Symbols and Definitions

1. The Absolute Maximum Ratings

The absolute maximum ratings specified in this data book are the values which should not be exceeded under any condition. They are defined at the case temperature, T_C, of 25°C unless otherwise specified. However, individual specification prescribes the temperature dependency of the characteristic.

The absolute maximum ratings of laser diodes (LDs) and infrared emitting diodes (IREDs) are defined individually as follows.

Table 1 Absolute Maximum Ratings

Item	Applicable Devices		Definitions
	LDs	IREDs	
Optical output power, P_O, $P_{O(pulse)}$, Pf	○	○	Maximum tolerable output power under continuous wave (CW) or pulsed whatever specified operation. The power of device with a numerical aperture is shown as optical output power, Pf.
Forward current, I_F		○	Maximum tolerable current under CW operation.
Reverse voltage, V_R	○	○	Maximum tolerable reverse bias voltage applied to a device. For the LDs with a built-in photodiode, the reverse voltages of the photodiode, $V_{R(PD)}$, and of the LD, $V_{R(LD)}$, are specified respectively.
Operating temperature, Topr	○	○	Operating temperature is defined by the value of the case temperature of a device. This value also differs according to package type.
Storage temperature, Tstg	○	○	Ambient temperature range under which a device can be safely stored. This value differs according to package type.

2. Optical and Electrical Characteristics

The limit values and the typical values of optical and electrical characteristics are described in this data book as much as possible for the user's convenience for application to electrical circuits and optics.

The definitions of optical and electrical characteristics are listed below.

Table 2 LD Optical and Electrical Characteristics

Item	Definitions
Optical output power, P_O, $P_{O(pulse)}$, Pf	Optical output power under the specified forward current, I_F. The power of device with a numerical aperture is shown as optical output power, Pf.
Threshold current, Ith	Forward current at which a diode starts to laser (figure 1). Practically, this value is specified as the crossing point of x axis and the extension of line B, where "A" is spontaneous emission region and "B" lasing region.
Operating current, I_{OP}	Forward current under the specified optical output power.
Operating voltage, V_{OP}	Forward voltage under the specified optical output power.
Slope efficiency, ηs	Optical output power increment per unit drive current in lasing region (B region) of figure 1.
Droop, –Rth	Droop is defined as the variation of the optical output power between two duty cycles at 600 Hz. It is calculated by the formula as below; where P0 is the initial power at the duty cycle of 10% and P1 is the end power at the duty cycle of 90% (figure 2). $-\text{Rth} = \frac{P_1 - P_0}{P_1} \times 100 \ (\%)$
Beam divergence parallel to the junction, θ// Beam divergence perpendicular to the junction, θ⊥ Astigmatism, A_S	Divergence of light beam emitted from a laser diode is described in figure 3 (a). θ// is the full angle at a half of the peak intensity in the parallel profile (figure 3 (b)). θ⊥ is the full angle at a half of the peak intensity in the perpendicular profile (figure 3 (c)). The position of the beam waist of the parallel profile is in the device while that of the perpendicular profile is at the facet. The distance between the two positions is defined as astigmatism (figure 3 (d)).
Lasing wavelength, λp	Maximum intensity wavelength in a spectral distribution (figure 4).
Rise time, t_r Fall time, t_f	Rise time, t_r, is time required for light intensity to rise from 10 to 90% of maximum output power when drive current is switched on. Fall time, t_f, is time required for light intensity to fall from 90 to 10% of maximum output power when current is switched off. (Figure 5)
Monitor current, I_S	Current of photodiode operated at the specified optical output power, P_O or Pf . It applies only to a device with a built-in photodiode.
Dark current, I_{DARK}	Leakage current of photodiode at the specified reverse voltage without any light input.
Capacitance ,Ct	Junction capacitance at the specified reverse bias voltage.

