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TYPE NAME

ML7701A, ML7911A

DESCRIPTION

Mitsubishi ML7XX1A series are InGaAsP laser diodes emitting light beams around 1310nm wavelength. They lase by applying forward current exceeding threshold values, and emit light power of about 25mW/facet at an operating current of around 60mA in excess of the threshold current. They operate, under CW or pulse conditions according to input current, at case temperatures up to 50°C.

The ML7701A are hermetically sealed devices having a InGaAs pin photodiode for monitoring the light output. Output current of the photodiode can be used for automatic control of the operating currents or case temperatures of the lasers.

The ML7911A are specially designed for installation in fiber modules and are mounted on flat open packages. Rear output can be used for automatic control of the operating current or case temperature of the laser. They are well suited for light sources in optical communication systems.

FEATURES

- Stable fundamental transverse mode oscillation
- Low threshold current, low operating current
- Pin photodiode is installed in the laser package
- High reliability, long operation life
- High power (CW 30mW, Pulse 100mW)
- 1310nm typical emission wavelength

APPLICATION

Digital communication systems, OTDR systems

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Conditions	Ratings	Unit
P_O	Light output (peak)	CW	30	mW
		Pulse (Note 1)	100	
V_{RL}	Reverse voltage	—	2	V
V_{RML}	Peak reverse voltage	—	2	V
V_{RD}	Reverse voltage (Photodiode)	—	20	V
V_{RMD}	Peak reverse voltage (Photodiode)	—	20	V
I_{FD}	Forward current (Photodiode)	—	2	mA
T_C	Case temperature	—	−20~+50	°C
Tstg	Storage temperature	—	−40~+100	°C

Note 1 : Duty less than 1%, pulse width less than 1μs.

ELECTRICAL/OPTICAL CHARACTERISTICS (T_C=25°C)

Symbol	Parameter	Test conditions	Limits			Unit
			Min.	Typ.	Max.	
I_{th}	Threshold current	CW	—	10	35	mA
I_{OP}	Operating current	CW, P_O=25mW	—	70	130	mA
V_{OP}	Operating voltage	CW, P_O=25mW	—	2.0	3.0	V
P_O	Light output	CW, I_F=I_{th}+60mA	—	25	—	mW
λ_P	Peak wavelength	CW, P_O=25mW	1280	1310	1330	nm
$\Delta\lambda_P$	Spectral half width	CW, P_O=25mW	—	8	—	nm
$\theta_{//}$	Full angle at half maximum (parallel)	CW, P_O=25mW	—	25	—	deg.
$\theta_{\perp}$	Full angle at half maximum (perpendicular)	CW, P_O=25mW	—	30	—	deg.
t_r, t_f	Rise and fall times	I_F=I_{th}, P_O=25mW, 10%~90%	—	0.3	0.7	ns
I_m	Monitoring output current	CW, P_O=25mW, V_{RD}=1V, R_L=10Ω (Note 2)	0.2	0.5	—	mA
I_D	Dark current (Photodiode)	V_{RD}=10V	—	0.2	0.5	μA
C_t	Capacitance (Photodiode)	V_{RD}=10V, f=1MHz	—	8	20	pF
P_m (Note 3)	Monitoring Light Output	CW, P_O=25mW	—	1.0	—	mW

Note 2 : R_L is load resistance of the photodiode.
Note 3 : P_m only apply to ML7911A.

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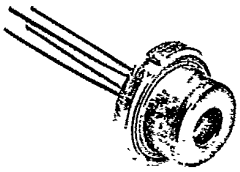
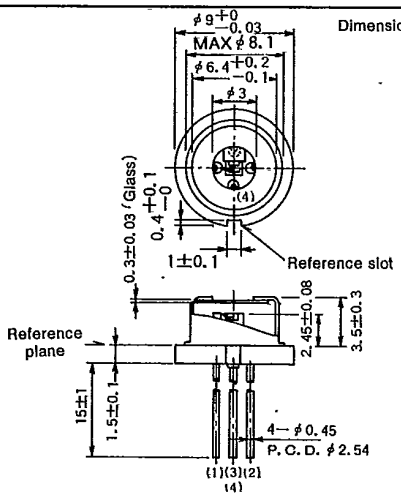
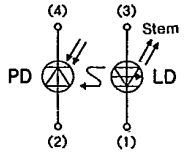
OUTLINE DRAWINGS

