AFCT-596xTLZ/TGZ/ATLZ/ATGZ

Single Mode Laser SFF Transceivers for ATM, SONET OC-3 / SDH STM –1 (S1.1)

Characterization Report

Introduction

AFCT-596xTLZ/TGZ/ATLZ/ATGZ transceivers are a family of high performance, 3.3 V modules for cost effective serial optical data communications. They are designed to provide an ATM/ SONET/SDH compliant link for 155.52 Mb/s intermediate reach applications. These modules are intended for single mode fiber, operate at a nominal wavelength of 1300 nm and are supplied in LC connector interface SFF packages.

AFCT-5962 and AFCT-5964 series have an industry standard 2 x 10 footprint providing a transmitter disable function and analogue monitor outputs. AFCT-5961 and AFCT-5963 series have an industry standard 2 x 5 footprint.

All of these modules share Avago Technologies' high performance, reliable, long wavelength optical devices and proprietary laser driver IC for the transmitter. The receiver utilizes commercially available ICs.

This report details the characterization work completed to evaluate performance under all conditions against target parameters in the product specification. Transceivers were characterized at –40°C,0°C,+25°C, +70°C and +85°C at supply voltages of 3.1V, 3.3V and 3.5V.

Avago Technologies' AFCT-5962ATLZ (2x10, extended temperature) was used as a vehicle to characterize the AFCT-596x series transceivers. The test results are therefore representative of AFCT-5961 ATLZ/ATGZ, AFCT-5962ATLZ/ATGZ, AFCT-5963ATLZ/ATGZ, AFCT-5964ATLZ/ATGZ (-40°C to +85°C) and AFCT-5961TLZ/TGZ, AFCT-5962TLZ/TGZ, AFCT-5963TLZ/TGZ, AFCT-5964TLZ/TGZ (0°C to +70°C).

AFCT-5963 and AFCT-5964 series have a +3.3V TTL signal detect output. Additional results are given in Appendix B covering the parameters affected by this change.

Summary

- Characterization demonstrates compliance with Product Specifications
- Typical Receiver Sensitivity: -38 dBm
- SONET OC-3/SDH STM-1 Compliant

Definition of terms

The following terms are used in this document and are explained and defined below:

Transmitter Parameters

Output Power (dBm)

This measures the optical output of the laser transmitter modulated with a 155 Mb/s, pseudo random bit sequence (PRBS) with worst case consecutive intersymbol duration as specified in ITU-T G.958. As recommended by ITU-T G.957, the output power is measured at a point after the first connector in order to account for the LC connector loss. To accomplish this, the optical output is coupled to a large area detector by a short patchcord.

Extinction Ratio (dB)

The extinction ratio measures the ratio of the output power of the light in a "1" or "on" logic state to the output power of the light in a "0" or "off" logic state. The ER is measured using a 2^{23}-1 PRBS at 155 Mb/s data rate with an Avago Technologies 83480A Digital Communications Analyzer running on an automatic algorithm.

Transmitter Supply Current (mA)

This is the current supplied to the transmitter at the stated supply voltage including that drawn by the termination resistance network on the evaluation board.

Wavelength (nm)

The mean wavelength as measured by an Avago Technologies 70950A optical spectrum analyzer. The transmitter is modulated with a 2^{23}-1 PRBS at 155 Mb/s.

Spectral Width (nm)

Spectral Width is defined as the RMS width containing all modes with energy greater than 20 dB down from the peak wavelength.

Optical Output Rise and Fall Times (ps)

The optical output rise and fall time is the transition time between 10% to 90% of the signal amplitude. With the transmitter driven by a 155 Mb/s alternate 1010 pattern measurements were completed using an Avago Technologies 83480A Digital Communications Analyzer on an unfiltered waveform.

Laser Bias Monitor
(2 x 10 pin products only)

The laser bias monitor output (BMON) is obtained by probing between BMON+ and BMON- and is measured in mV. The module was modulated at 155 Mb/s using a 2^{23}-1 PRBS.

