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Measuring methods of light emitting diodes for fiber optic transmission

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of International Trade and Industry through deliberations at Japanese Industrial Standards Committee in accordance with the Industrial Standardization Law. Consequently, JIS C 5951:1989 has been revised and replaced with this Standard.

In this revision, conformance of provisions between JIS and International standard was taken into consideration.

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.

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Measuring methods of light emitting diodes for fiber optic transmission

Introduction Users should note that at application of this Standard, the normative references to this Standard shall be referred at the same time. Further, it is often necessary to carry out comparison with and study on the similar standard(s), if any.

This is a Japanese Industrial Standard prepared based on IEC 747–5, *Semiconductor devices. Discrete devices and integrated circuits—Part 5: Optoelectronic devices* issued in 1992 and IEC 747–5 Amendment 1 issued in 1994 without any modification in technical contents.

1 Scope This Japanese Industrial Standard specifies the measuring methods of light emitting diodes for fiber optic transmission to be used as the light source (diodes accommodated in electronic circuit are excluded, hereafter referred to as “light-emitting diode”).

Remarks 1 The normative references to this Standard are as follows.

JIS C 0301 *Graphical symbols for electrical apparatus*

JIS C 1102 *Electrical indicating instruments*

JIS C 5001 *General rules for electronic components*

JIS C 5941 *Test methods of laser diodes for fiber optic transmission*

JIS C 5950 *General rules of light emitting diodes for fiber optic transmission*

2 The International Standard corresponding to this Standard is shown below.

IEC 747–5:1992 *Semiconductor devices. Discrete devices and integrated circuits—Part 5: Optoelectronic devices*

IEC 747–5 Amendment 1: 1994

2 Definitions For the purpose of this Standard, the principal definitions given in JIS C 5950 apply.

3 Atmospheric conditions for measurement

3.1 Standard conditions Unless otherwise specified the measurements shall be carried out under the standard conditions (temperature 15 °C to 35 °C, relative humidity 25 % to 85 %, air pressure 860 hPa to 1 060 hPa) specified in 4.1 of JIS C 5001. If any doubt arises on the decision of measured values under this standard conditions or if specially required, the measurements shall be carried out under the conditions of 3.3.

If the measurement under the standard conditions is difficult, the measurement may be carried out under the conditions other than the standard conditions unless doubt arises on the decision.

3.2 Reference conditions The reference conditions shall be those specified in 4.2 of JIS C 5001 (temperature 25 °C, relative humidity 45 %, air pressure 860 hPa to 1 060 hPa). However, only the temperature may be employed as the reference condition.

3.3 Referee conditions The referee conditions shall be the referee condition 1, temperature grade 2 and relative humidity grade 2 (temperature 25 ± 2 °C, relative humidity 45 % to 55 %, air pressure 860 hPa to 1 060 hPa) specified in 4.3 of JIS C 5001.

4 Measuring apparatus and equipment

4.1 Measuring power supply The d.c. power supply shall be of a ripple content not exceeding 3 %, the higher harmonic content of a.c. power supply and the a.c. impedance of the d.c. power supply circuit through which a.c. current flows shall have small values so that they will not affect the measurement.

Enough protective means shall be provided against ingress of surge.

4.2 Instrument and measuring apparatus Unless otherwise specified the instrument shall be that of class index 0.5 or better specified in JIS C 1102* and the measuring apparatus shall have at least equivalent accuracy, and their impedances shall be such that the influence on the measuring system is negligible.

Remarks: If there is no instrument of class index 0.5 or better, or measuring apparatus of equivalent accuracy as the standard products, the provision of 4.2 does not apply.

Note (*) JIS C 1102 was revised into JIS C 1102-1 to 9.

4.3 Optical power meter The optical power meter shall be calibrated at the appropriate wavelength, and shall have sufficiently flat sensitivity profile on its photo-receptive plane.

