Data Sheet

1.25G SFP Optical Transceiver

TSFP553-DSL80

(Up to 80km transmission)

Description

TSFP553-DSL80 is high performance, cost effective module. It is designed for Gigabit Ethernet and 1x Fibre Channel applications, which supports 80km transmission with 9/125 μm SMF.

The transceiver consists of two sections: The transmitter section incorporates a DFB laser. And the receiver section consists of a PIN photodiode integrated with a trans-impedance preamplifier (TIA). All modules satisfy class I laser safety requirements.

The optical output can be disabled by a TTL logic high-level input of Tx Disable. Tx Fault is provided to indicate that degradation of the laser. Loss of signal (LOS) output is provided to indicate the loss of an input optical signal of receiver.

TSFP553-DSL80 is compliant with RoHS.

Features

- Dual data-rate of 1.25Gbps/1.0625Gbps
- 80km transmission distance with 9/125 μm SMF
- 1550nm DFB laser
- PIN photodiode receiver
- Class I laser product
- Standard serial ID information compatible with SFP MSA
- SFP MSA package with duplex LC receptacle
- With Spring latch for high density application
- Very low EMI and excellent ESD protection
- Single 3.3V power supply
- Operating case temperature:
  Standard: 0 to +70°C

Applications

- Switch to Switch interface
- Switched backplane applications
- Router/Server interface
- Other optical transmission systems

Standard

- Compatible with SFP MSA
- Compatible with IEEE 802.3z
- Compatible with IEEE 802.3ah
- Compatible with FCC 47 CFR Part 15, Class B
- Compatible with FDA 21 CFR 1040.10 and
- 1040.11, Class I
- Compatible with ANSI INCITS Fibre Channel FC-PI Rev13
- Compatible with Telcordia GR-468-CORE
- compliance with RoHS

Functional Diagram

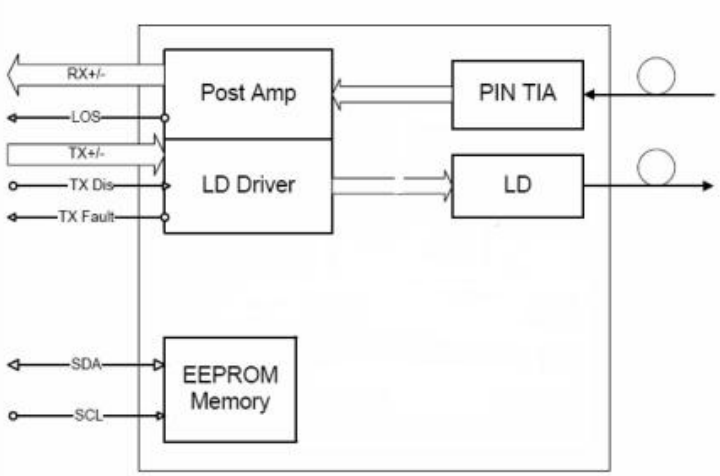


Figure 1 Functional Diagram

Transmitter Section

Transmitter is designed for single mode fiber and operates at a nominal wavelength of 1310nm. The transmitter module uses a MQW FP laser diode and full IEC825 and CDRH class 1 eye safety. The output power can be disabled via the single TxDis pin. Logic LVTTL HIGH level disables the transmitter. It contains APC function, temperature compensation circuit, PECL data inputs, LVTTL Txdis input and Tx fault Output interface.

Receiver Section

The receiver section uses a hermetic packaged front end receiver (InGaAs PIN and preamplifier). The postamplifier is ac coupled to preamplifier through a capacitor and a low pass filter. The capacitor and LPF are enough to pass the signal from 5Mb/s to 200Mb/s without significant distortion or performance penalty. The LPF limits the preamplifier bandwidth to improve receiver sensitivity. As the input optical is decreased, LOS will switch from low to high. As the input optical power is increased from very low levels, LOS will switch back from high to low.

EEPROM Section

The optical transceiver contains an EEPROM. It provides access to sophisticated identification information that describes the transceiver's capabilities, standard interfaces, manufacturer, and other information.