Rear Facet Monitor
(2 x 10 pin products only)

The laser rear facet power monitor output (PMON) is obtained by probing between PMON+ and PMON- and is measured in mV. The module was modulated at 155 Mb/s using a 2^{23}-1 PRBS.

Receiver Parameters

Sensitivity (dBm)

This measures the receiver sensitivity with a 2^{23}-1 PRBS input signal compliant to SDH/SONET recommendations. An Avago Technologies 83430A optical source with 10 dB extinction ratio was used as the test laser. The sensitivity is the minimum optical power that the receiver can recover a signal with an error rate of 1E-10. Receiver Supply Current (mA) This is the current supplied to the receiver at the stated supply voltage including that drawn by the termination resistance network on the evaluation board. AFCT-5961 and AFCT-5962 series have a LVPECL SD which was terminated with the standard 82 ohm/130 ohm scheme.

Signal Detect Deasserted Threshold (dBm)

This is the optical power level that causes the device's Signal Detect circuit to switch from asserted to deasserted (logic "high" to "low") due to optical signal loss. It is measured by decreasing the optical power from a known point using an Avago Technologies 8156A optical attenuator calibrated to display the power level present at the receiver port when the logic output switches.

Signal Detect Hysteresis (dB)

This is the difference between the Signal Detect Deasserted Threshold value and the value at which the signal detect voltage returns to the "high" state in response to an increased optical signal.

Signal Detect High (V)

This measures the Signal Detect output voltage for a logic "high" state. LVPECL alarm output is measured with respect to the positive supply VCC.

Signal Detect Low (V)

This measures the Signal Detect output voltage for a logic "low" state. LVPECL alarm output is measured with respect to the positive supply VCC.

Data Rise and Fall Time (ps)

The rise and fall time is the transition time between 20% and 80% of the signal amplitude. This is measured using an alternate 1010 pattern at 155 Mb/s using an Avago Technologies 83480A Digital Communications Analyzer.

Temperature (°C)

The tests were conducted in a controlled environment with an approximate airflow of 2 m/s, to ensure that the devices under test had settled to the required temperature ±1°C.

Results

Characterization of AFCT-5962ATLZ devices a 3.1 V and 3.5 V, –40°C, +25°C and +85°C.

Table 1 reports results from the extreme single point and mean measurements for AFCT-5962ATLZ devices against the product specification at the minimum and maximum supply voltages (3.1 V and 3.5 V) and over the operating temperature range (-40°C, +25°C and +85°C).

These results demonstrate that the AFCT-5962ATLZ remains within the product specification at the extreme supply voltages over the operating temperature range.

Table 1. AFCT-5962ATLZ mean, minimum and maximum parameters at VCC = 3.1 V and 3.5 V over the operating temperature range compared to product specification limits

					Product Specification	
Parameter	**Units**	**Mean**	**Minimum**	**Maximum**	**Minimum**	**Maximum**
Output power	dBm	-10.28	-12.23	-8.83	-15	-8
Extinction Ratio	dB	12.99	8.39	18.43	8.2	-
Transmitter Supply Current	mA	53.2	38	76	-	140
Wavelength	nm	1303.66	1270.17	1334.3	1261	1360
Spectral Width	nm	1.34	0.907	2.85	-	7.7
Tx Rise Time	ps	705.3	211	1489		2000
Tx Fall Time	ps	1055	444	1622		2000
Receiver Supply Current	mA	102	92	110	-	140
Sensitivity	dBm	-38.06	-38.83	-36.12	-	-31
Signal Detect Deasserted Threshold	dBm	-41.38	-41.97	-39.97	-45	
Signal Detect Output Voltage - High[1]	V	-1.05	-1.07	-1.03	-1.1	-0.88
Signal Detect Output Voltage - Low[1]	V	-1.76	-1.762	-1.72	-1.84	-1.6
Signal Detect Hysteresis	dB	1.39	1.08	1.89	0.5	4
Rx Rise Time	ps	701.4	400	889		2200
Rx Fall Time	ps	575.14	233	977		2200

Note 1. Referenced to Vcc

Main characterization of AFCT-5962ATLZ devices at 3.3 V and –40°C, 0°C, +25°C, +70°C and +85°C.

