

HL7838G**GaAlAs LD****T-41-05****Description**

The HL7838G is a 0.78 μm band GaAlAs laser diode with a double heterojunction structure and is appropriate as the light source for various optical application devices, including laser beam printers and laser levellers.

Features

- Visible light output: $\lambda_p = 770$ to 795 nm
- High output: 20 mW in standard continuous operation, and 30 mW in pulsed operation.
- Built-in monitor photodiode
- Single longitudinal mode lasing

Absolute Maximum Ratings ($T_C = 25^\circ\text{C}$)

Item	Symbol	Rated Value	Units
Optical output power	P_O	20	mW
Pulse optical output power	$P_{O(\text{pulse})}$	30*	mW
LD reverse voltage	$V_R(\text{LD})$	2	V
PD reverse voltage	$V_R(\text{PD})$	30	V
Operating temperature	T_{opr}	-10 to +60	$^\circ\text{C}$
Storage temperature	T_{stg}	-40 to +85	$^\circ\text{C}$

* At a duty cycle under 50% and pulse widths under 1 μs

Optical and Electrical Characteristics ($T_C = 25^\circ\text{C}$)

Item	Symbol	Min	Typ	Max	Units	Test Conditions
Threshold current	I_{th}	20	—	70	mA	
Optical output power	P_O	20	—	—	mW	Kink free
Slope efficiency	η	0.3	0.45	—	mW/mA	$\frac{12 \text{ (mW)}}{I(16 \text{ mW}) - I(4 \text{ mW})}$
Lasing wavelength	λ_p	770	780	795	nm	$P_O = 20 \text{ mW}$
Beam divergence (parallel)	$\theta_{\parallel}$	8	10	14	deg.	$P_O = 20 \text{ mW}$
Beam divergence (perpendicular)	$\theta_{\perp}$	20	26	35	deg.	$P_O = 20 \text{ mW}$
Monitor current	I_S	30	—	—	μA	$V_R(\text{PD}) = 5 \text{ V}$ $P_O = 2 \text{ mW}$

HL7838G**Internal Circuit**

T-41-05

Package Type
• HL7838G: G2

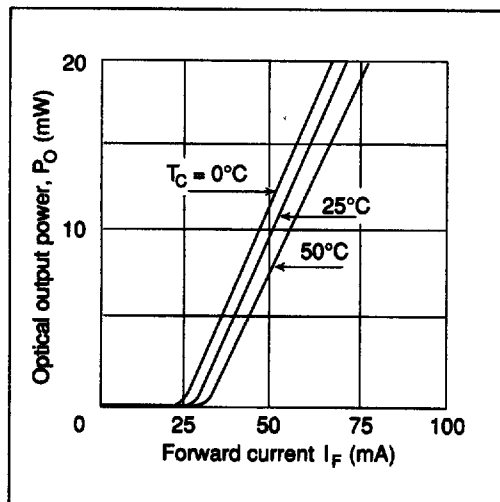
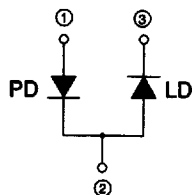


