

**AFCT-5701xxZ, AFCT-5705xxZ, AFCT-5710xxZ,  
AFCT-5715xxZ, AFCT-5765xxZ**  
Single-Mode SFP Optical Transceivers  
with Optional DMI for Gigabit Ethernet and Fibre Channel



## 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

This reliability data sheet addresses reliability parameters for the single-mode AFCT-5701xxZ, AFCT-5705xxZ, AFCT-5710xxZ, AFCT-5715xxZ, and AFCT-5765xxZ families of SFP optical transceivers.

These transceivers are primarily targeted at serving Gigabit Ethernet or Fibre Channel links interconnecting optical networking and storage equipment.

### Reliability Qualification

The Optical Transceivers have been qualified in accordance with the requirements of 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 units fails to respond properly to a functional test condition. The functional test condition should not exceed the absolute maximum data sheet limits for the product.

### FIT Rate Summary

The mean and standard deviation of the AFCT-5701xxZ, AFCT-5705xxZ, AFCT-5710xxZ, and AFCT-5715xxZ families of SFP Optical Transceiver steady-state failure rate is calculated as 118.4 FIT and 66.6 FIT at 40 °C, respectively.

### Conclusion

Avago Technologies AFCT-5701xxZ, AFCT-5705xxZ, AFCT-5710xxZ, AFCT-5715xxZ, and AFCT-5765xxZ families of SFP Optical Transceivers have completed and passed the reliability qualification criteria defined by Avago Technologies' Quality & 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  $MTTF = 1/FIT$ .

### FITs 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 shows the FITs for the components used in the module and the total FITs that has been calculated for a case temperature of 40 °C.

**Table 1a.**

Reliability Prediction Based On Telcordia SR-332 Issue 3 – Parts Count Method		Temperature Factor @ 40 °C				1	
		Stress Factor at 50%				1	
		Environmental Factor				1	
Component	Telcordia Information	Quantity	Component Failure Rate (FITs)	Component Standard Deviation (FITs)	Quality Factor	Total Component Failure Rate (FITs)	Total Component Standard Deviation (FITs)
1G FP Laser Diode	Laser	1	100	81	0.8	80	64.8
Photodiode	Telcordia (Photodiode)	1	7.7	5.5	0.8	6.16	4.4
IC	Telcordia: (91-170 transistor)	3	7.7	5.5	0.8	18.48	13.2
IC	Telcordia: (91-170 transistor)	1	7.7	5.5	0.8	6.16	4.4
Capacitors	Fixed Ceramic	3	0.1	0.01	1	0.3	0.03
Resistor	Thick Film	5	0.18	0.13	1	0.9	0.65
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
<b>Module Failure @ 40 °C (Total FITs)</b>						118.4	66.6
<b>MTTF @ 40 °C (Hours)</b>						8.45E+06	1.50E+07

FITs at other temperatures can be derived following the procedure of Telcordia SR-332, assuming activation energy,  $E_a$ , of 0.35 eV to determine the component temperature factor  $\pi_T$ . Table 1b shows the FITs at different temperatures for the transceiver.

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

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

T <sub>case</sub> (° C)	FITs
25	61.6
40	118.4
50	177.6
60	260.5

The limitations of the FIT prediction based on the Parts Count Method include the fact that the piece part failure rates are obtained from 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 substitutes 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%	122.8
90%	207.7

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