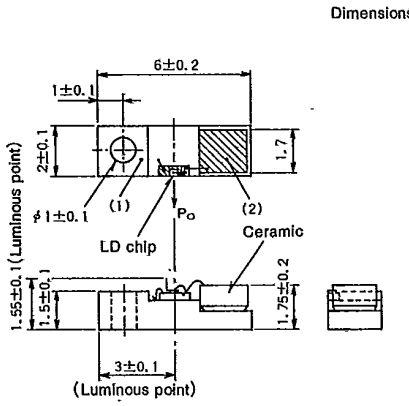
ML7701A







ML7911A



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1 Light output vs. forward current

Typical light output vs. forward current characteristics are shown in Fig. 1. The threshold current for lasing is typically 10mA at room temperature. Above the threshold, the light output increases linearly with current, and no kinks are observed in the curves. As can be seen in Fig. 1, the threshold current and slope efficiency (dP_O/dI_F) depends on case temperature of the lasers. This suggests that automatic control of temperature or current is necessary to keep the light output constant since temperature variation is inevitable in practical systems. The automatic controls should be such that the maximum ratings for the light output and the case temperature are not exceeded. "OPERATING CONSIDERATIONS." gives an example of an automatic light output control circuit.

Fig. 1 Light output vs. forward current

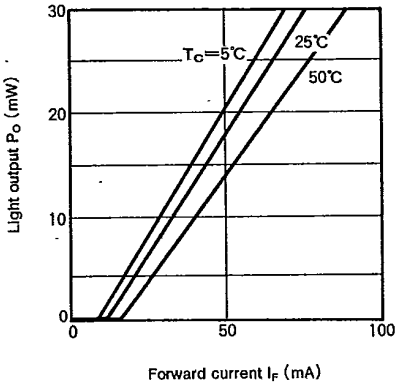
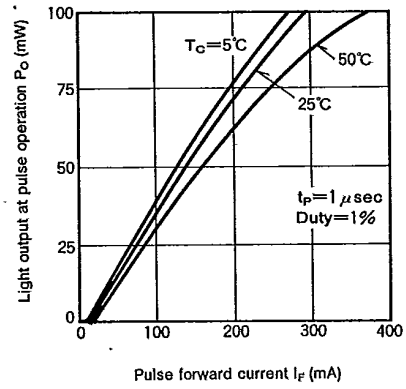


Fig. 2 shows a typical light output vs. forward current at pulse operation.
Pulse conditions are pulse width t_P=1μsec and duty=1%. They emit light power of 100mW up to 50℃ case temperature.

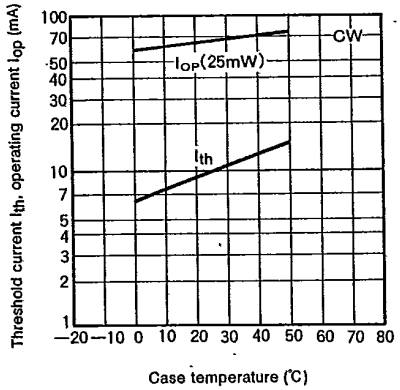
Fig. 2 Light output vs. forward current at pulse operation



2 Temperature dependence of I_{th}, I_{op}

Typical temperature dependence of the threshold and operating currents is shown in Fig. 3. The characteristic temperature T_0 of the threshold current is typically 55K for $T_C \leqq 50℃$, where the definition of To is $I_{th} \propto \exp(T_C/T_O)$.

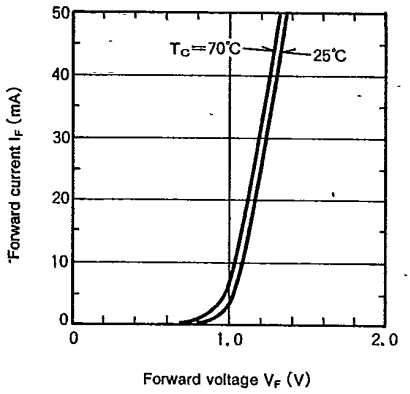
Fig. 3 Temperature dependence of threshold and operating currents



3 Forward current vs. voltage

Typical forward current vs. voltage characteristics are shown in Fig. 4. In general, as the case temperature rises, the forward voltage V_F decreases slightly against the constant current I_F. V_F varies typically at a rate of −1.3mV/℃ and −1mW/℃ at I_F =1mA and 10mA, respectively.