The serial interface uses the 2-wire serial CMOS EEPROM protocol defined for the ATMEL AT24C01A/02/04 family of components. When the serial protocol is activated, the host generates the serial clock signal (SCL, Mod Def 1). The positive edge clocks data into those segments of the EEPROM that are not write protected within the SFP transceiver. The negative edge clocks data from the SFP transceiver. The serial data signal (SDA, Mod Def 2) is bi-directional for serial data transfer. The host uses SDA in conjunction with SCL to mark the start and end of serial

protocol activation. The memories are organized as a series of 8-bit data words that can be addressed individually or sequentially.

Memory Map

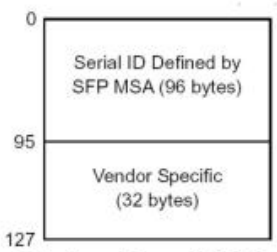


Figure 2 2 wire address 1010000x (A0h)

Absolute Maximum Ratings

Table 1 - Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit	Notes
Storage Temperature	TS	-40	+85	°C	
Supply Voltage	VCC	-0.5	3.6	V	
Operating Relative Humidity	-	5	95	%	

Note:

Stress in excess of the maximum absolute ratings can cause permanent damage to the module.

Operating Conditions

Table 2 - Operating Conditions

Parameter		Symbol	Min.	Typical	Max.	Unit	Notes
Operating Case Temperature		TC	0		70	°C	
Power Supply Voltage		VCC	3.13		3.47	V	
Power Supply Current		ICC		200	300	mA	
Date Rate	Gigabit Ethernet			1.25		Gbps	
	Fibre Channel			1.0625			

Electrical Input/Output Characteristics

Table 3- Transmitter electrical Characteristics

Parameter		Symbol	Min.	Typical	Max.	Unit	Notes
Data Input Swing Differential		Vin	500		2400	mV	1
Input Differential Impedance		Zin	90	100	110	Ω	
TX Disable	Disable		2.0		Vcc+0.3	V	
	Enable		0		0.8	V	
TX Fault	Fault		2.0		Vcc+0.3	V	2
	Normal		0		0.8	V	

Table 4- Receiver electrical Characteristics

Parameter		Symbol	Min.	Typical	Max.	Unit	Notes
Data Output Swing Differential		VOUT	370		2000	mV	3
LOS	High		2.0		Vcc+0.3	V	2
	Low		0		0.8	V	

Notes:

1. TD+/- are internally AC coupled with 100Ω differential termination inside the module.
2. Tx Fault and Rx LOS are open collector outputs, which should be pulled up with 4.7k to 10kΩ resistors on the host board. Pull up voltage between 2.0V and Vcc+0.3V.
3. RD+/- outputs are internally AC coupled, and should be terminated with 100Ω (differential) at the user SERDES.

Optical Characteristics

Table 5- Transmitter Optical Characteristics

Parameter		Symbol	Min.	Typical	Max.	Unit	Notes
Average Output Power		P0ut	-2		3	dBm	1
Centre Wavelength		λC	1540	1550	1560	nm	
P0ut@TX Disable Asserted		P0ut			-45	dBm	1
Extinction Ratio		EX	9			dB	
Total Jitter	1.25G	TJ			0.431	UI	3
	1.0625				0.43		
Spectral Width (RMS)		σ			1	nm	
Rise/Fall Time (20%～80%)		tr/tf			0.26	ns	2
Output Optical Eye		IEEE 802.3z and ANSI Fibre Channel Compatible					4

Table 6- Receiver Optical Characteristics

Parameter		Symbol	Min.	Typical	Max.	Unit	Notes
Centre Wavelength		λC	1260	1550	1570	nm	
Receiver Sensitivity					-24	dBm	5
Receiver Overload			3			dBm	5
Return Loss			12			dB	
LOS De-Assert		LOSD			-25	dBm	
LOS Assert		LOSA	-35			dBm	
LOS Hysteresis			0.5		4.5	dB	
Total Jitter	1.25G	TJ			0.749	UI	3
	1.0625				0.61		
Deterministic Jitter	1.25G	DJ			0.462	UI	3
	1.0625				0.36		

Notes:

1. The optical power is launched into SMF.

2. Unfiltered, measured with a PRBS 2^7-1 test pattern @1.25Gbps

3. Measured with a PRBS 2^7-1 test pattern @1.25Gbps/1.0625Gbps. Meet the specified maximum output jitter requirements if the specified maximum input jitter is present.

