

Symbols and definitions

(1) Absolute maximum ratings

Absolute maximum ratings are values which must not be exceeded even momentarily regardless of external conditions. These values are specified for a case temperature T_C of 25°C.

Item	Symbol	Definition
Optical output	P_O	Maximum allowable optical output during continuous or pulse operation. No kinks will appear in the output vs. forward current curve up to this output value. (Fig. 11)
Reverse voltage	V_R	The maximum allowable voltage when a reverse bias is applied to the device. Lasers and photo diodes are rated separately.
Operating temperature	T_{opr}	Allowed ambient temperature range when the device is in operation. Defined to be the case temperature of the device.
Storage temperature	T_{stg}	Allowed temperature range when the device is being stored.

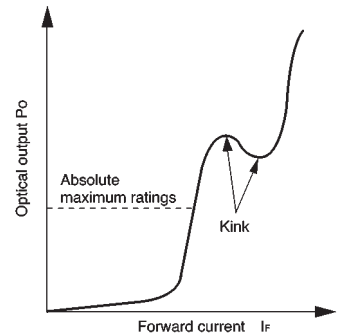


Fig. 11 Optical output vs. forward current

● Electrical and optical characteristics

Item	Symbol	Definition
Threshold current	I_{th}	In Fig. 12, A is the spontaneous emission range and B is the stimulated emission range. The threshold current is the current at which laser emission begins.
Operating current	I_{OP}	The forward current required to generate the specified optical output.
Operating voltage	V_{OP}	The forward voltage required to generate the specified optical output.
Differential efficiency	η	The average increase in the output per unit of drive current. In the laser emission range, this is the slope of the linear optical output vs. forward current curve. (Fig. 12)
Monitor current	I_m	When the specified optical output is generated, this is the output current of the photo diode when a specified reverse voltage is applied to the monitor photo diode.
Parallel divergence angle Perpendicular divergence angle	$\theta_{//}$ θ_{\perp}	Light emitted from the laser spreads as shown in Fig. 13. The result of measurements of this spread in the parallel (x) and perpendicular (y) directions with respect to the junction surface is shown in Fig. 13. The widths of the spread at the points where the strength drops to 1 / 2 the peak strength (half value full angles) are defined as angles and called $\theta_{//}$ and θ_{\perp} . (Fig. 14)
Parallel deviation angle Perpendicular deviation angle	$\Delta \phi_{//}$ $\Delta \phi_{\perp}$	These values express the deviation of the optical axis with respect to the reference plane, and are defined for the parallel and perpendicular spread angles (Fig. 14) to be $(a - b) / 2$ (Fig. 15).
Emission point accuracy	$\Delta X, \Delta Y, \Delta Z$	This indicates the amount of deviation of the emission point. Δx and Δy indicate deviation from the center of the package, and Δz indicates deviation from the reference plane. (Fig. 16)
Peak emission Wavelength	λ	Peak emission wavelength when generating the specified output. As shown in Fig. 17, the emission spectrum has both a single mode and a multimode. In the case of the multimode, the wavelength is defined as the wavelength with the highest intensity.
Coherence	γ	This parameter indicates the coherence of a laser beam. When the laser beam forms interference fringes, this parameter indicates the amount of attenuation of the clarity of the fringes.
Astigmatism (wavefront aberration)	Δl ($\Delta \Phi$)	Astigmatism refers to an apparent difference between the parallel and perpendicular (with respect to the junction plane) focal points (Fig. 18). In terms of laser wave characteristics this is called wavefront aberration, and is given by the following equation: $\Delta \Phi = \frac{1}{4\sqrt{6}} (\Delta \ell) (NA)^2 \frac{1}{\lambda}$
Droop	ΔP	Attenuation of output when the laser is driven by pulse. This is defined as $(P_1 - P_4) / P_4 \times 100\%$ as shown in Fig. 19.