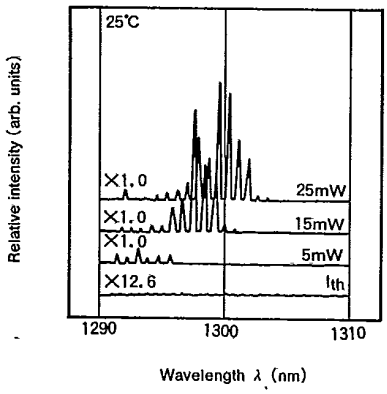
Fig. 4 Forward current vs. voltage characteristics



4 Emission spectra

Typical emission spectra under CW operation are shown in Fig. 5. In general, at an output of 25mW, several modes are observed. Longitudinal mode spacings are typically 1nm and spectral width (FWHM) is typically 8nm at an output of 25mW. The peak wavelength depends on the operating case temperature and the forward current (output level).

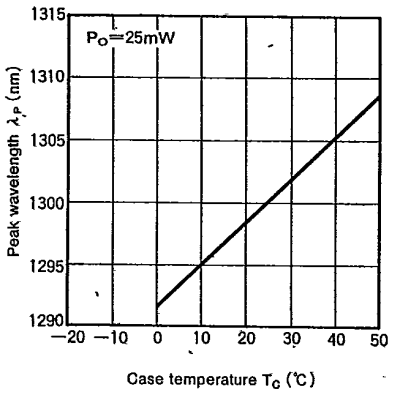
Fig. 5 Emission spectra under CW operation



5 Temperature dependence of peak wavelength

A typical temperature dependence of the peak wavelength at an output of 25mW is shown in Fig.6.
The peak wavelength of the beam shifts to adjacent longitudinal mode by variation of operating temperature.
Averaged temperature coefficient is about 0.35nm/℃.

Fig. 6 Temperature dependence of peak wavelength



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6 Far-field radiation pattern

The ML7XX1A laser diodes lase in fundamental transverse (TE_{00}) mode and the mode does not change with the current. They have a typical emitting area (size of near-field pattern) of $1.25 \times 1.0 \mu m^2$. Fig. 7 and Fig. 8 show typical far-field radiation patterns in "parallel" and "perpendicular" planes.

The full angles at half maximum points (FAHM) are typically 25° and 30°.

Fig. 7 Far-field patterns in plane parallel to heterojunctions

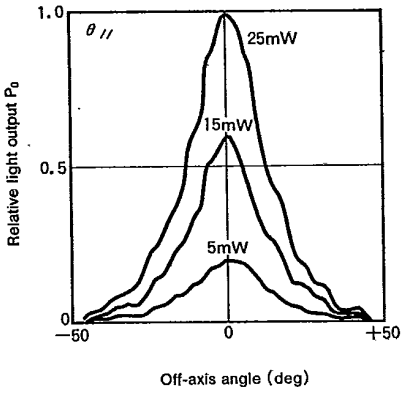
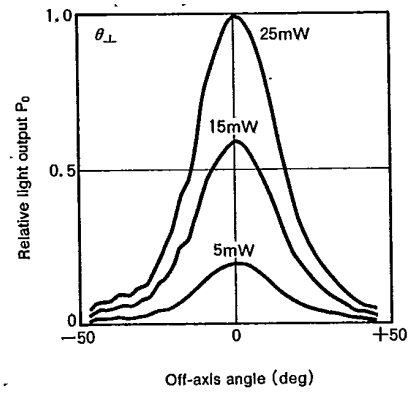


Fig. 8 Far-field patterns in plane perpendicular to heterojunctions



7 Monitoring output

The laser diodes emit beams from both of their mirror surfaces, front and rear surfaces (see the outline drawing). The rear beam can be used for monitoring the power of the front beam since the power of the rear beam is proportional to the front one. In the ML7XX1 series, the rear beam power is changed into photocurrents by monitor photodiodes. Fig. 10 shows typical light output vs. monitoring photocurrent characteristics. Above the threshold current, the monitoring photocurrent increases linearly with the front light output. The monitoring output current is typically 0.5mA when the front light output is 25mW.

In the ML7911A, monitor photodiodes is not installed in the laser package. Monitoring output is emitted from the back of package.

Monitoring output is typically 1mW when the front light output is 25mW.

Fig. 9 Light output vs. monitoring output current