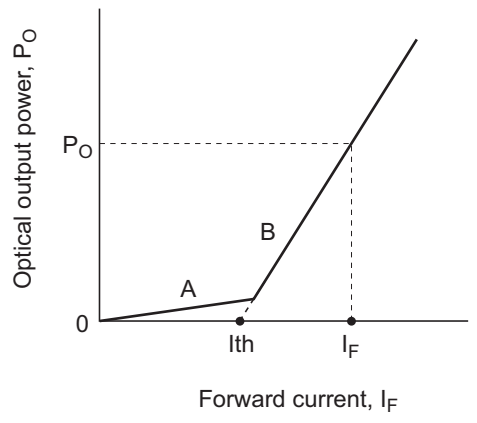


Figure 1 Light vs. Current Characteristics

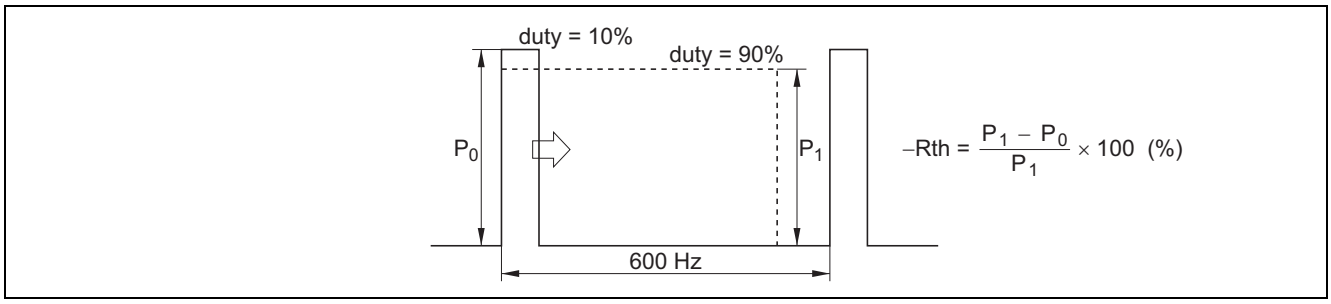


Figure 2 Droop

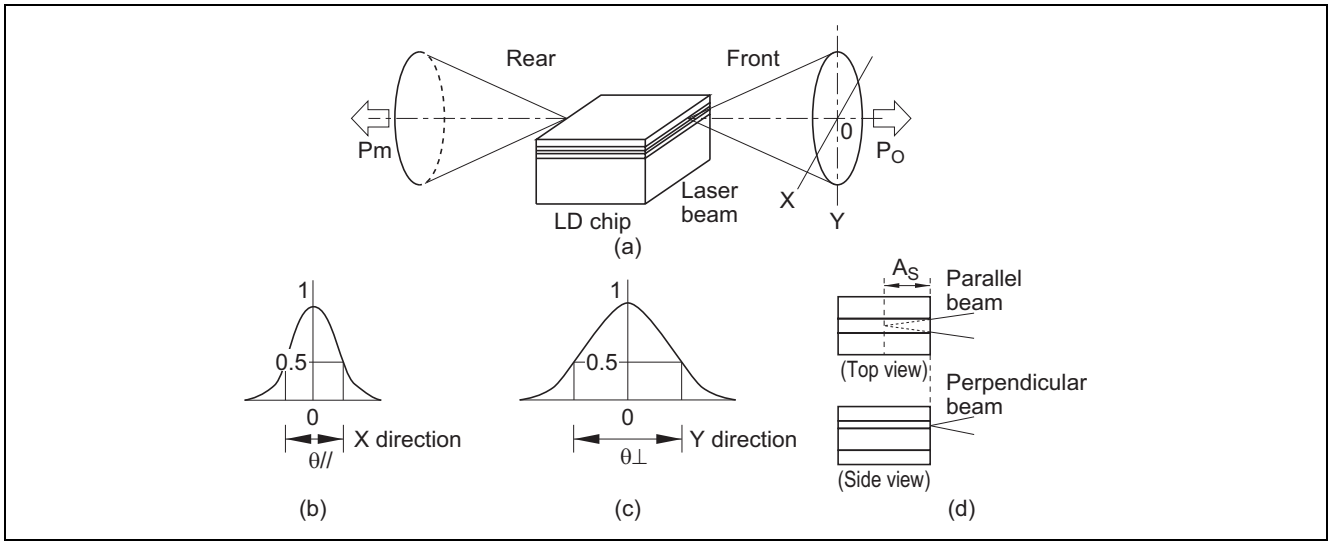


Figure 3 Beam Divergence and Astigmatism

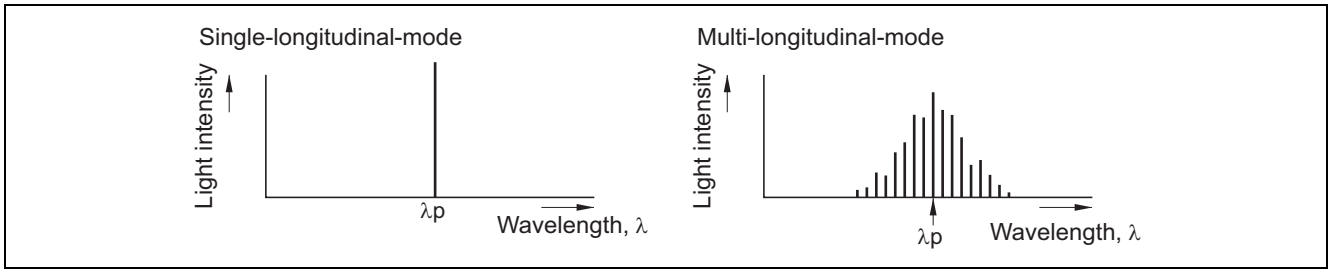


Figure 4 Lasing Spectrum

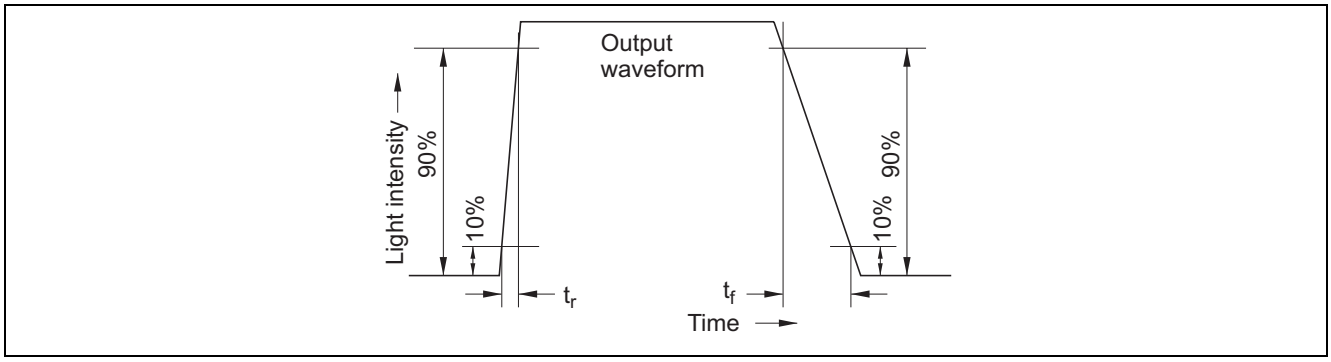
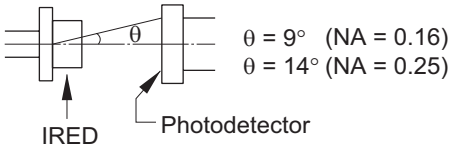


Figure 5 Definition of Rise & Fall Time

Table 3 IRED Optical and Electrical Characteristic

Item	Definitions
Optical output power, P_O (Pf)	Total optical output power emitted from chip at specified forward current (figure 6). The power of device with a fiber pigtail is shown as fiber optical output power, Pf.
Forward optical output power, P_F	Indicates forward optical output power emitted from chip for prescribed forward current, I_F. This measurement is carried out with NA = 0.16 or 0.25, as shown in the figure below. 
