AFBR-5701xxZ, AFBR-5705xxZ, AFBR-5710xxZ, AFBR-5715xxZ



Families of Multi-Mode Small Form Factor Pluggable (SFP) Optical Transceivers with Optional DMI for Gigabit Ethernet (1.25 GBd) and Fiber Channel (1.0625 GBd)

Reliability Data Sheet

Introduction

Avago Technologies Quality system includes an ongoing Reliability Monitoring program to generate a database from which this reliability datasheet is published.

Description

The AFBR-57xxZ family of Small Form Factor Pluggable SFP) LC optical transceivers offers a wide range of design options, including optional DMI features, two temperature ranges (extended or industrial), and choice of standard or bail delatch. The

AFBR-5705xxZ and AFBR-5715xxZ family targets applications requiring DMI, while the AFBR-5710xxZ and AFBR-5701xxZ family is streamlined for those applications where DMI is not needed.

The AFBR-571*x*Z family is compliant with IEEE802.3Z (1000BASE-SX) while the AFBR-570*x*Z family is compliant with both IEEE802.3Z (1000BASE-SX) and Fiber Channel 100-SM-LC-L.

In addition, the AFBR-57xxZ family complies with the SFP Multi-Source Agreement (MSA) specification.

Reliability Qualification

The optical transceivers and receivers have been qualified with reference to Telcordia Document GR-468-CORE. Reliability predictions follow the method of Telcordia-SR-332 issue 3. Avago internal test specifications have also been applied. Testing was carried out under the supervision of Avago Technologies Quality & Reliability Department.

Stress Test Pass Criteria

Product failure has occurred when the unit fails to respond properly to a functional test. The functional test condition shall not exceed the absolute maximum or minimum data sheet limits.

FIT Rate Summary

The mean and standard deviation of AFBR-5701xxZ, AFBR-5705xxZ, AFBR-5710xxZ and AFBR-5715xxZ steadystate failure rate is calculated as 28.7 FIT and 8.2 FIT at 40 degrees C respectively. The details of this calculation are included in this report.

Conclusion

AFBR-5701xxZ, AFBR-5705xxZ, AFBR-5710xxZ and AFBR-5715xxZ have completed and passed the reliability qualification criteria defined by Avago Technologies' Quality and Reliability requirements.

Random Failure Rate (FIT) Calculation

Failure in time rate, or FIT, is defined as the number of failures per billion device hours. In the product useful life region, the random failure rate is considered as a constant failure rate. In this region MTTF, Mean Time to Failure, is defined as MTTF = 1/FIT.

FIT Prediction Based on Telcordia SR-332 Parts Count Procedure

The Telcordia parts count method assumes that the module failure rate is equal to the sum of the device component failure rates. Modifiers are included to take into consideration variations in module operation environments, device quality requirements, temperature, and stress. Table 1a below shows the FIT for the components used in the modules and the total FIT which have been calculated for a case temperature of 40° C.

		Temperature Factor @ 40° C				1	
Reliability Prediction Based On Telcordia SR-332 Issue 3 – Parts Count Method		Stress Factor at 50% Environmental Factor				1 1	
VSCEL	Avago data	1	1	0.8	0.8	0.8	0.64
Monitor PIN IC	Photodiode	1	7.7	5.5	0.8	6.16	4.4
ORION PIN	Photodiode	1	7.7	5.5	0.8	6.16	4.4
Capacitors	Fixed Ceramic	14	0.1	0.01	1	1.4	0.14
Resistor	Thick Film	3	0.18	0.13	1	0.54	0.39
Ferrite Chip (Inductor)	Power Filter	5	0.24	0.07	1	1.2	0.35
Pre-Amp IC, Monet	IC: (91 - 170 Transistor)	1	3	2.12	1	3	2.12
IC, Durer	IC: (91 - 170 Transistor)	1	3	2.12	1	3	2.12
IC 8-BIT MCU W/8K FLASH 256B RAM 36-LFBGA	CMOS Technology	1	3.8	3.9	1	3.8	3.9
Connector	PCB, Edge / Multi-Pin	20	0.13	0.088	1	2.6	1.76
	Module Failure @ 40° C (Total FITs)					28.7	8.2
	MTTF @ 40° C (Hours)					3.49E+07	1.22E+08

Table 1a. FIT rate for AFBR-5701xxZ, AFBR-5705xxZ, AFBR-5710xxZ and AFBR-5715xxZ

FIT at other temperatures can be derived following the procedure of Telcordia-SR332, assuming activation energy, Ea, of 0.35eV to determine the component temperature factor π_{T} . Table 1b shows FIT rate at different temperatures for the transceiver family.

FITs between 60% and 90% Upper Confidence Levels (UCLs) can be derived following the procedure of Telcordia SR-332 to determine the shape κ and scale θ of the gamma distribution. Table 1c shows the FITs at the UCLs.

Table 1b. FIT rates at different operation case temperatures, following the Telcordia Parts Count Method

Tcase (° C)	FITs	
25	14.9	
40	28.7	
50	43.0	
60	63.1	

The limitations of FIT prediction based on the Parts Count method include the fact that the piece part failure rates are mostly obtained from the Telcordia database, which may not be exhaustive for state-of-the-art piece parts, and that the results are independent of true module environmental stress tests. Nevertheless, the information obtained from the Parts Count method is a useful reference during design-in and evaluation. Whenever possible, Avago substitute's internal data for the FIT rates of individual components, and predictions will be updated as more current data becomes available.

Table 1c. FIT rates at 40° C at 60% and 90% Upper Confidence Level, following the Telcordia Parts Count Method

UCL	FITs	
60%	30.0	
90%	39.5	

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