Figure 1 Optical Output Power vs. Forward Current

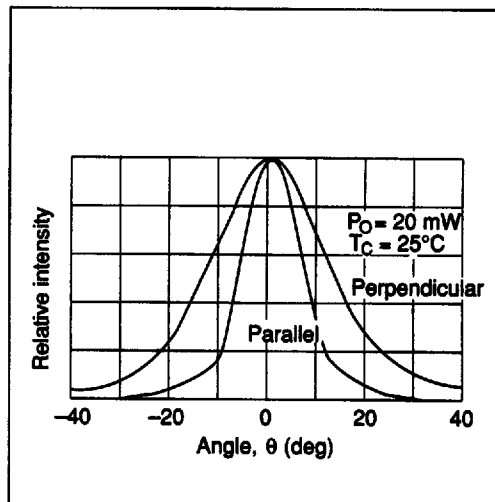


Figure 2 Far Field Pattern

HITACHI

T-41-05

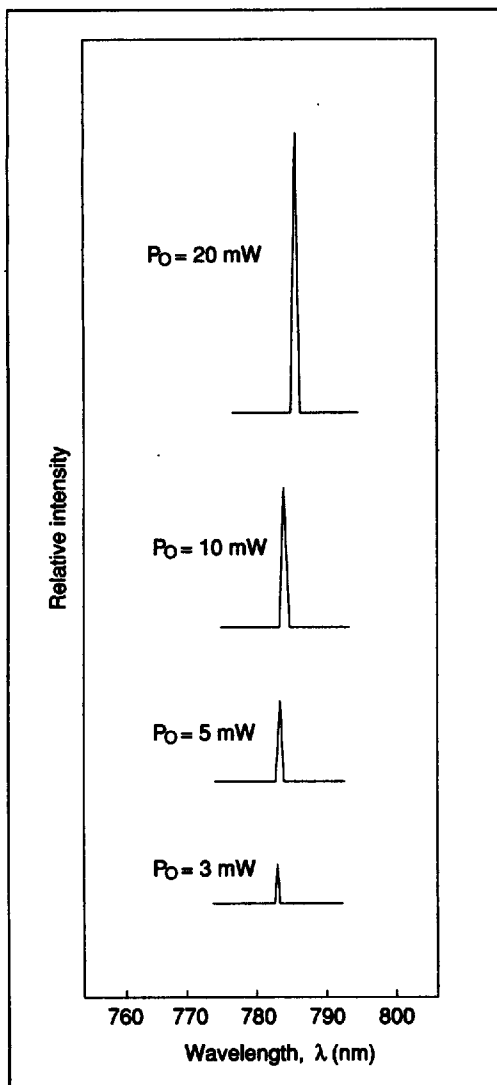


Figure 3 Lasing Spectrum

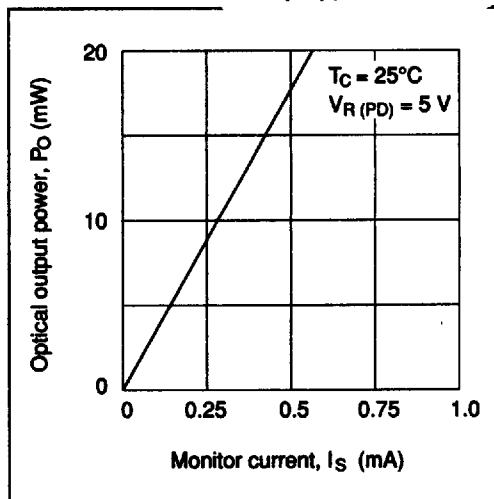


Figure 4 Optical Output Power vs. Monitor Current

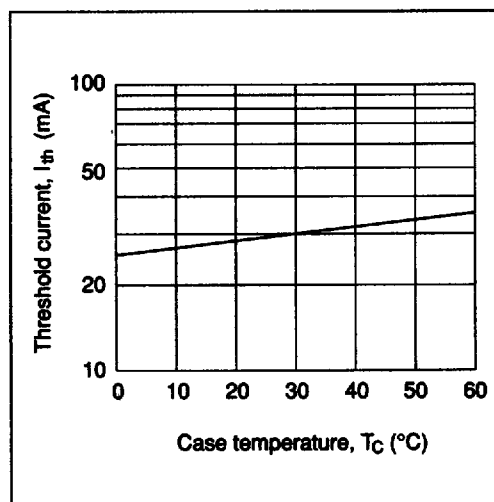


Figure 5 Threshold Current vs. Case Temperature

HL7838G

T-41-05

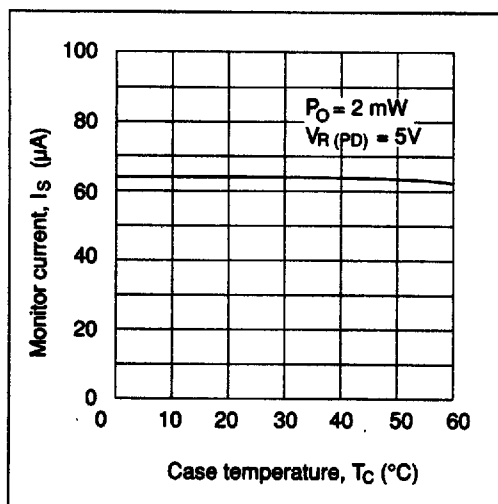


Figure 6 Monitor Current vs. Case Temperature

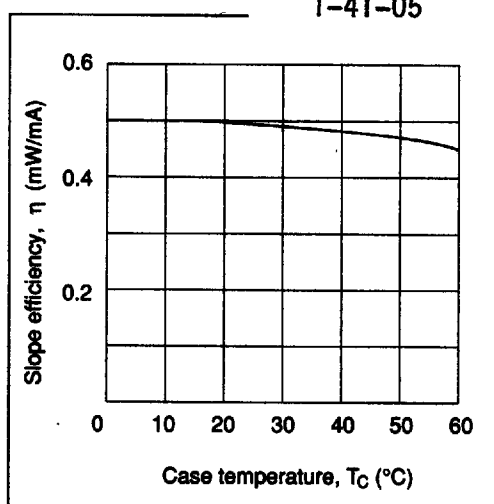