Peak wavelength, λp Spectral width, Δλ	Wavelength width at half intensity of the peak wavelength (figure 7). This differs according to junction structure, single vs. double heterojunction structure.
Beam divergence, θ_H	Full angle at half of maximum peak intensity.
Forward voltage, V_F	Forward voltage at the specified forward current input.
Reverse current, I_R	Leakage current at the specified reverse voltage.
Capacitance, Ct	Junction capacitance at the specified reverse bias voltage.
Rise time, t_r Fall time, t_f	Rise time, t_r, is time required for light intensity to rise from 10 to 90% of maximum output power when current is switched on. Fall time, t_f, is time required for light intensity to fall from 90 to 10% of maximum power when current is switched off (figure 5).

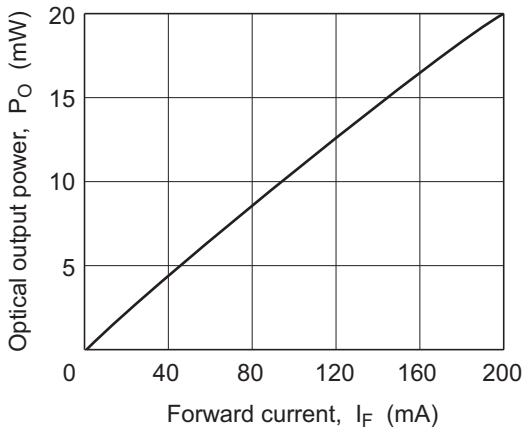


Figure 6 Light vs. Current Characteristics

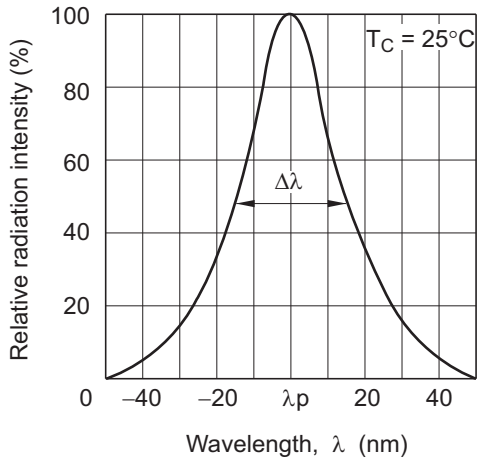


Figure 7 Spectral Characteristics for HE8807SG