4. Measured with a PRBS 2^7-1 test pattern @1.25Gbps/1.0625Gbps.

5. Measured with a PRBS 27-1 test pattern @1.25Gbps, worst-case extinction ratio, BER ≤1×10-12.

Pin Definitions

Figure 3, 4 below shows the pin numbering of SFP electrical interface. The pin functions are described in Table 7 and the accompanying notes.

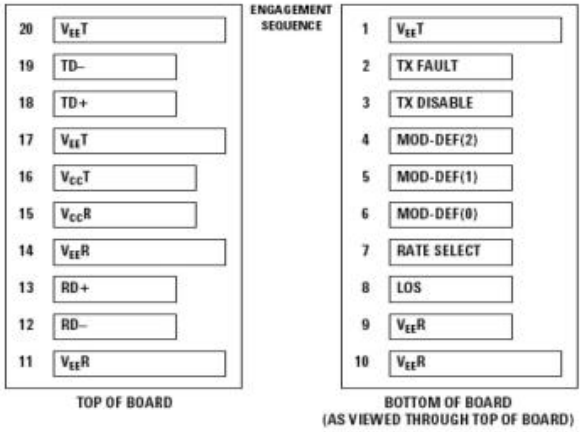


Figure 3 Pin Out Diagram

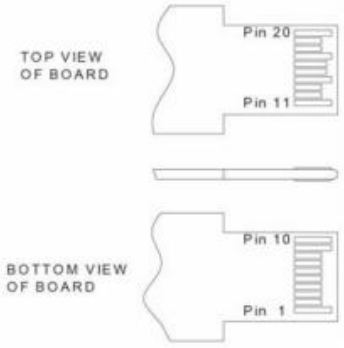


Figure 4 Pin View

Table 7-Pin Function Definitions

Pin Num .	Name	Function	Notes
1	VeeT	Transmitter Ground	
2	TX Fault	Transmitter Fault Indication	Note 1
3	TX Disable	Transmitter Disable	Note 2 Module disables on high or open
4	MOD-DEF2	Module Definition 2	Note 3, 2 w ire serial ID interface
5	MOD-DEF1	Module Definition 1	Note 3, 2 w ire serial ID interface
6	MOD-DEF0	Module Definition 0	Note 3 Grounded internally via 100Ω
7	NUC	NUC	No User Connection, reserved for future function.
8	LOS	Loss of Signal	Note 4
9	VeeR	Receiver Ground	
10	VeeR	Receiver Ground	
11	VeeR	Receiver Ground	
12	RD-	Inv. Received Data Out	Note 5
13	RD+	Received Data Out	Note 5
14	VeeR	Receiver Ground	
15	VccR	Receiver Power	Note 6,3.3V± 5%
16	VccT	Transmitter Power	Note 6,3.3V± 5%
17	VeeT	Transmitter Ground	
18	TD+	Transmit Data In	Note 7
19	TD-	Inv. Transmit Data In	Note 7
20	VeeT	Transmitter Ground	

Notes:

1. T_X Fault is an open collector/drain output, which should be pulled up with a 4.7KΩ~10KΩ resistor on the host board. Pull up voltage between 2.0V and V_{CCT}, R+0.3V. When high, output indicates a laser fault of some kind. Low indicates normal operation. In the low state, the output will be pulled to <0.8V.

2. T_X Disable is an input that is used to shut down the transmitter optical output. It is pulled up within the module with a 4.7KΩ~10KΩ resistor. Its states are:

   Low (0 – 0.8V): Transmitter on
   (>0.8, < 2.0V): Undefined
   High (2.0 – 3.465V): Transmitter Disabled
   Open: Transmitter Disabled

3. Mod-Def 0,1,2. These are the module definition pins. They should be pulled up with a 4.7KΩ~10KΩ resistor on the host board. The pull-up voltage shall be V_{CCT} or V_{CCR}.