Table 2 reports the extreme single point and mean measurements for AFCT-5962ATLZ devices against the product specification at 3.3 V over the ambient operating temperature range–40°C to +85°C.

These results demonstrate that all the devices meet the limits outlined in the product specification.

The tables in Appendix A contain a more detailed set of data featuring results taken for each parameter. Results of each specific measurement are held on file at Avago Technologies.

Table 2. AFCT-5962ATLZ mean, minimum and maximum parameters at VCC = 3.3 V over the operating temperature range compared to product specification limits

					Product Specification	
Parameter	**Units**	**Mean**	**Minimum**	**Maximum**	**Minimum**	**Maximum**
Output power	dBm	-10.16	-11.85	-8.79	-15	-8
Extinction Ratio	dB	12.97	8.33	18.46	8.2	-
Transmitter Supply Current	mA	53.2	39	74	-	140
Wavelength	nm	1303.66	1270.17	1334.3	1261	1360
Spectral Width	nm	1.34	0.907	2.85	-	7.7
Tx Rise Time	ps	722.48	219	1211		2000
Rx Fall Time	ps	1053.1	822	1333		2000
Receiver Supply Current	mA	102	99	105	-	140
Sensitivity	dBm	-38.1	-38.84	-36.79	-	-31
Signal Detect Deasserted Threshold	dBm	-41.59	-42.4	-40.89	-45	
Signal Detect Output Voltage - High[1]	V	-1.05	-1.08	-1.02	-1.1	-0.88
Signal Detect Output Voltage - Low[1]	V	-1.75	-1.78	-1.68	-1.84	-1.6
Signal Detect Hysteresis	dB	1.38	1.18	1.58	0.5	4
Rx Rise Time	ps	678.1	367	878		2200
Rx Fall Time	ps	568.5	278	944		2200

Note 1. Referenced to Vcc

Eye Diagram

A typical output eye diagram for a AFCT-5962ATLZ at +25°C and 3.3 V is displayed in Figure 2. The eye mask was measured through a filter as defined by the SONET/SDH recommendation and is compared to the standard's output eye diagram mask.

Also shown in Figure 3 is a typical unfiltered transmitter output at +25°C and 3.3 V.

Conclusions

The AFCT-5962ATLZ characterization was completed and showed that all the critical parameters met the Product Specification.