5 Appearance The appearance shall be examined by a stereo microscope and/or metallurgical microscope.

6 Measuring method

6.1 Forward current (I_f)

6.1.1 Purpose The purpose is to measure the forward current of light emitting diode under specified conditions.

6.1.2 Measuring circuit Carry out the measurement of forward current in the circuit of Fig. 1, in accordance with the method stated below.

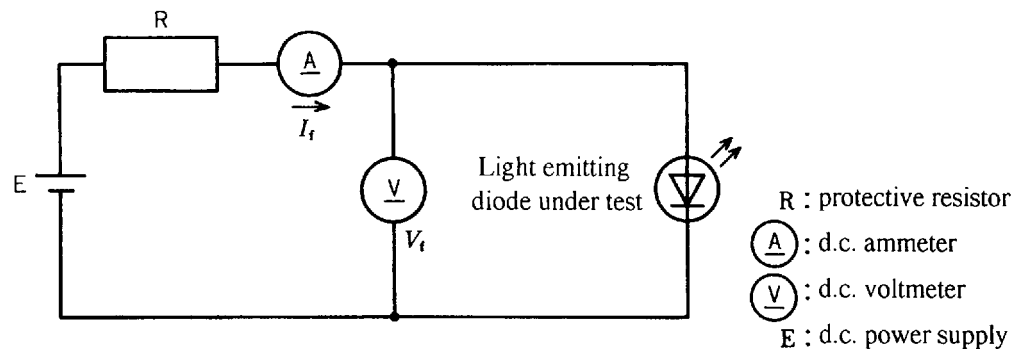


Fig. 1 Measurements of forward current and forward voltage

6.1.3 Measuring method Measure the forward current I_f of the light emitting diode when the specified forward voltage V_f is applied across electrode terminals. However, this measurement may be made by such a method that an a.c. power supply not exceeding 1 kHz is used and the current–voltage waveform is displayed on the picture plane of an oscilloscope.

6.1.4 Precaution If the light emitting diode consumes significant electric power so that the temperature rise of junction influences greatly the measured values, carry out the test by either of following methods and describe clearly the method.

- (1) Use the direct current and measure the current after the thermal equilibrium has been attained. If the thermal equilibrium is not attained, measure the current after the specified time from initiation of application of the specified voltage.
- (2) Measure the current by means of pulses or in a short time during which the temperature rise of junction is ignorable.

When pulses are used, describe clearly the pulse width and duty cycle.

The internal resistance of voltmeter must be sufficiently larger than the resistance of light emitting diode so that the measured values are not influenced.

6.1.5 Items to be specified in detail specifications

- (1) Forward voltage V_f
- (2) Operating temperature T_{op}

6.2 Forward voltage (V_f)

6.2.1 Purpose The purpose is to measure the forward voltage of light emitting diodes under specified conditions.

6.2.2 Measuring circuit Carry out the measurement of forward voltage in the circuit of Fig. 1, in accordance with the method stated below.

6.2.3 Measuring method Pass the specified forward current I_f through the light emitting diode and measure the forward voltage V_f at that time. However, this measurement may be made by such a method that an a.c. power supply not exceeding 1 kHz is used and the current – voltage waveform is displayed on the picture plane of an oscilloscope.

6.2.4 Precaution If the light emitting diode consumes significant electric power so that temperature rise of junction influences greatly the measured values, carry out the test by either of the following methods and describe the method clearly.

- (1) Use the direct current and measure the voltage after the thermal equilibrium has been attained. If the thermal equilibrium is not attained, measure the voltage after the specified time from initiation of passing the specified current.
- (2) Measure the voltage by means of pulses or in a short time during which the temperature rise of junction is ignorable.

When the pulses are used, describe clearly the pulse width and duty cycle.

6.2.5 Items to be specified in detail specifications

- (1) Forward current I_f and its application conditions
- (2) Operating temperature T_{op}

6.3 Reverse current (I_r)

6.3.1 Purpose The purpose is to measure the reverse current of light emitting diodes under specified conditions.

6.3.2 Measuring circuit Carry out the measurement of reverse current in the circuit of Fig. 2, in accordance with the method stated below.