Figure 7 Slope Efficiency vs. Case Temperature

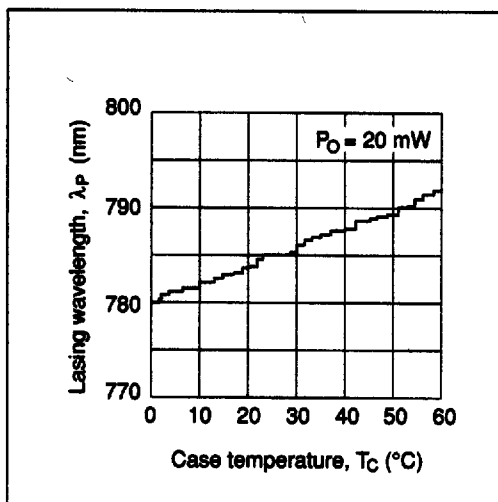


Figure 8 Lasing Wavelength vs. Case Temperature

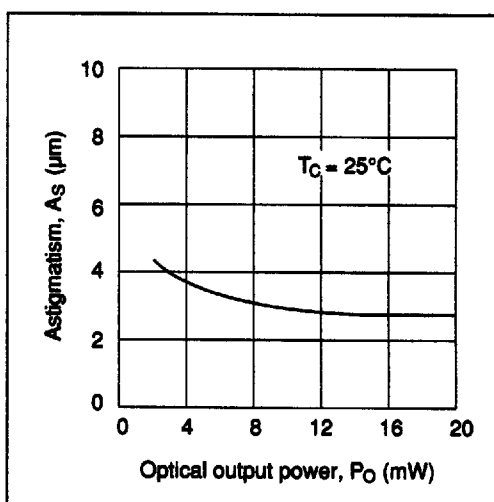


Figure 9 Astigmatism vs. Optical Output Power

HITACHI

T-41-05

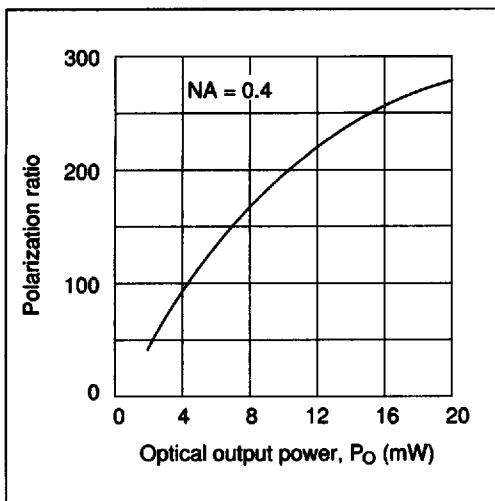


Figure 10 Polarization Ratio vs. Optical Output Power

Section 6 Reliability

This section covers points which particularly affect the operating life light emitting devices, and provides some examples which should be studied before proceeding with your system design.

