

HL1521A/AC/FG**InGaAsP LD****Description**

T-41-05

The HL1521A/AC/FG are 1.55 μm band laser diodes.

Features

- Long wavelength output: $\lambda_p = 1530 - 1570 \text{ nm}$
- 5 mW CW operation at room temperature
- Built-in monitor photodiode (HL1521FG)
- Fast pulse response: $t_r, t_f \leq 0.5 \text{ ns}$

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

Item	Symbol	Rated Value	Units
Optical output power	P_O	5	mW
LD reverse voltage	$V_{R(LD)}$	2	V
PD reverse voltage	HL1521FG $V_{R(PD)}$	15	V
PD forward current	HL1521FG $I_F(PD)$	1	mA
Operating temperature	T_{opr}	0 to +60	$^\circ\text{C}$
Storage temperature	HL1521A/AC T_{stg}	0 to +80	$^\circ\text{C}$
	HL1521FG T_{stg}	-40 to +80	$^\circ\text{C}$

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

Item	Symbol	Min	Typ	Max	Units	Test Conditions
Threshold current	I_{th}	—	30	50	mA	
Optical power output	HL1521A/AC P_O	5	—	—	mW	Kink free
		2.0	—	—		$I_F = I_{th} + 20 \text{ mA}$
	HL1521FG	5	—	—		Kink free
		1.5	—	—		$I_F = I_{th} + 20 \text{ mA}$
Monitor output	HL1521A/AC P_m	0.45	—	—	mW	$I_F = I_{th} + 20 \text{ mA}$
Lasing wavelength	λ_p	1530	1550	1570	nm	$P_O = 3 \text{ mW}$
Spectral width	$\Delta\lambda$	—	2	—	nm	$P_O = 3 \text{ mW}$
Beam divergence (horizontal)	$\theta_{//}$	—	30	—	deg.	$P_O = 3 \text{ mW}$, FWHM
Beam divergence (vertical)	$\theta_{\perp}$	—	40	—	deg.	$P_O = 3 \text{ mW}$, FWHM
PD dark current	HL1521FG I_{DARK}	—	—	350	nA	$V_{R(PD)} = 5 \text{ V}$
Monitor current	HL1521FG I_S	50	—	—	μA	$V_{R(PD)} = 5 \text{ V}$, $P_O = 3 \text{ mW}$
PD capacitance	HL1521FG C_t	—	10	20	pF	$V_{R(PD)} = 5 \text{ V}$, $f = 1 \text{ MHz}$
Photosensitivity saturation bias current	HL1521FG $V_{R(S)}$	—	—	2	V	
Rise time	t_r	—	—	0.5	ns	$I_{bias} = I_{th}$, 10 to 90 %
Fall time	t_f	—	—	0.5	ns	$I_{bias} = I_{th}$, 90 to 10 %

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HL1521A/AC/FG

Internal Circuit

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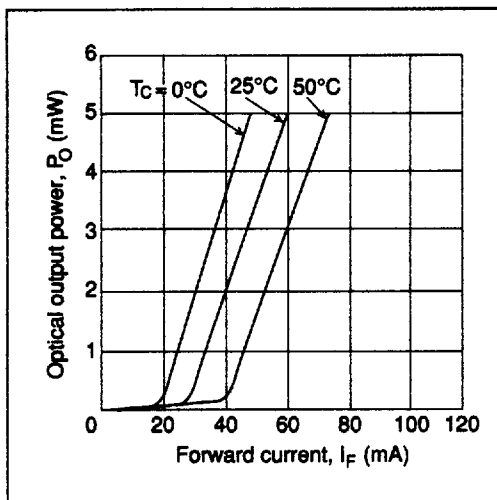
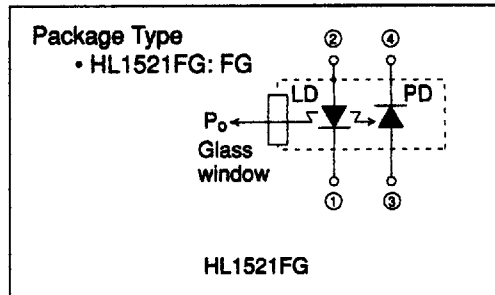
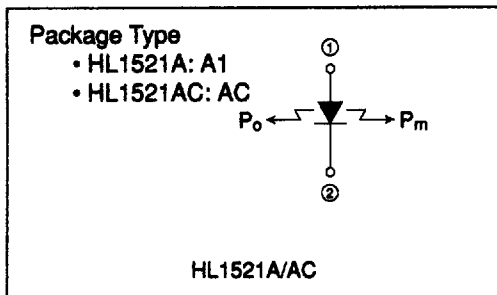


