Laser Diode and Fan – Long Lifetime

- Laser diode MTTF 128340 hours, @25℃ for 4mW laser diode (about 14.7 years based on working 24 hours/ day)
- Fan MTTF 172616 hours, @ 25℃ (about 19.7 years based on working 24 hours/ day)

HGLD-790TO5.6-ZSP-5mW

MTTF Test Report

- Test item

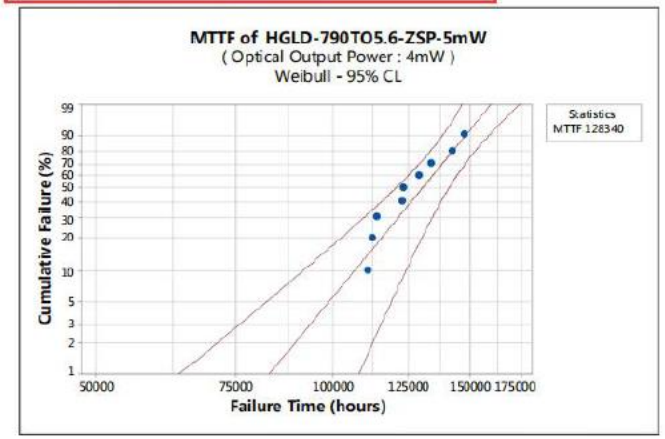
  Mean Time to Failure

- Test method

  Samples 10pcs, temperature 70C, constant-out optical power 5mW accelerate aging for 1000 hours, MTTF is calculated based on operating current change rates and out-of-light power acceleration factors.

- Test result

  Aging conditions: temperature 70℃, 5mW, APC, aging 1000 hours
  Sample number: 10pcs
  MTTF: 128340 hours (at 4mW light output)



◎ L_{10} Expectancy: 60,000 hours minimum @ fan rated voltage and the temperature of 40℃

According to the equation for **Weibull distribution**, MTTF ≒ 7×L10 = 420,000 hours

And we rely on a zero failure Weibull test strategy and accelerated testing technique, to determine the total test time (t) for verifying the above life estimation by the equations,

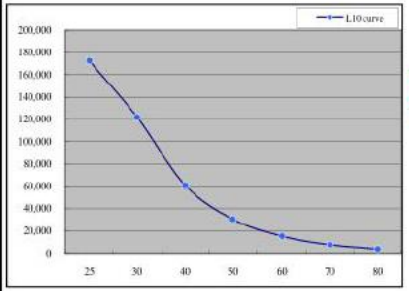
$$t = 1.036 \times MTTF \times [(B_{rc}) \div n]^{0.91} \div A_F, \text{ and } A_F = 2^{(Ts-Tu)/10}$$

where, (B_{rc}) is Poisson distribution factor with the failure number of requal to 0 and the decimal confidence level of c equal to 0.90(90%)

Stress/Elevated Temperature Ts (℃)	Unstress Temperature Tu (℃)	Acceleration Factor A_F	Quantity of Test Devices n (pcs)	Poisson Distribution Factor B_{rc}	Requiree test time with zero failure t (hours)	Actual test time with zero failure t (hours)	Verified MTTF (hours) at40℃	Verified L_{10} (hours) at40℃
85	40	22.63	56	2.303	1.052	1,072.0	427,282	60,000

Test Progress:

Date for Test Beginning	Date for Test Termination (at least)	Current Test Status			Current Total Test Time (hours)
2020/8/2 8:00 PM	2020/9/17 8:00 AM	☑ In process	☐ In process (exceed requested)	☐ Termination	1072



Temperature for MTTF Estimation (℃)	Acceleration Factor A_F	Estimated MTTF (hours)	Estimated L_{10} (hours)
25	64.00	1,208,311	172,616
30	45.25	854,495	122,058
40	22.63	427,282	61,029
50	11.31	213,691	30,514
60	5.66	106,891	15,257
70	2.83	53,400	7,629
80	1.41	26,700	3,814

Fan permission criteria for the measurement after test :
1. For current, the limit is less than spec.(max.).
2. For speed, the allowable decrease is less than 30%.
3. For noise, the limit is less than spec.(max.). + 3 dB

Herewith , we could assume as right on the basis of above test result. Besides, if the actual test time exceed the required, it comes out that those fans' L10 expectancy and MTTF are greater than the warrant.