6.1 Characteristic Drift

When optical emission devices such as the LD or IRED are operated in the forward mode, crystal defects (point defects and dislocations) propagate in the active region of the crystal.

These crystal defects cause optical emission characteristics (optical output power, threshold current, etc.) to drift, and ultimately lead to the end of the device's useful operating life.

Figure 6-1 shows an example of drift in the optical output power vs current characteristic of a LD. From t_1 to t_4 , the threshold current increases and the slope efficiency declines. The end of useful operating life is defined as the point where the operating current becomes 1.5 times of its initial value.

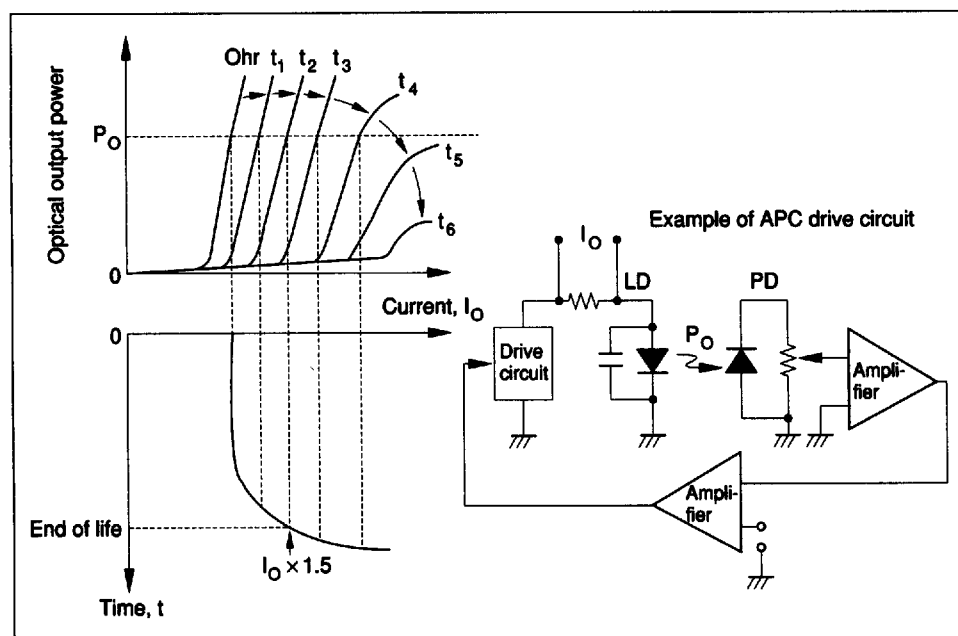


Figure 6-1 Example of Drift in LD Optical Output Power vs. Current Characteristic

6.2 Derating

T-90-40

LDs and IREDs have a strong temperature dependence of lifetime. Thus, the expected operating life shows an exponential decrease with operating temperature. Derating should be employed to keep the rise of junction temperature as small as possible. (See figure 6-2, and 6-3). Figure 6-4 shows the dependence of operating life on optical output power. Please note that this decrease in operating life occurs even at threshold current bias.