Figure 1 Optical Output Power vs. Forward Current

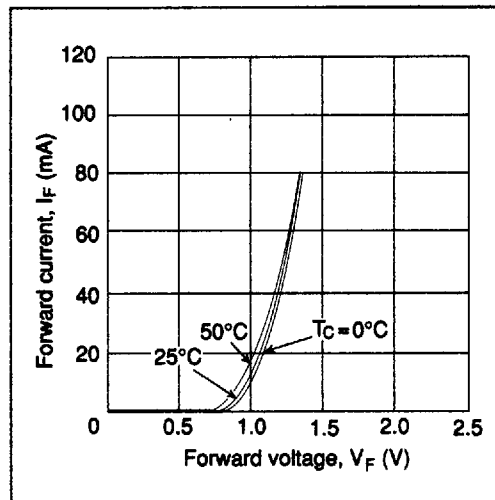
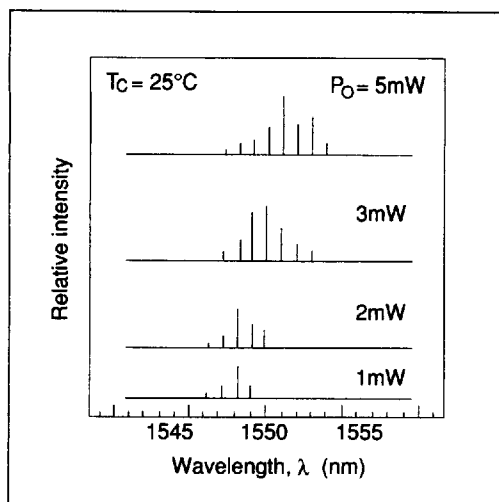
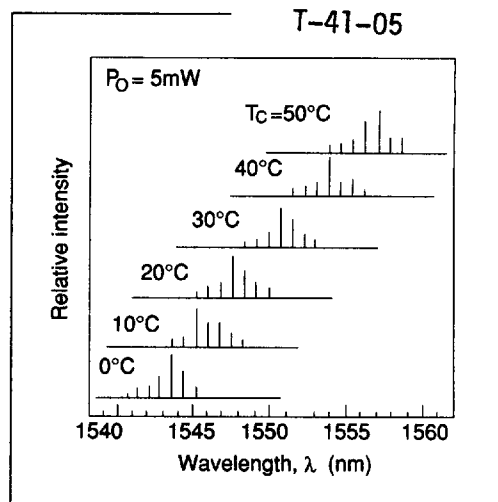
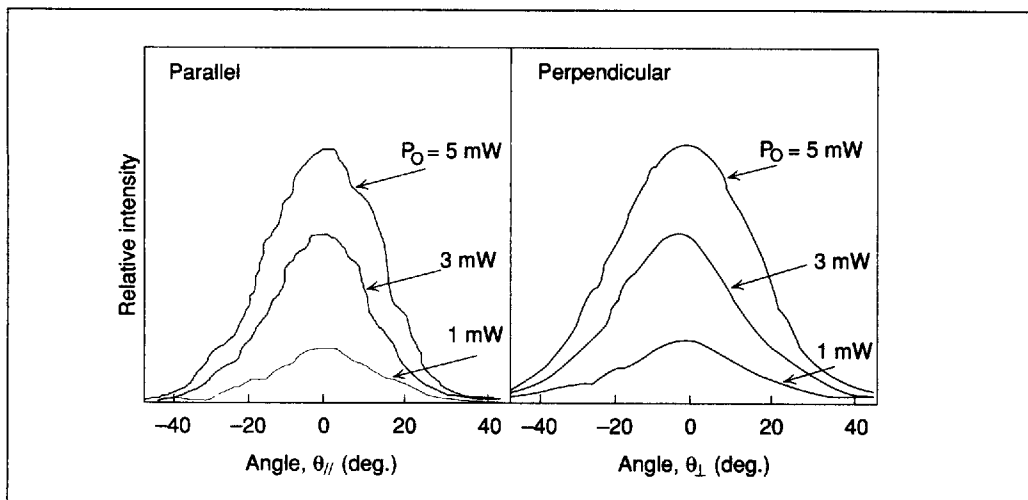
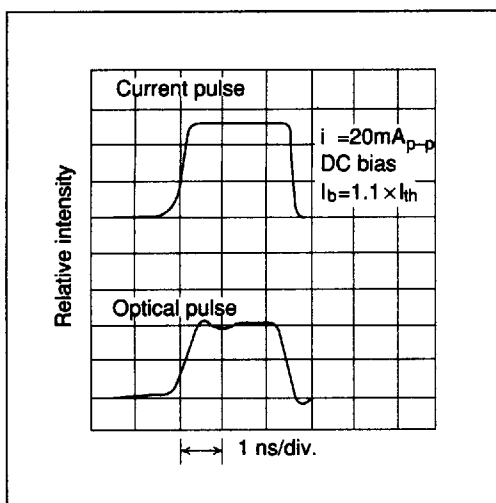
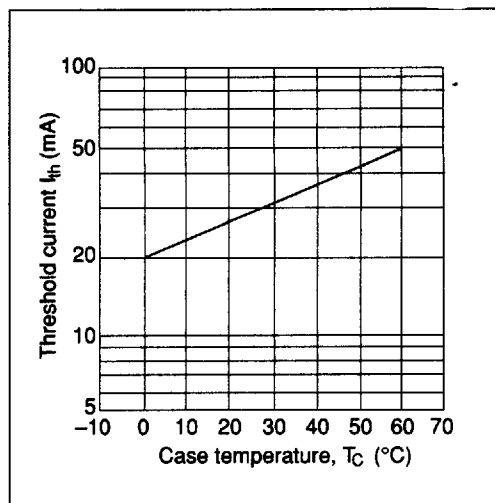
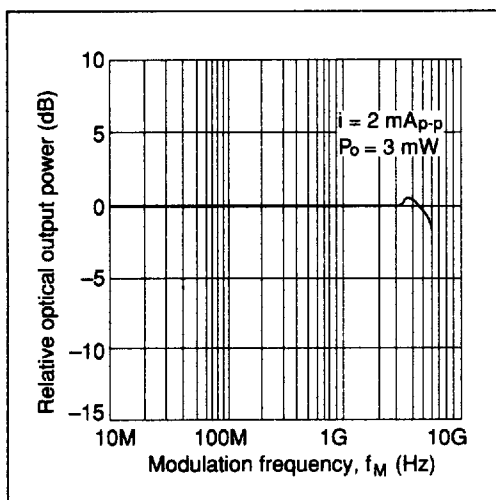
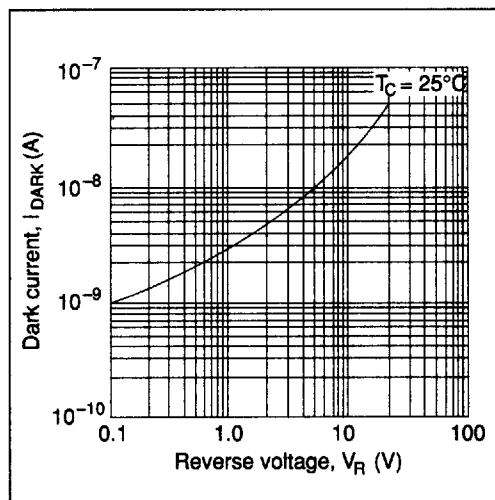