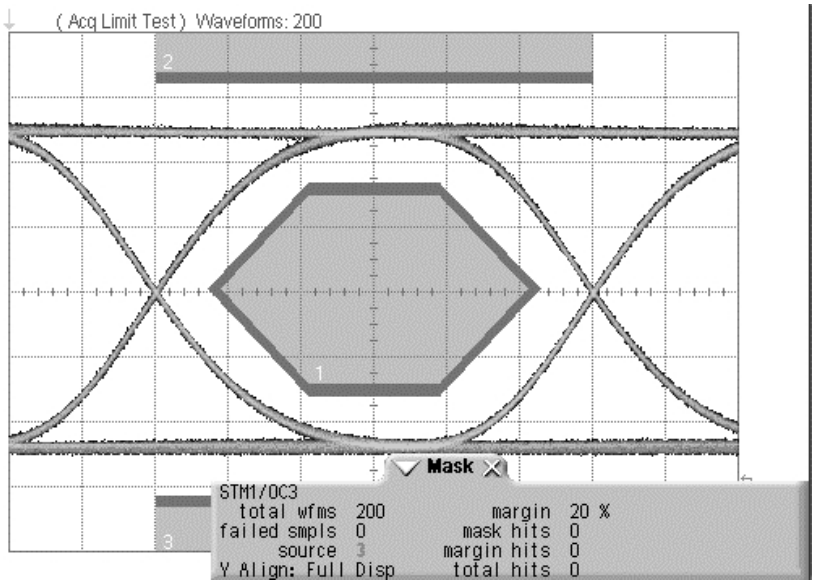

Figure 2. Typical filtered transmitter eye mask plot at 25°C

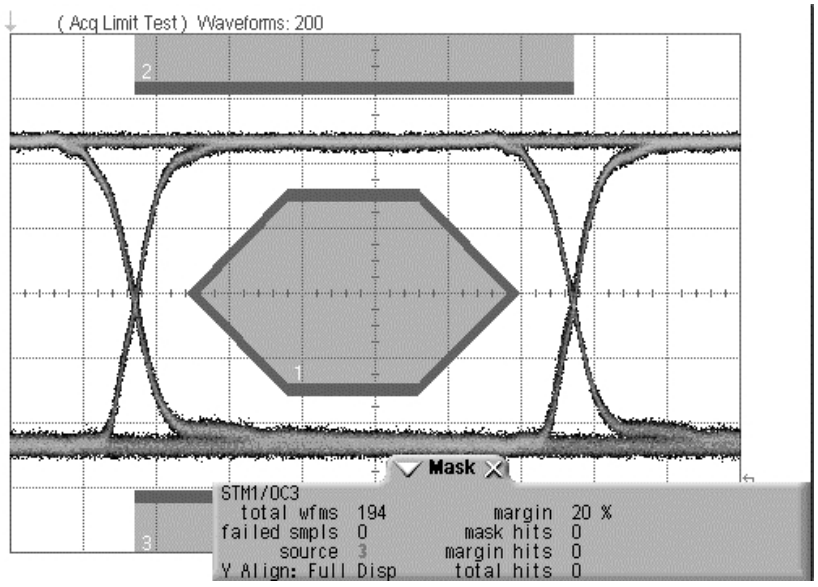

Figure 3. Typical unfiltered transmitter eye mask plot at 25°C

Appendix A. AFCT-5962ATLZ measured at -40°C, 0°C ,+25°C, +70°C, +85°C at 3.3V

Characterization results at –40°C, 3.3V

Parameters	Units	Minimum	Mean	Maximum
Output power	dBm	-10.71	-11.85	-9.01
Extinction Ratio	dB	11.97	8.33	19.57
Transmitter Supply Current	mA	44	39	51
Wavelength	nm	1279.4	1276.2	1293.17
Spectral Width	nm	1.07	0.97	1.25
Tx Rise Time	ps	496.6	219	644
Tx Fall Time	ps	900	822	1000
Receiver Supply Current	mA	100	99	101
Sensitivity	dBm	-38.28	-38.84	-37.44
Signal Detect Deasserted Threshold	dBm	-41.73	-42.4	-41.14
Signal Detect Output Voltage - High[1]	V	-1.07	-1.08	-1.06
Signal Detect Output Voltage - Low[1]	V	-1.71	-1.72	-1.68
Signal Detect Hysteresis	dB	1.43	1.28	1.58
Rx Rise Time	ps	773.9	578	878
Rx Fall Time	ps	635.6	478	833

Characterization results at 0°C, 3.3V

Parameters	Units	Minimum	Mean	Maximum
Output power	dBm	-10.36	-11.16	-9.31
Extinction Ratio	dB	12.63	10.33	17.85
Transmitter Supply Current	mA	47	42	53
Wavelength	nm	1293.64	1290.54	1297.11
Spectral Width	nm	1.18	0.96	1.36
Tx Rise Time	ps	640.5	488	767
Tx Fall Time	ps	969.95	844	1067
Receiver Supply Current	mA	101	100	103
Sensitivity	dBm	-38.18	-38.83	-37.67
Signal Detect Deasserted Threshold	dBm	-41.49	-41.85	-40.99
Signal Detect Output Voltage - High[1]	V	-1.05	-1.05	-1.04
Signal Detect Output Voltage - Low[1]	V	-1.76	-1.77	-1.75
Signal Detect Hysteresis	dB	1.48	1.38	1.58
Rx Rise Time	ps	567.8	367	678
Rx Fall Time	ps	553.85	433	756