   Mod-Def 0 is grounded by the module to indicate that the module is present
   Mod-Def 1 is the clock line of two wire serial interface for serial ID
   Mod-Def 2 is the data line of two wire serial interface for serial ID

4. LOS (Loss of Signal) is an open collector/drain output, which should be pulled up with a 4.7KΩ~10KΩ resistor.

Pull up voltage between 2.0V and V_{CCT}+0.3V. When high, this output indicates the received optical power is below the worst-case receiver sensitivity (as defined by the standard in use). Low indicates normal operation. In the low state, the output will be pulled to <0.8V.

5. RD-/RD+: These are the differential receiver outputs. They are AC coupled 100 differential lines which should be terminated with 100 (differential) at the user SERDES. The AC coupling is done inside the module and is thus not required on the host board.

6. V_{CCR} and V_{CCT} are the receiver and transmitter power supplies. They are defined as 3.3V±5% at the SFP connector pin. Maximum supply current is 300mA. Recommended host board power supply filtering is shown below. Inductors with DC resistance of less than 1 should be used in order to maintain the required voltage at the SFP input pin with 3.3V supply voltage. When the recommended supply filtering network is used, hot plugging of the SFP transceiver module will result in an inrush current of no more than 30mA greater than the steady state value. V_{CCR} and V_{CCT} may be internally connected within the SFP transceiver module.

7. TD-/TD+: These are the differential transmitter inputs. They are AC-coupled, differential lines with 100 differential terminations inside the module. The AC coupling is done inside the module and is thus not required on the host board.

Recommended Board Layout Hole Pattern

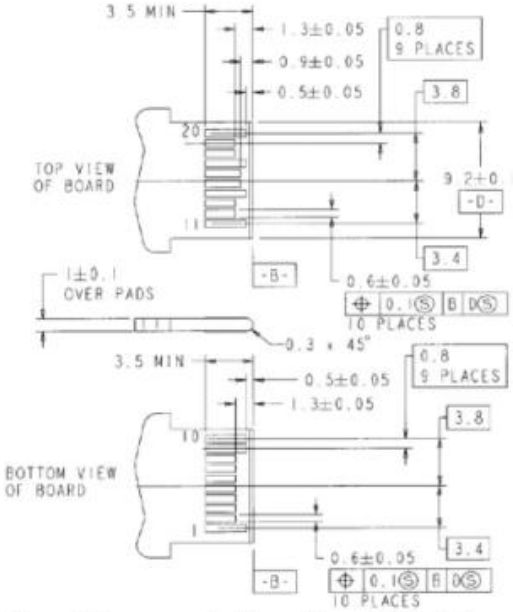
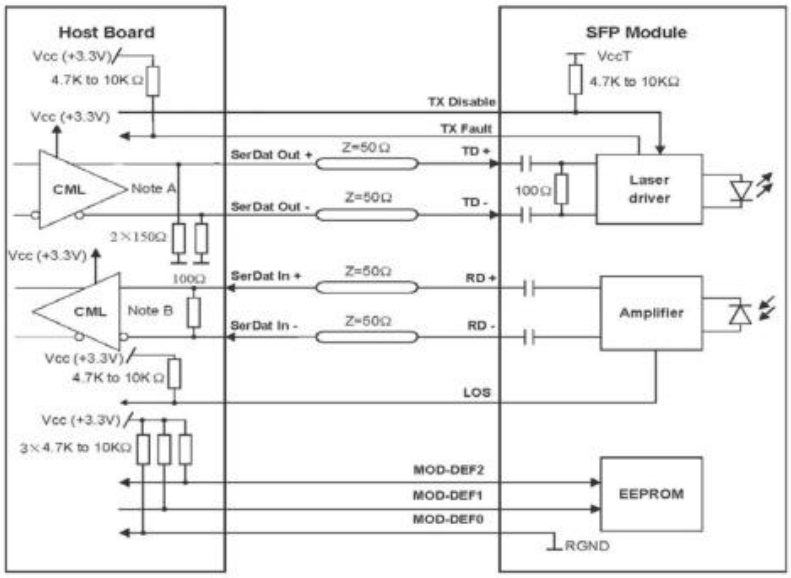