Figure 2 Forward Current vs. Forward Voltage

HL1521A/AC/FG**Figure 3 Lasing Spectrum****Figure 4 Lasing Spectrum Temperature Dependence****Figure 5 Far Field Pattern**

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**Figure 6 Pulse Response Characteristics****Figure 7 Threshold Current vs. Case Temperature****Figure 8 Frequency Response Characteristics****Figure 9 Dark Current vs. Reverse Voltage (HL1521FG)**

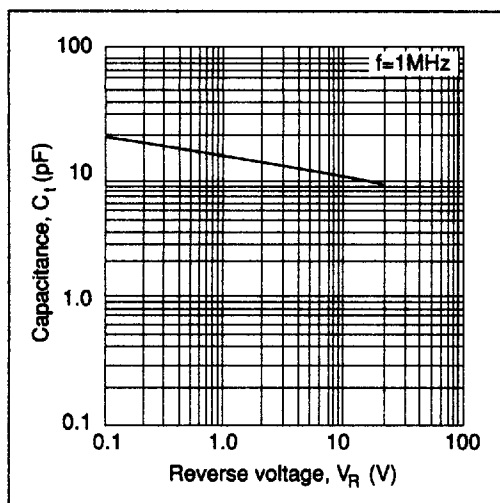
HL1521A/AC/FG

Figure 10 Capacitance vs. Reverse Voltage (HL1521FG)

