Agilent Technologies
Innovating the HP Way

850 nm VCSEL 1x9 Transceiver

Reliability Data

HFBR-5303/53D3
HFBR-5305/53D5

This reliability data sheet describes a newly released 850 nm VCSEL optical transceiver for multimode Gigabit Fiber Channel, Ethernet and General Purpose applications.

1. Life Test

The following demonstrated data represents information based upon the High Temperature Operating Life tests on HFBR-5305 transceivers.

Definition of Failure

Product failure has occurred when the unit fails to respond properly to a dc/ac functional test condition. The functional test condition shall not exceed the absolute maximum data sheet limits for the product.

A. Demonstrated Performance

Test Name	Stress Test Conditions	Total Device Hours	Total Units Tested	No. of Failed Units	Demonstrated MTBF @ T_A = 75°C	Demonstrated FITS @ T_A = 75°C
High Temperature Operating Life	V_{CC} = 5.0 Vdc T_A = 75°C See Note 1.	488,000	99	2*	244,000	–
Total		488,000		2	244,000	4,098

* Failures attibuted to mechanical damage to the VCSEL die as a result of manual handling during the assembly process. Since August 1997, VCSEL transmitter assembly has been accomplished using an automatic pick and place system. No further failures of this type have been observed.

Failure Rate Prediction

The Demonstrated Point MTBF given on this data sheet is on device performance at maximum allowed stress conditions. Temperature is an alterable stress. The failure rate will have a direct relationship to the life stress. MIL-HDBK-217 uses, for this type of product (hybrid packaging), a 0.43 electron volt activation energy which represents the most conservative temperature acceleration reported. Estimates for typical equipment use temperatures are as follows:

Ambient Temp. (°C)	Point Typical Performance MTBF	Point Typical Performance FITS	60% Confidence MTBF	90% Confidence MTBF	60% Confidence FITS	90% Confidence FITS
75	244,000	4,090	156,700	91,600	6,380	10,900
70	300,000	3,320	192,900	113,000	5,200	8,840
65	372,000	2,680	238,900	140,000	4,200	7,130
60	465,000	2,140	297,700	174,000	3,360	5,710
55	584,000	1,700	373,600	219,000	2,700	4,540
50	740,000	1,350	472,200	278,000	2,120	3,590
45	943,000	1,050	601,100	354,000	1,660	2,810
40	1,210,000	824	771,200	455,000	1,297	2,190
35	1,570,000	636	997,000	590,000	1,003	1,690
30	2,050,000	487	1,301,000	771,000	769	1,290
25	2,700,000	369	1,712,000	1,010,000	590	983

2. Mechanical and Environmental Tests (Testing done on a constructional basis)

Test	Conditions	Duration	Sample Size (HFBR-5305)	Failure
Temp. Cycle	-40°C to 100°C, 15 min. dwell 5 min. transfer	200 cycles	40	0
85/85 Biased	T_A = 85°C, 85% RH, V_{cc} = +5.25 V. (See note 1)	1000 hours	39	0
Unbiased Pressure pot	121°C, 100% RH, 2 Atm. net	168 hours	20	0
Popcorn Test	Moisture Soak: T_A = 85°C, 85% RH; Wave Soldering: 2 sec. on 260°C Solder; 5 min. wash in 60°-70° C DI water under 40 psi; 20 min. bake at 70°C	Moisture Soak: 96 hours; Wave Soldering: 3 times	20	0
Power Cycle, Temp. Cycle & Humidity	MIL-STD-883 Method 1004, T_A = -10°C to 65°C, Relative Humidity = 95%, Power On/Off @ 30 min./ 30 min. V_{CC} = 5.25 V (See note 1)	1000 hours	39	0
LTOL	T_A = -40°C, V_{CC} = +5.25 V (See note 1)	1000 hours	11	0
Thermal Shock	T_A = -40° to 100°C, Liquid to Liquid, 5 min. dwell, 10 sec. transfer	100 cycles	10	0
Mechanical Shock	MIL-STD-883, Method 2002B, 1500 g 0.5 ms, 5 times/axis		11	0
Mechanical Vibration	MIL-STD-883, Method 2007A, 20 - 2000 Hz, 20 g		11	0
Hand Soldering	315°C - 10 sec.		4	0
High Temperature Storage	T_A = 100°C	500 hours	11	0
Low Temperature Storage	T_A = -40°C	500 hours	11	0
Solderability	MIL-STD-883, Method 2003		11	0

3. Electrostatic Discharge Information (Testing done on a constructional basis)

Test	Conditions	Duration	Sample Size (HFBR-5305)	Failure
ESD 1	MIL-STD-883 Method 3015.4 (Human Body Model)	Apply (5)+ then (5)- voltage pulses to each pin & GND at each voltage level. 2000 V max. (Class 2)	6	0
ESD 2	EIAJ#1988.3.2B, Version 2, C = 200 pF, R = 0 (Machine model)	Apply (5)+ then (5)- voltage pulses to each pin & GND at each voltage level. 150 volts max.	6	0
ESD 3	25 KV max. Air Discharge (Simulation of human body discharge into D.U.T.)	40 discharges per D.U.T. (10 discharges each at the top, bottom, right and left of the front of the housing while D.U.T. was powered up)	6 (Same units from ESD 1)	0
ESD 4	25 KV max. Air Discharge (Simulation of human body discharge into D.U.T.)	40 discharges per D.U.T. (10 discharges each at the top, bottom, right and left of the front of the housing while D.U.T. was powered up)	8 (Housing partially covered with metal shield)	0

Note 1: Both the Transmitter and Receiver of each transceiver were connected by a loop-back connectored cable in this test and operated in a self-oscillation mode.

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Data subject to change.
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