AFCT-5745NPZ/ANPZ, AFCT-57J5ANPZ & AFCT-5745UPZ/AUPZ

Family of Singlemode SFP Transceivers for Long Reach SONET OC-48 and SDH/STM-16 with Digital Diagnostic Monitoring (DMI) Interface

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 AFCT-5745xxxZ is high performance, effective modules for serial optical data communications applications that range from 125 Mb/s to 2.7 Gb/s. They are designed to provide SONET/SDH compliant links at 2488 Mb/s for both short and intermediate reach links.

The transmitter section of the AFCT-5745NPZ/ANPZ & AFCT-57J5ANPZ incorporates a 1300 nm Distributed Feedback (DFB) laser. The transmitter in the AFCT-5745UPZ/AUPZ uses a 1550 nm Distributed Feedback (DFB) Laser.

For each device the receiver section uses an Avalanche Photodiode (APD). A positive-ECL logic interface simplifies interface to external circuitry.

Reliability Qualification

The optical transceivers and receivers have been qualified in accordance with the requirements of Telcordia Document GR-468-CORE. Reliability predictions follow the method of Telcordia-SR-332. 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

FIT rate for AFCT-5745NPZ/ANPZ & AFCT-57J5ANPZ is calculated as 252.14; FIT rate for AFCT-5745UPZ/AUPZ is calculated as 252.14.

The details of this calculation are included in this report.

Conclusion

AFCT-5745NPZ/ANPZ & AFCT-57J5ANPZ and AFCT-5745UPZ/AUPZ 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. The tables that follow show the FIT for the components used in the modules and the total FIT which have been calculated for an operating ambient temperature of 40°C.

Table 1a. FIT rate for AFCT-5745NPZ/ANPZ & AFCT-57J5ANPZ

Reliability Prediction Based On Telecordia SR-332 - Parts Count Method		**Temperature Factor @ 40°C**			1
		Stress Factor at 50%			1
		Enviromental Factor			1
Component	**Telecordia Information/Data Source**	**Quantity**	**Component Base Rate (FITs)**	**Quality Factor**	**Total Component Failure Rate (FITs)**
2.5G DFB Laser Diode (1310nm)	Supplier Data	1	86	0.9	77.4
Monitor PIN	Telcordia (Photodiode)	1	15	0.9	13.5
2.5G APD Photodiode	Telcordia (Photodiode)	1	15	0.9	13.5
Pre-Amp IC	Supplier Data	1	8.09	1	8.09
Capacitors	Telcordia (Fixed Ceramic)	41	1	1	41
Resistors	Telcordia (Thick Film)	26	0.5	1	13
Inductors	Supplier (Ferrite Beads)	4	0.5	1	2
Inductors	Telcordia (Chip Coil- RF,Fixed)	2	7	1	14
Power Inductor	Telcordia (Transformer Power)	1	19	1	19
Diode	Refer Telcordia (Silicon)	1	6	1	6
Transistors	Telcordia (NPN Silicon <0.6W)	2	4	1	8
Driver/Quantizer IC	Supplier Data	1	1.3	1	1.3
Laser Driver IC	Supplier Data	1	10.93	1	10.93
IC, High Voltage Boost Converter	Supplier Data	1	6.79	1	6.79
IC, P-MOSFET	Supplier Data	1	2.8	1	2.8
IC, Current Shunt Monitor	Supplier Data	1	6.83	1	6.83
DMI management IC (uP)	Supplier Data	1	4	1	4
Connector	Telcordia (Printed Board,Edge)	20	0.2	1	4
				AFCT-5745NPZ Module Failure @ 40°C (FITs)	252.14
				MTTF @ 40°C (Hours)	3.97E+06

Table 1b. FIT rate for AFCT-5745UPZ/AUPZ

Reliability Prediction Based On Telecordia SR-332 - Parts Count Method		**Temperature Factor @ 40°C**			1
		Stress Factor at 50%			1
		Enviromental Factor			1
Component	**Telecordia Information/ Data Source**	**Quantity**	**Component Base Rate (FITs)**	**Quality Factor**	**Total Component Failure Rate (FITs)**
2.5G DFB Laser Diode (1550nm)	Supplier Data	1	86	0.9	77.4
Monitor PIN	Telcordia (Photodiode)	1	15	0.9	13.5
2.5G APD Photodiode	Telcordia (Photodiode)	1	15	0.9	13.5
Pre-Amp IC	Supplier Data	1	8.09	1	8.09
Capacitors	Telcordia (Fixed Ceramic)	41	1	1	41
Resistors	Telcordia (Thick Film)	26	0.5	1	13
Inductors	Supplier (Ferrite Beads)	4	0.5	1	2
Inductors	Telcordia (Chip Coil- RF,Fixed)	2	7	1	14
Power Inductor	Telcordia (Transformer Power)	1	19	1	19
Diode	Refer Telcordia (Silicon)	1	6	1	6
Transistors	Telcordia (NPN Silicon <0.6W)	2	4	1	8
Driver/Quantizer IC	Supplier Data	1	1.3	1	1.3
Laser Driver IC	Supplier Data	1	10.93	1	10.93
IC, High Voltage Boost Converter	Supplier Data	1	6.79	1	6.79
IC, P-MOSFET	Supplier Data	1	2.8	1	2.8
IC, Current Shunt Monitor	Supplier Data	1	6.83	1	6.83
DMI management IC (uP)	Supplier Data	1	4	1	4
Connector	Telcordia (Printed Board,Edge)	20	0.2	1	4
				AFCT-5745UPZ Module Failure @ 40°C (FITs)	252.14
				MTTF @ 40°C (Hours)	3.97E+06

FITs 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 πT. The following table shows FITs at different temperatures for the transmitter, receiver, and transceiver.

Table 2. FIT rates at different operation ambient temperatures, following the Telcordia Parts Count Method

Operating Ambient Temperture (°C)	AFCT-5745NPZ (FITs)	AFCT-5745UPZ (FITs)
40	252.14	252.14
45	302.57	302.57
50	378.21	378.21
55	453.85	453.85

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.

Accelerated Aging Tests

Product integrity is also verified by Accelerated Aging. Tables 3a and 3b summarize the High Temperature Operating Life stress (HTOL) performed on the product. On-going reliability monitoring will continue to add to the total device hours under test.

Table 3a. Demonstrated Operating Life Test Performance – AFCT-5745NPZ/ANPZ & AFCT-57J5ANPZ

Test Name	Stress Test Conditions	Units Tested	Total Device Hours	No. of Failed Units
High Temperature Operating Life	Vcc = 3.3V Ta = 85°C	AFCT-5745NPZ (11 X 2000 Hrs)	22,000	0

Table 3b. Demonstrated Operating Life Test Performance – AFCT-5745UPZ/AUPZ

Test Name	Stress Test Conditions	Units Tested	Total Device Hours	No. of Failed Units
High Temperature Operating Life	Vcc = 3.3V Ta = 85°C	AFCT-5745UPZ (25 X 2000 Hrs)	50,000	0

Information on random FIT calculations based upon this data can be obtained from your local Avago Technologies contact.

For product information and a complete list of distributors, please go to our web site: **www.avagotech.com**

Avago, Avago Technologies, and the A logo are trademarks of Avago Technologies in the United States and other countries.
Data subject to change. Copyright © 2005-2010 Avago Technologies. All rights reserved.
AV02-2693EN - October 22, 2010