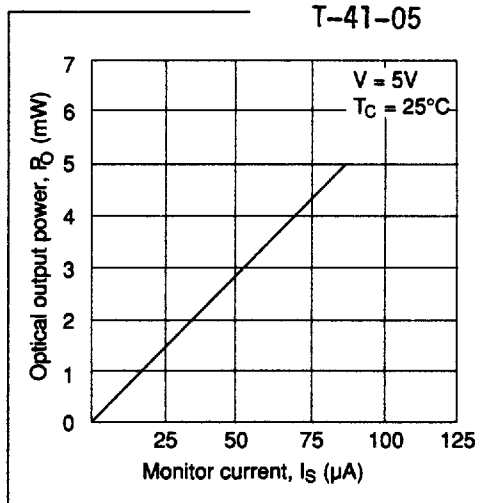


Figure 11 Optical Output Power vs. Monitor Current (HL1521FG)

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.

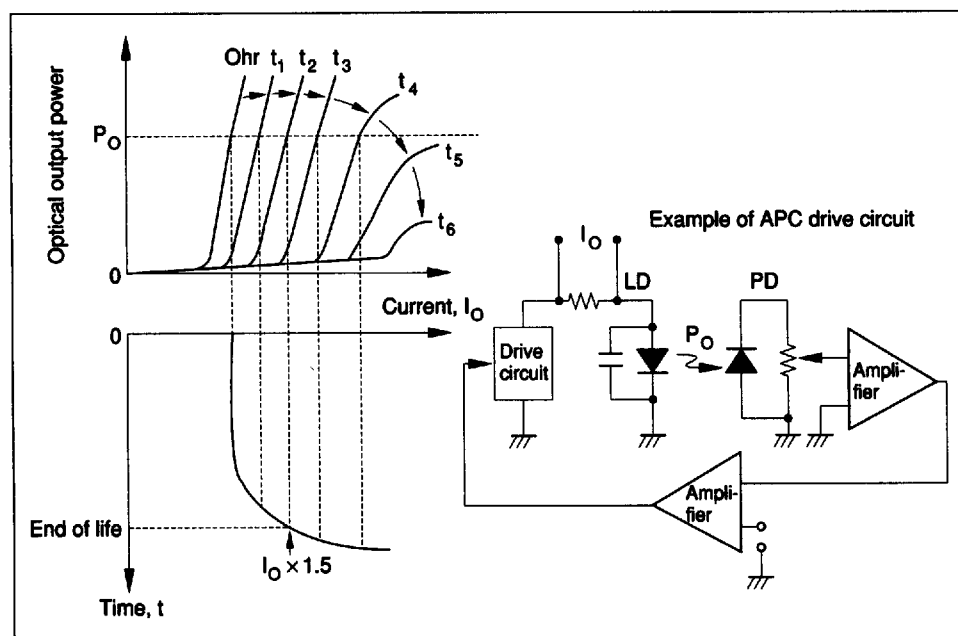


Figure 6-1 Example of Drift in LD Optical Output Power vs. Current Characteristic

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.