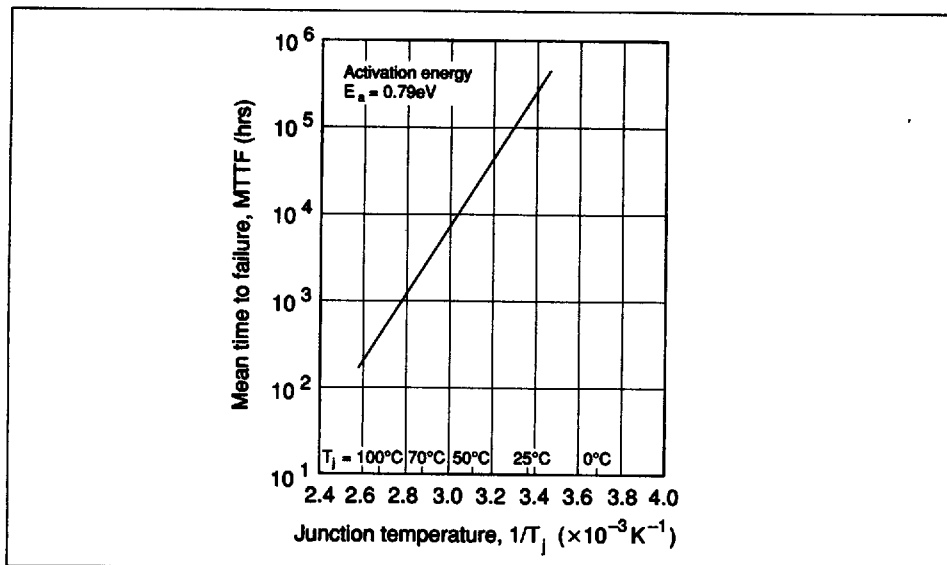


Figure 6-2 LD Mean Time to Failure vs. Junction Temperature (Example)

T-90-40

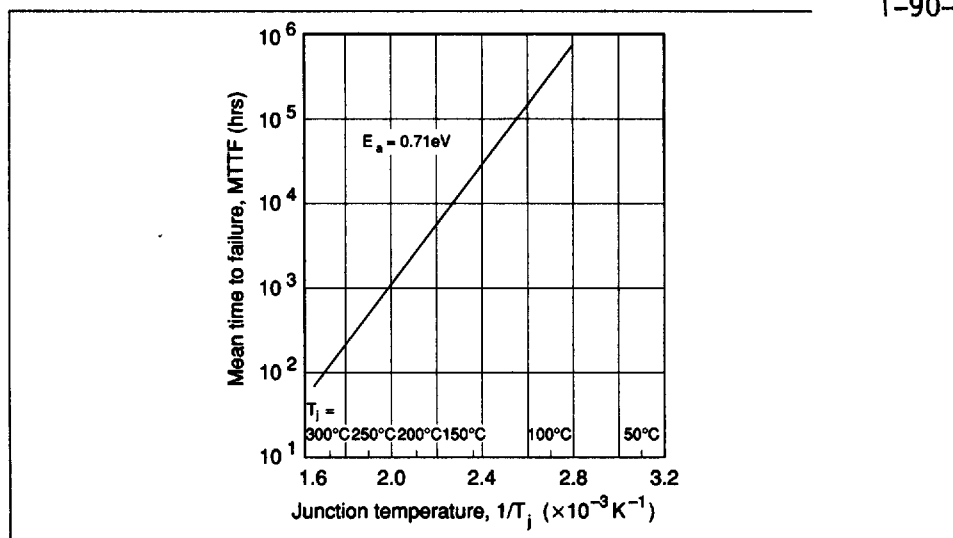


Figure 6-3 IRED Mean Time to Failure vs. Junction Temperature (Example)