Characterization results at +25°C, 3.3V

Parameters	Units	Minimum	Mean	Maximum
Output power	dBm	-10.21	-11.03	-9.02
Extinction Ratio	dB	12.76	9.88	18.68
Transmitter Supply Current	mA	50	46	58
Wavelength	nm	1303.36	1300.3	1307.18
Spectral Width	nm	1.29	1.11	1.41
Tx Rise Time	ps	691.15	400	889
Tx Fall Time	ps	1029.95	944	1100
Receiver Supply Current	mA	102	101	104
Sensitivity	dBm	-38.2	-38.75	-37.31
Signal Detect Deasserted Threshold	dBm	-41.72	-42.4	-41.17
Signal Detect Output Voltage - High[1]	V	-1.03	-1.04	-1.02
Signal Detect Output Voltage - Low[1]	V	-1.78	-1.77	-1.74
Signal Detect Hysteresis	dB	1.45	1.37	1.48
Rx Rise Time	ps	790.5	644	844
Rx Fall Time	ps	613.9	422	733

Characterization results at +70°C, 3.3V

Parameters	Units	Minimum	Mean	Maximum
Output power	dBm	-10.21	-11.03	-9.02
Extinction Ratio	dB	12.76	9.88	18.68
Transmitter Supply Current	mA	50	46	58
Wavelength	nm	1303.36	1300.3	1307.18
Spectral Width	nm	1.29	1.11	1.41
Tx Rise Time	ps	691.15	400	889
Tx Fall Time	ps	1029.95	944	1100
Receiver Supply Current	mA	102	101	104
Sensitivity	dBm	-38.2	-38.75	-37.31
Signal Detect Deasserted Threshold	dBm	-41.72	-42.4	-41.17
Signal Detect Output Voltage - High[1]	V	-1.03	-1.04	-1.02
Signal Detect Output Voltage - Low[1]	V	-1.78	-1.77	-1.74
Signal Detect Hysteresis	dB	1.45	1.37	1.48
Rx Rise Time	ps	790.5	644	844
Rx Fall Time	ps	613.9	422	733

Characterization results at +85°C, 3.3V

Parameters	Units	Minimum	Mean	Maximum
Output power	dBm	-9.74	-11.17	-8.79
Extinction Ratio	dB	14.76	10.31	17.78
Transmitter Supply Current	mA	66	45	74
Wavelength	nm	1329.81	1326.21	1334.3
Spectral Width	nm	1.71	1.32	2.85
Tx Rise Time	ps	970.47	611	1211
Tx Fall Time	ps	1203.95	1044	1333
Receiver Supply Current	mA	104	103	105
Sensitivity	dBm	-37.83	-38.44	-36.79
Signal Detect Deasserted Threshold	dBm	-41.6	-42.25	-41.17
Signal Detect Output Voltage - High[1]	V	-1.04	-1.05	-1.02
Signal Detect Output Voltage - Low[1]	V	-1.77	-1.78	-1.75
Signal Detect Hysteresis	dB	1.25	1.18	1.39
Rx Rise Time	ps	438.95	278	656
Rx Fall Time	ps	499.85	278	611

Appendix B. AFCT-5964ATLZ measured at -40°C, 0°C, +25°C, +70°C, +85°C at 3.3V

Results demonstrate 3.3V TTL signal detect variants on AFCT-5964ATLZ comply with product specification.

					Product Specification	
Parameter	**Units**	**Mean**	**Minimum**	**Maximum**	**Minimum**	**Maximum**
Signal Detect Deasserted Threshold	dBm	-41.65	-42.15	-41.15	-45	
Signal Detect Asserted Threshold	dBm	-40.25	-40.71	-39.68		-34
Signal Detect Hysteresis	dB	1.39	1.17	1.58	0.5	4
Signal Detect Output Voltage - High	V	3.21	3.00	3.43	2.2	
Signal Detect Output Voltage - Low	V	0.21	0.12	0.34		0.6

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

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