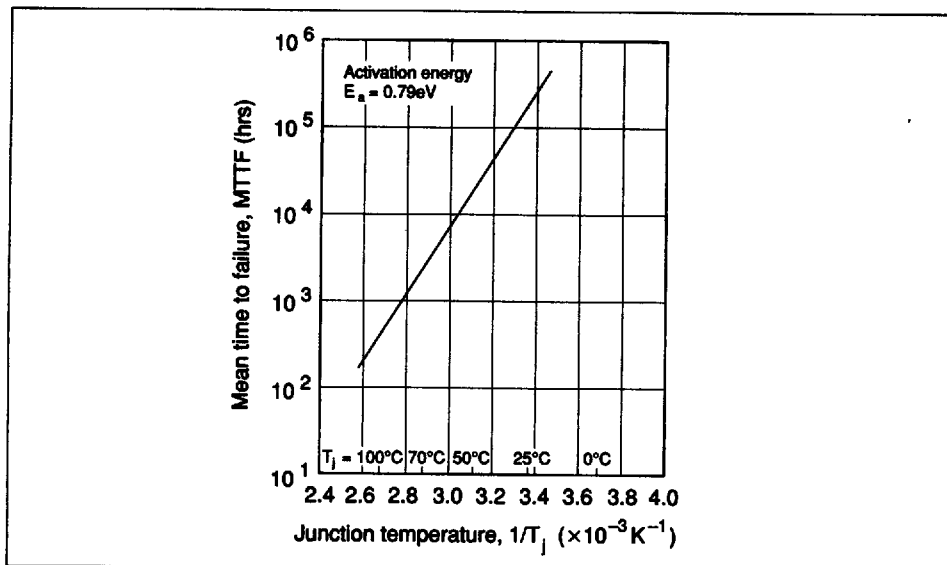


Figure 6-2 LD Mean Time to Failure vs. Junction Temperature (Example)

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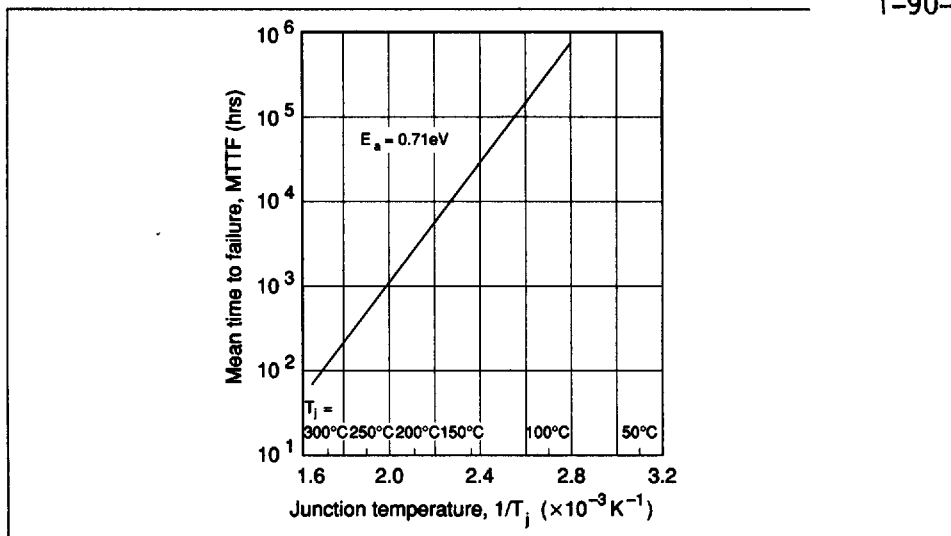


Figure 6-3 IRED Mean Time to Failure vs. Junction Temperature (Example)

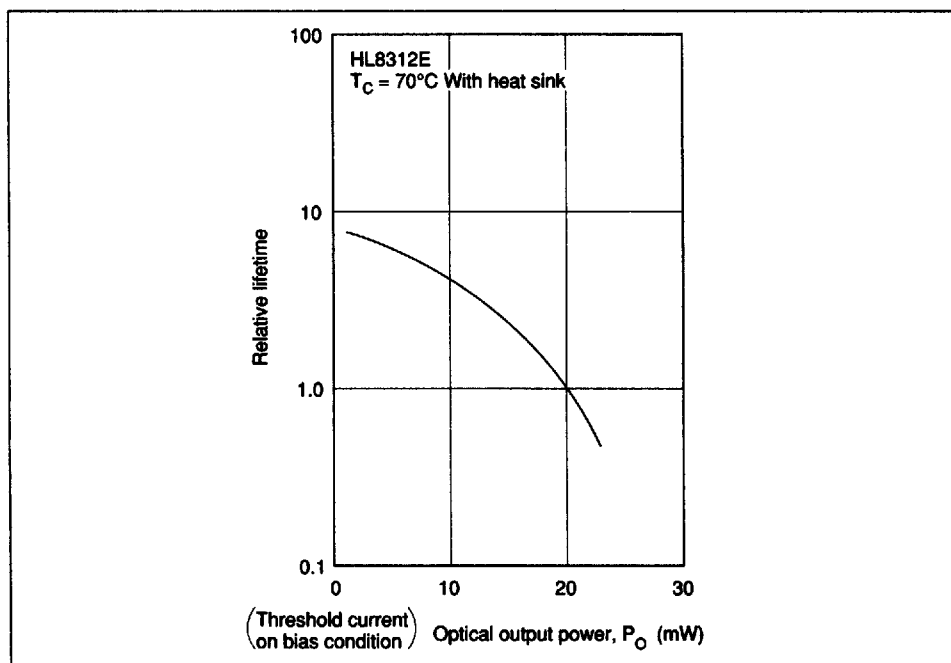


Figure 6-4 LD Operating Life vs. Optical Output Power (Example)

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.

