- b) **N-dB method** The average wavelength of the emission wavelength of a longitudinal mode on the longest side and the emission wavelength of a longitudinal mode on the shortest side among wavelengths that become a specified value to the peak in the wavelength band of both sides of a peak emission wavelength. When the specified value is 50 % of the peak, this method is called a threshold method, also.
- c) **RMS method** The wavelength obtained according to the following equation from the radiant power and the emission wavelength of the n th longitudinal mode.

$$\lambda_c = \frac{\sum A_n \times \lambda_n}{\sum A_n}$$

where, λ_c : central emission wavelength
 λ_n : emission wavelength of n th longitudinal mode
 A_n : radiant power of n th longitudinal mode

3.13 spectral radiation bandwidth $\Delta\lambda_w$

spread of an emission spectrum

The spectral radiation bandwidth of 50 % of the maximum intensity of an emission spectrum is specially called spectral half bandwidth or FWHM (full width at half maximum). The spectral radiation bandwidth is obtained by any of the following measurement methods.

- a) **Envelope method** The difference between the wavelength on the longest side and the wavelength on the shortest side when peaks of each longitudinal mode are connected by an envelope and the envelope becomes a specified value to the peak of the longitudinal mode.
- b) **N-dB method** In the case of single mode emission, the spectral radiation bandwidth cut by the specified value to the peak of a longitudinal mode. In the case of multimode emission, the difference between the wavelength on the longest side and the wavelength on the shortest side among longitudinal modes that emit at not less than the specified value to the peak of the longitudinal mode. In the case of single longitudinal mode emission, the spread width of a spectral line that becomes a specified value to the maximum peak of an emitting longitudinal mode (when the spectral half bandwidth is to be obtained, the value of 50 % of the peak).
- c) **RMS method** The bandwidth obtained according to the following equation from the radiant power and the emission wavelength of the n th longitudinal mode.