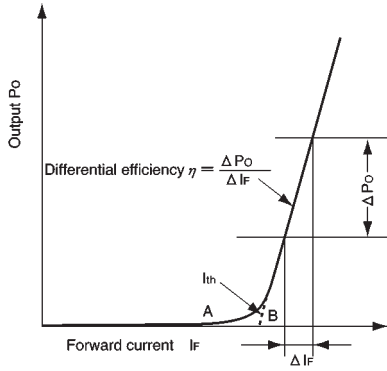


Fig. 12 Optical output vs. forward current

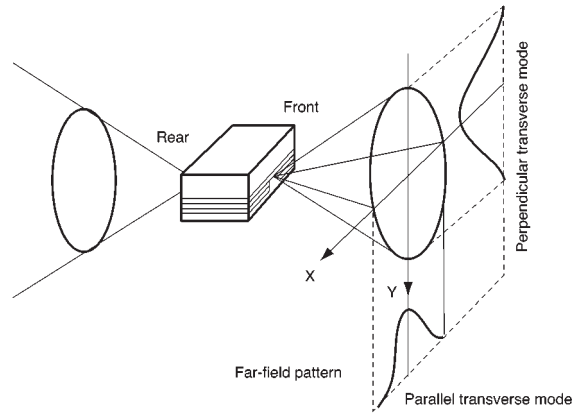


Fig. 13 Radiation characteristics

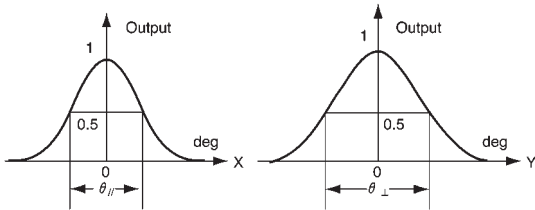


Fig. 14 Radiation characteristics

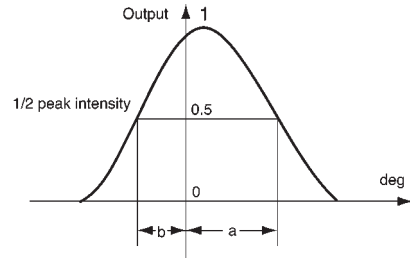


Fig. 15 Deviation angle

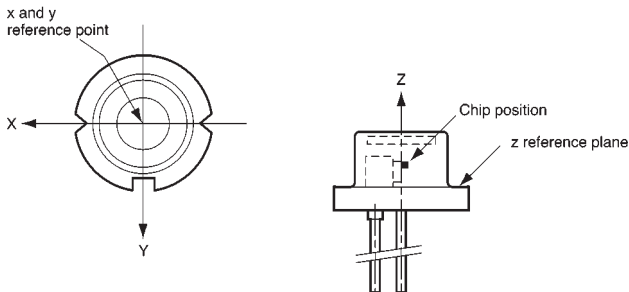


Fig. 16 Emission point accuracy

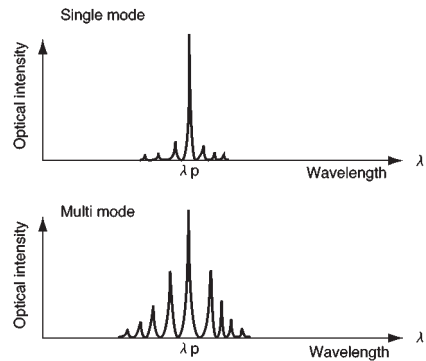


Fig. 17 Emission spectrum

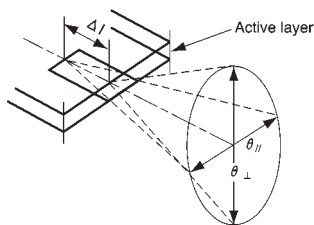


Fig. 18 Astigmatism

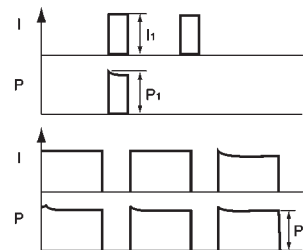


Fig. 19 Droop

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