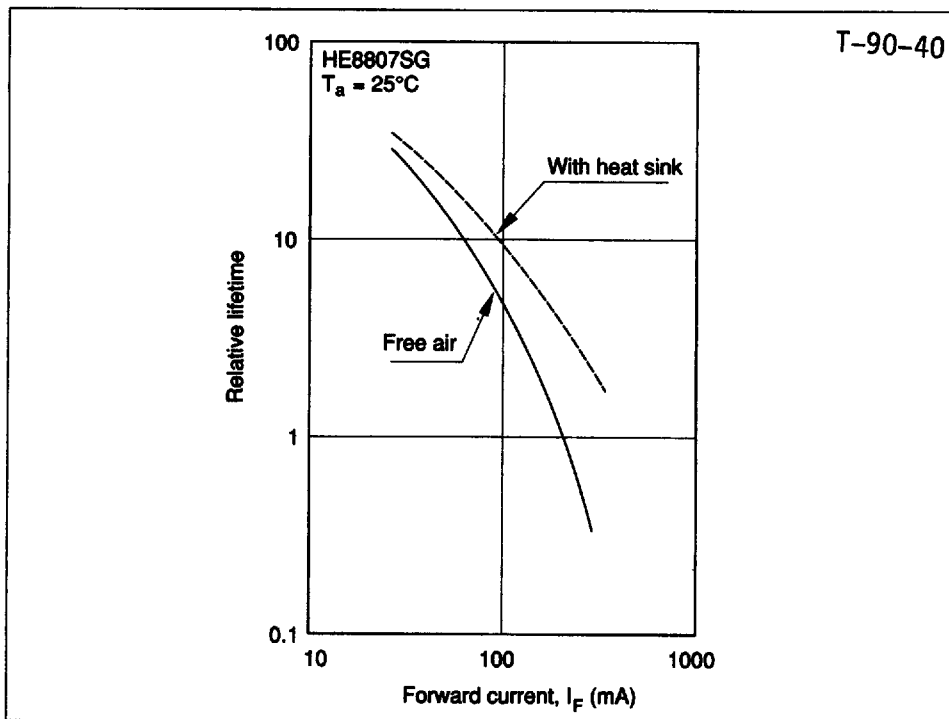


Figure 6-5 IRED Operating Life vs. Forward Current (Example)

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.

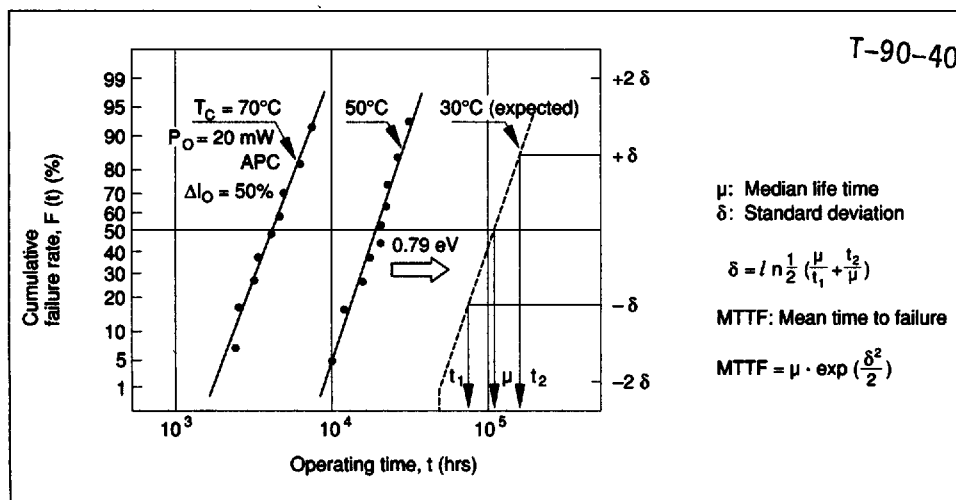


Figure 6-6 Distribution of Expected LD Life (Example)

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