Test Restult	☑ Accept
	☐ Reject

CO_2
PM
A2L

VOC
Methane
Propane

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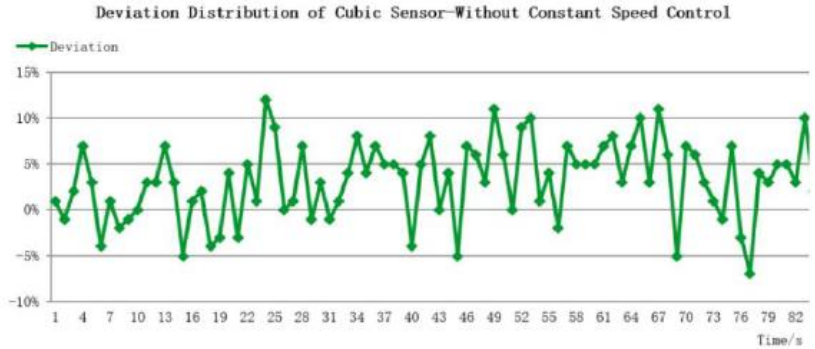
Constant Speed Setting Fan

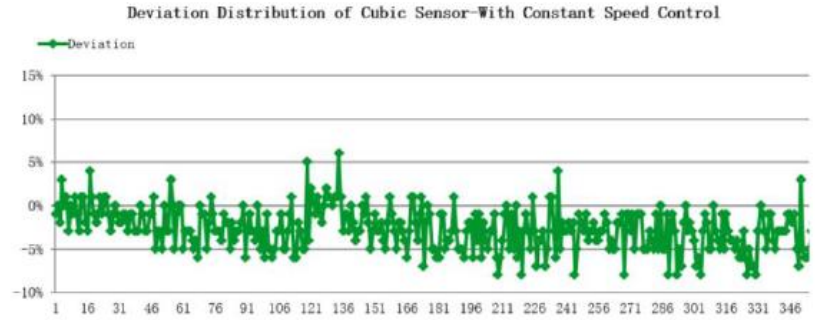
There have 3 wires of the fan, one of them is for FG signal, it is a pulse feedback signal, the fan send its FG signal to the sensor's MCU, then the MCU know the RPM of the fan, then adjust the voltage to the fan to increase or decrease the fan's speed to the setting RPM.

Pin 1---UL1571,AWG30#,黑，负极(BLK, Negative)

Pin 2---UL1571,AWG30#,黄，FG (Yellow, FG)

Pin 3---UL1571,AWG30#,红，正极(Red, Positive)





CUBIC

CO_2
PM
A2L

VOC
Methane
Propane

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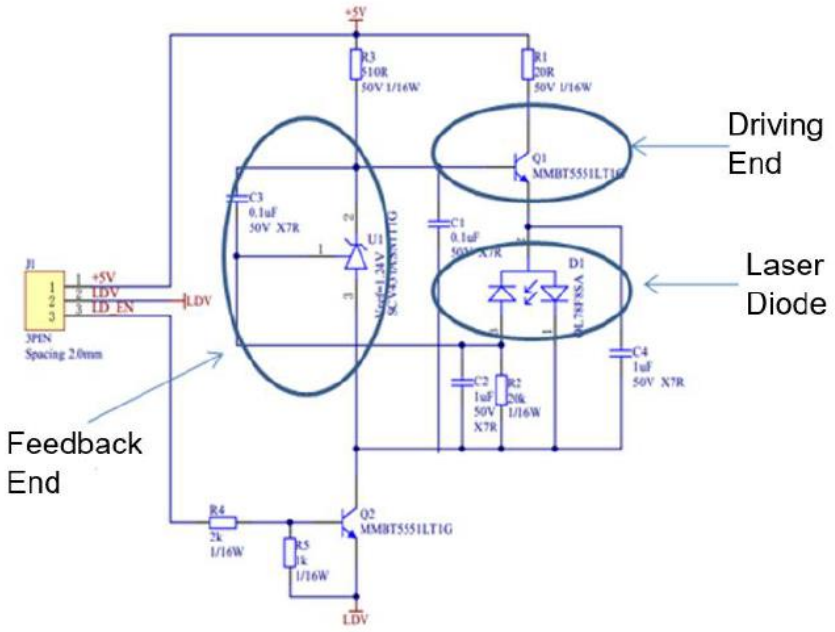
Constant Power Output Laser



With feedback control, power of the laser diode is constant without influence of temperature, to ensure stable signal and measuring performance.

CUBIC

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