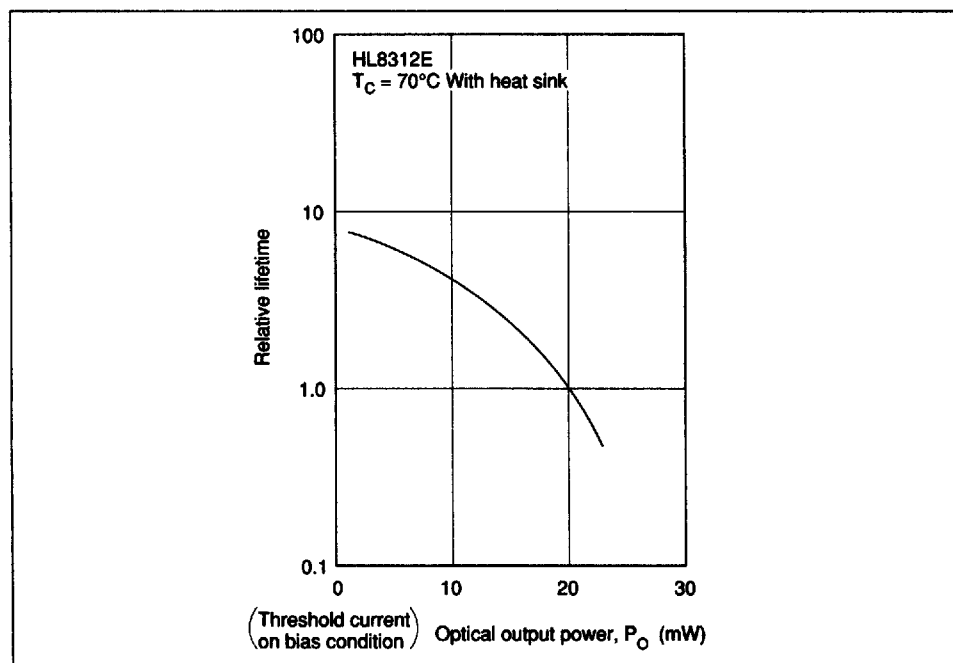


Figure 6-4 LD Operating Life vs. Optical Output Power (Example)

Figure 6-5 shows operating current dependence of IRED lifetime. In particular, when operated in open air at high current, the operating life is drastically affected by the rise in junction temperature due to heat generated by the device. Careful attention must be paid to carrying away excess heat.

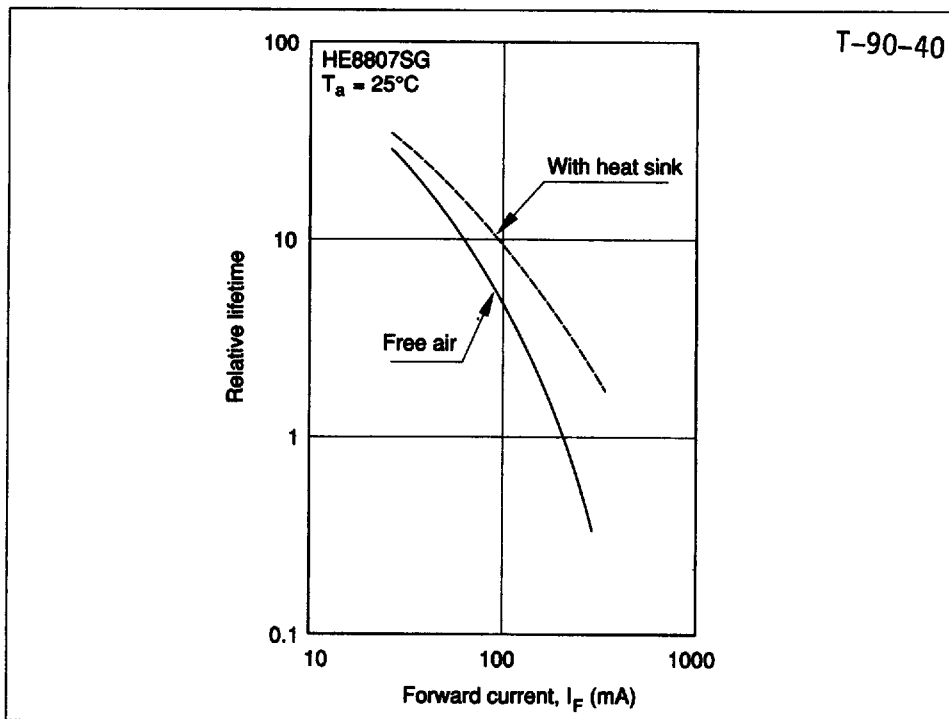


Figure 6-5 IRED Operating Life vs. Forward Current (Example)