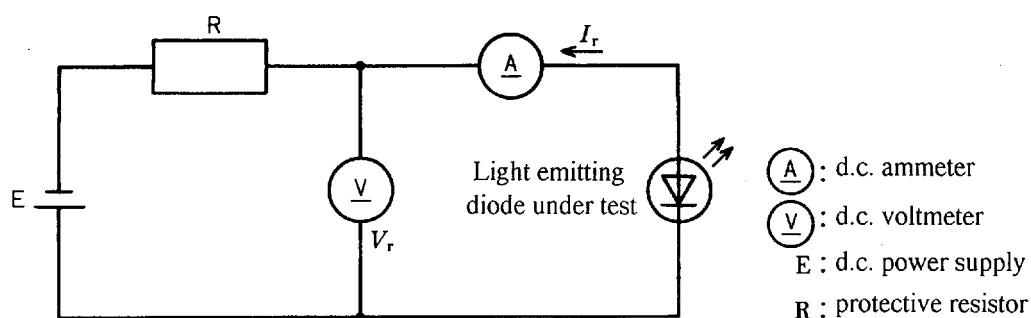


Fig. 2 Measurements of reverse current and reverse voltage

6.3.3 Measuring method Apply the specified reverse voltage V_r across the electrode terminals of the light emitting diode, and measure the reverse current I_r at that time. However, this measurement may be made by such a method that an a.c. power supply not exceeding 1 kHz is used and the current-voltage waveform is displayed on the picture plane of an oscilloscope

6.3.4 Precaution If the light emitting diode consumes significant electric power so that the temperature rise of junction influences greatly the measured values, carry out the test by either of the following methods and describe clearly the method.

- (1) Use the direct current and measure the current after the thermal equilibrium has been attained. If the thermal equilibrium is not attained, measure the current after the specified time from initiation of application of the specified voltage.

- (2) Measure the current by means of pulses or in a short time during which the temperature rise of junction is ignorable.

When the pulses are used, describe clearly the pulse width and duty cycle.

If the specified reverse voltage is higher than the maximum d.c. reverse voltage and lower than the maximum peak reverse voltage, use only the method of (2) in the above.

The internal resistance of voltmeter must be sufficiently larger than the resistance of light emitting diode so that the measured values are not influenced.

6.3.5 Items to be specified in detail specifications

- (1) Reverse voltage V_r
- (2) Operating temperature T_{op}

6.4 Reverse voltage (V_r)

6.4.1 Purpose The purpose is to measure the reverse voltage of light emitting diodes under specified conditions.

6.4.2 Measuring circuit Carry out the measurement of reverse voltage in the circuit of Fig. 2, in accordance with the method stated below.

6.4.3 Measuring method Pass the specified reverse current I_r through the light emitting diode and measure the reverse voltage V_r at that time. However, this measurement may be made by such a method that an a.c. power supply not exceeding 1 kHz in used the current-voltage waveform is displayed on the picture plane of an oscilloscope.

6.4.4 Precaution If the light emitting diode consumes significant electric power so that the temperature rise of junction influences greatly the measured values, carry out the test by either of following methods and describe clearly the method.

- (1) Use the direct current and measure the voltage after the thermal equilibrium has been attained. If the thermal equilibrium is not attained, measure the voltage after the specified time from initiation of passing the specified current.
- (2) Measure the voltage by means of pulses or in a short time during which the temperature rise of junction is ignorable.

When the pulses are used, describe clearly the pulse width and duty cycle.

6.4.5 Items to be specified in detail specifications

- (1) Reverse current I_r
- (2) Operating temperature T_{op}

6.5 Total capacitance

6.5.1 Purpose The purpose is to measure the capacitance between both terminations of light emitting diodes under specified conditions.