Figure 5 Recommended Board Layout Hole Pattern

Recommended Interface Circuit



Note A: Circuit assumes open emitter output
Note B: Circuit assumes high impedance internal bias @Vcc-1.3V

Figure 6 Recommended Interface Circuit

Recommended Host Board Power Supply Circuit

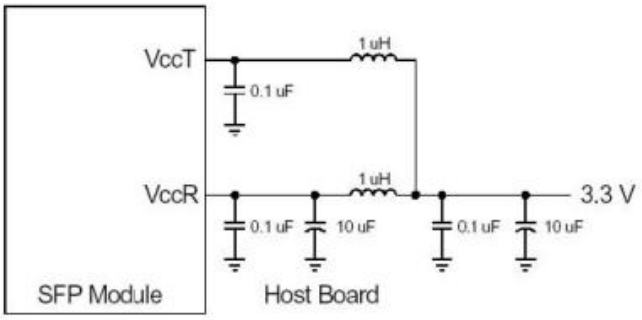
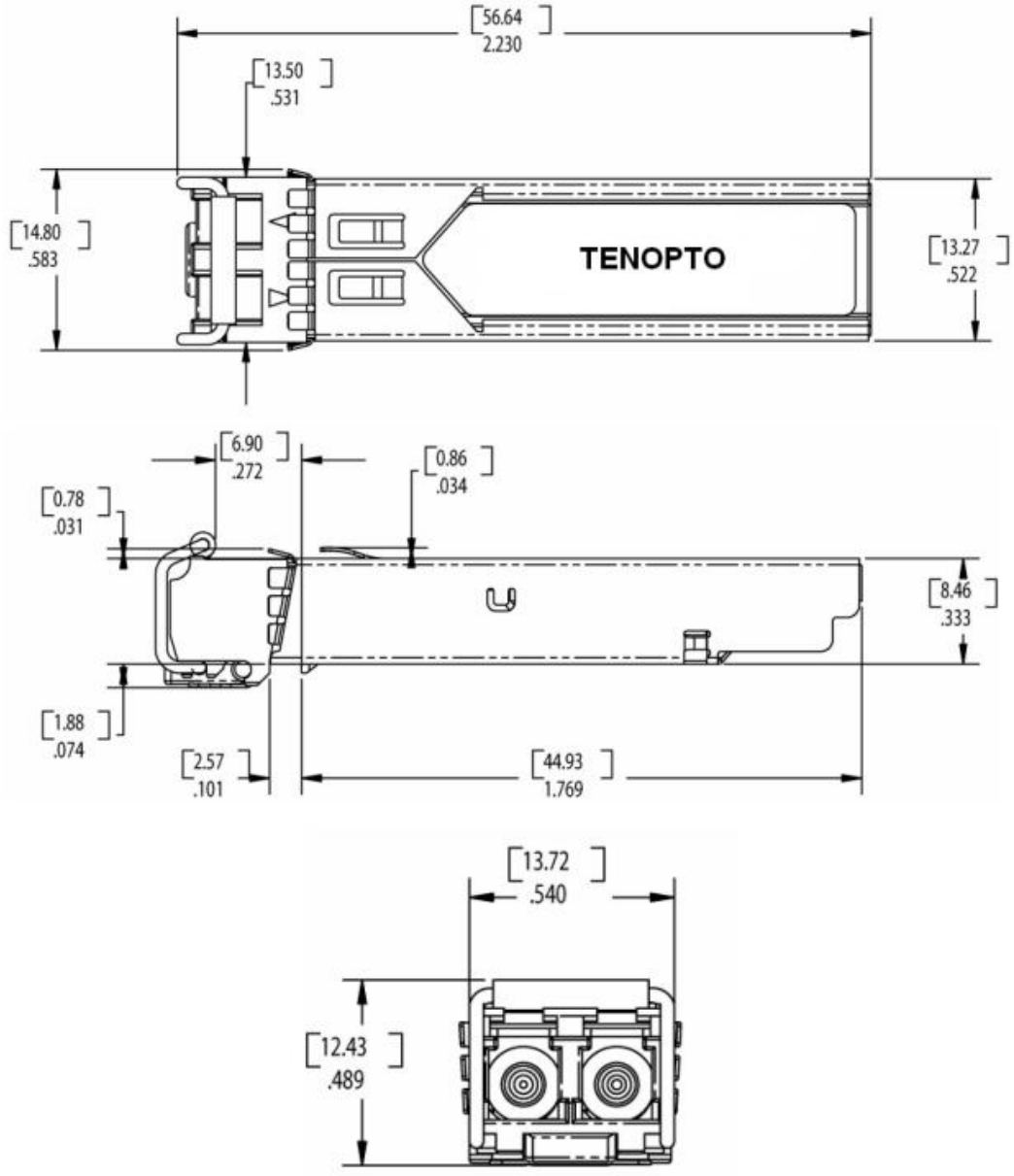