6.3 Estimation for Useful Operating Life

The operating life of light emitting devices exhibits the typical wear failure distribution, and thus is generally approximated by the lognormal distribution. Figure 6-6 shows an example distribution for LD operating life. When the temperature derating and optical output power derating discussed in the previous section are also considered, the actual expected operating life under given operating conditions can be estimated.

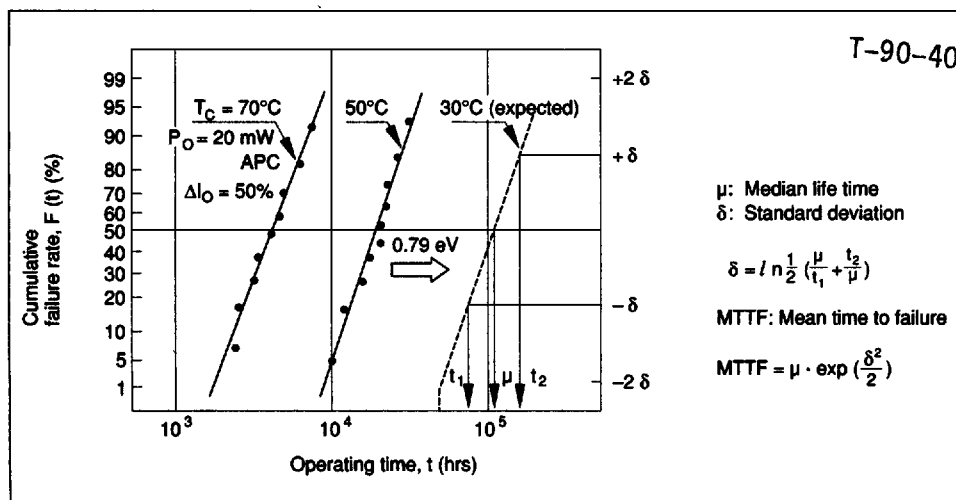


Figure 6-6 Distribution of Expected LD Life (Example)

6.4 Standard Devices Graded by Expected Life

Hitachi classifies IREDs of standard-specifications by life levels and applications as shown in table 6-1. For special requests or further details, please see your Hitachi representative.

Table 6-1 Lifetime and Application for Standard-specification IREDs

Applications	Expected Life Time	Operating Conditions	Criteria	Applicable Products
Auto-focusing still camera	10 hrs.	$I_F = 200 \text{ mA}$	$F(t) = 0.1\%$, $\Delta P_O \leq 30\%$	HE8815VG HE8813VG
Auto-focusing VTR camera	200 hrs.	$I_F = 250 \text{ mA}$ $f = 10 \text{ kHz}$, duty 25%	$F(t) = 0.1\%$, $\Delta P_O \leq 30\%$	HE8815VG
Measurement or general use	1000 hrs.	$T_J \leq P_O 100^\circ\text{C}$	$F(t) = 0.1\%$, $\Delta P_O \leq 30\%$	HLP series, HE8811, HE8812SG, HE8404SG, HE7601SG
Industrial use	10000 hrs.	$T_J \leq 100^\circ\text{C}$	$F(t) = 1\%$, $\Delta P_O \leq 50\%$	HE8807 series
Communications use	24000 hrs.	$T_J \leq 100^\circ\text{C}$	$F(t) = 1\%$, $\Delta P_O \leq 50\%$	HE8403 series, HE1301 series