Figure 7 Recommended power supply filter

Note:

Inductors with DC resistance of less than 1Ω should be used in order to maintain the required voltage at the SFP input pin with 3.3V supply voltage. When the recommended supply filtering network is used, hot plugging of the SFP transceiver module will result in an inrush current of no more than 30 mA greater than the steady state value.

Package Dimension



EEPROM Information

EEPROM Serial ID Memory Contents

The SFP MSA defines a 256-byte memory map in EEPROM describing the transceiver's capabilities, standard interfaces, manufacturer, and other information, which is accessible over a 2 wire serial interface at the 8-bit address 1010000X (A0h). The memory contents refer to Table 8.

Table 8-EEPROM Serial ID Memory Contents

Addr.	Field Size (Bytes)	Name of Field	Hex	Description
0	1	Identifier	03	SFP
1	1	Ext. Identifier	04	MOD4
2	1	Connector	07	LC
3—10	8	Transceiver	00 00 00 02 12 00 0D 01	Transmitter Code
11	1	Encoding	01	8B10B
12	1	BR, nominal	0D	1.25Gbps
13	1	Reserved	00	
14	1	Length (9um)-km	50	80km
15	1	Length (9um)	FF	
16	1	Length (50um)	00	
17	1	Length (62.5um)	00	
18	1	Length (copper)	00	
19	1	Reserved	00	
20—35	16	Vendor name	xx xx xx xx xx xx xx xx xx xx xx xx xx xx xx xx	"Vendor name "(ASC Ⅱ)
36	1	Reserved	00	
37—39	3	Vendor OUI	00 00 00	
40—55	16	Vendor PN	xx xx xx xx xx xx xx xx xx xx xx xx xx xx xx xx	"Vendor PN" (ASC Ⅱ)
56—59	4	Vendor rev	xx xx xx xx	ASC Ⅱ ("31 30 20 20" means 1.0 revision)
60-61	2	Wavelength	06 0E	1550nm
62	1	Reserved	00	
63	1	CC BASE	xx	Check sum of bytes 0 - 62
64—65	2	Options	00 1A	LOS, TX_FAULT and TX_DISABLE
66	1	BR, max	00	
67	1	BR, min	00	
68—83	16	Vendor SN	xx xx xx xx xx xx xx xx xx xx xx xx xx xx xx xx	ASC Ⅱ

84—91	8	Vendor date code	xx xx xx xx xx xx 20 20	Year(2 bytes), Month(2 bytes), Day (2 bytes)
92—94	3	Reserved	00 00 00	
95	1	CC_EXT	xx	Check sum of bytes 64 - 94
96—255	160	Vendor specific		

Optical Transmitter Eye Diagrams

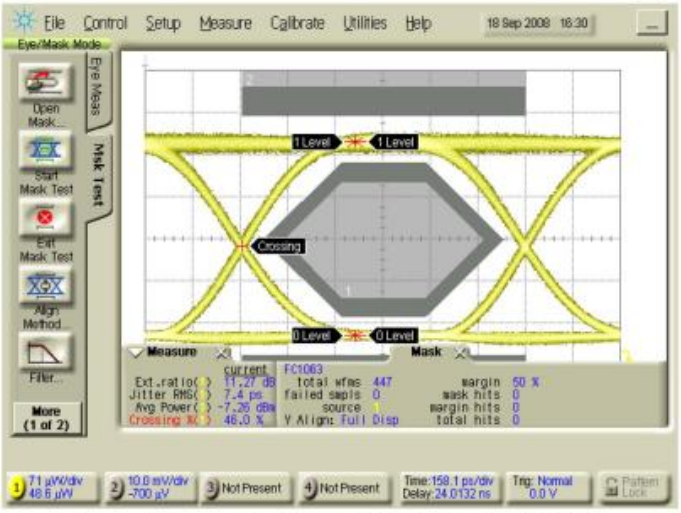


Figure 8 Transmitter Eye Mask FOR FC1063 at 1G FC

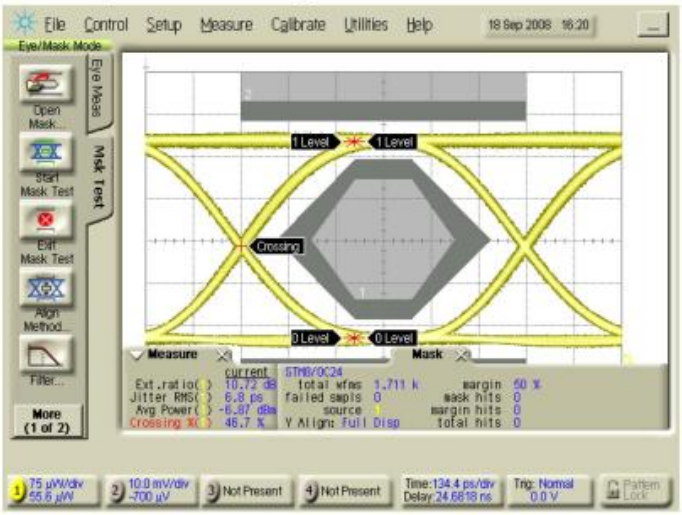


Figure 9 Transmitter Eye Mask For OC-24 at Gigabit Ethernet

Reliability Test Program

Scope and Conditions

The SFP series Single-mode transceivers have been fully qualified in accordance with the requirement of Telcordia Document GR-468-CORE. In this report, we briefly describe the qualification test performed on the transceivers under conditions defined in GR-468-CORE standards.

Table 9- Scope and Conditions

HEADING	TEST	CONDITIONS	SAMPLING		
			LTPD	SS	C
Mechanical Integrity	Mechanical Shock	5 times/axis 1,500G, 0.5ms	20	11	0
	Vibration	Cond. A 20G, 20-2,000 Hz, 4min/cy, 4cy/axis	20	11	0
Endurance	Accel. Aging (High Temp.)	85°C; rated power 1,000 hrs. for pass/fail 2,000, 5,000 hrs. for info.	-	25 10	-
	Low Temp. Storage	min. storage T 1,000 hrs. for pass/fail 2,000 hrs. for info.	20	11	0
	Temperature Cycling	-40°C to +85°C 500 for pass/fail 1,000 for info.	20 -	11 11	0 -
	Damp Heat	85°C/85%RH 1,000hrs.	20	11	0
	Cyc. Moist. Res.	-	20	11	0
Special Tests	Internal Moisture	Max. 5,000ppm water vapour	20	11	0
	ESD Threshold		-	6	-

Notes:

SS : Sample Size

C : Maximum number of failure allowed to pass the test

Sampling methods

Acceptance sampling of reliability test have been qualified in accordance with the requirements of Telcordia document GR-468-CORE and CNS14179.LTPD-20%,confidence-90%,SS/C-11/0,except accelerated aging (Biased), ESD threshold and flammability.

Regulatory Compliance

TSFP553-DSL80 SFP transceiver is designed to be class Laser safety compliant and is certified per the flowing standards:

Table 10- Regulatory Compliance

Feature	Standard	Performance
Electrostatic Discharge (ESD) to the Electrical Pins	MIL-STD-883E Method 3015.7	Class 2(>2000 V)
Electrostatic Discharge (ESD) to the Duplex LC Receptacle	IEC 61000-4-2 GR-1089-CORE	Compatible with standards
Electromagnetic Interference (EMI)	FCC Part 15 Class B EN55022 Class B (CISPR 22B) VCCI Class B	Compatible with standards
Immunity	IEC 61000-4-3	Compatible with standards
Laser Eye Safety	FDA 21CFR 1040.10 and 1040.11 EN60950, EN (IEC) 60825-1,2	Compatible with Class 1 laser product.
Component Recognition	UL and CSA	Compatible with standards
RoHS	2002/95/EC 4.1&4.2 2005/747/EC	Compliant with standards note

Package and handling instructions

Process Plug

It is important to note that single mode optics , as with all optical devices are susceptible to contamination from air borne particles, human body oils, and mating connector particles. Care should be taken to protect all exposed optical interfaces with process plugs and dust covers. All Tenopto TSFP553-DSL80 SFP products are supplied with a process plug. This plug protects the transceiver's optics during standard handling and manufacturing processes. It is recommended that the process plug remain in the transceiver whenever an optical fibre connector is not inserted.

ESD Discharge (ESD)

Normal ESD precautions are required during the handling of this module. This transceiver is shipped in ESD protective packaging and it should not be removed from its packaging or otherwise handled unless in an ESD protected environment utilizing standard grounded benches, floor mats, and wrist straps.

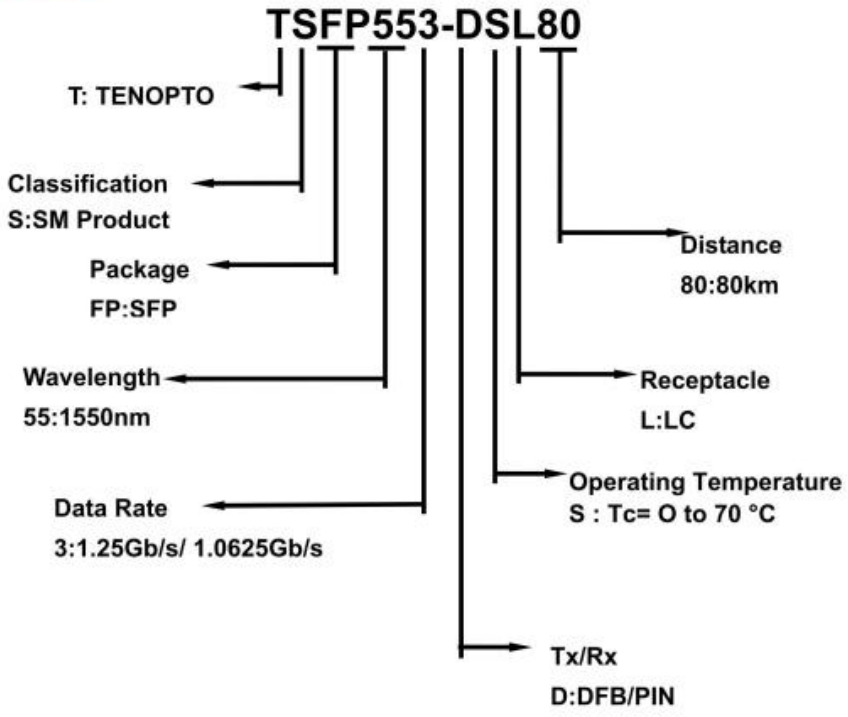
Eye Safety

TSFP553-DSL80 SFP products are Class laser products per IEC/EN60950-1:2001 and 60825-1:2001, and are certified per CDRH, 21 CFR1040, Laser Safety Requirements. It is an eye safe device when operated within

the limits of this specification. Operating this product in a manner inconsistent with intended usage and specification of the modified product as required by the U.S. Food and Drug Administration (21 CFR 1040).

Ordering information

Ordering Number



Label Part Number

Table 11- Label Part Number

Part NO	Product Description
TSFP553-DSL80	1550nm, 1.0625/1.25Gbps, 80km, Spring-latch SFP, 0°C~+70°C,

Note:

Some option codes may not be applicable to all the product models, please contact our sales representatives for further information.