

ESP5503-F0D(I)

155Mbps SFP Optical Transceiver, 150KM Reach

PRODUCT FEATURES

- Up to 155Mbps data-rate
- 1550nm DFB laser and APD photo detector for 150KM transmission
- Compliant with SFP MSA and SFF-8472 with duplex LC receptacle
- Digital Diagnostic Monitoring:
- Internal Calibration or External Calibration
- Compatible with RoHS
- +3.3V single power supply
- Operating case temperature:

Standard: 0 to +70°C

Industrial: -40 to +85°C



APPLICATIONS

- SDH STM-1, S-1.1, L-1.1, L-1.2
- SONET OC-3 IR1, LR1, LR2
- Other optical links

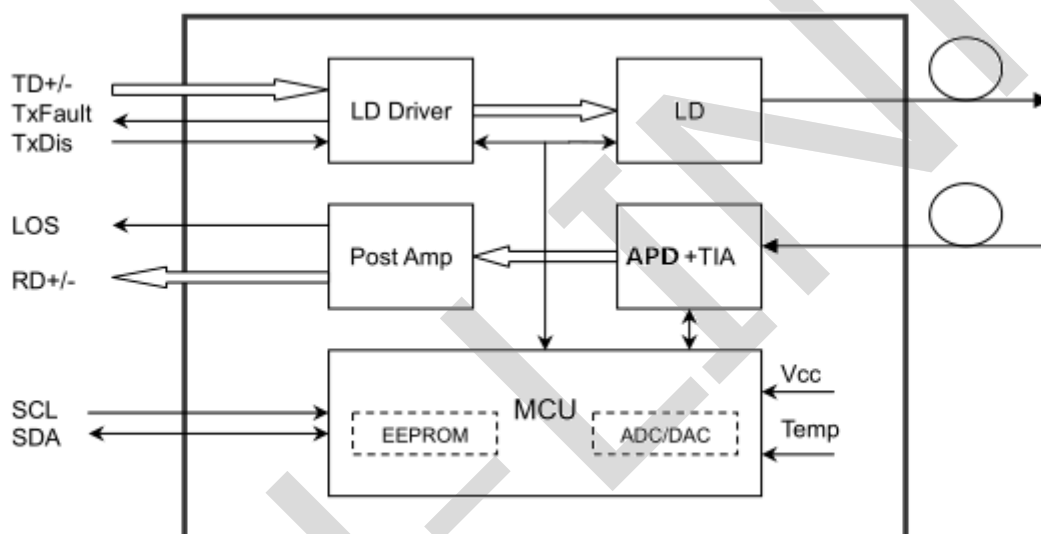
DESCRIPTIONS

The SFP transceivers are high performance, cost effective modules supporting data-rate of 155Mbps and 150KM transmission distance with SMF.

The transceiver consists of three sections: a DFB laser transmitter, b APD photodiode integrated with a trans-impedance preamplifier (TIA) and MCU control unit. All modules satisfy class I laser safety requirements.

The transceivers are compatible with SFP Multi-Source Agreement (MSA) and SFF-8472. For further information, please refer to SFP MSA.

Module Block Diagram



Ordering Information

Part No.	Data Rate(optical)	Laser	Fiber Type	Distance	Optical Interface	Temp	DDMI	Latch Color
ESP5503-F0D	155Mbps	DFB	SMF	150km	LC	0~70°C	Y	Green
ESP5503-F0DI	155Mbps	DFB	SMF	150km	LC	-40~ +85	Y	Green

Absolute Maximum Ratings

Parameter	Symbol	Min.	Typ	Max.	Unit	Ref.
Maximum Supply Voltage	Vcc	-0.5		4.7	V	
Storage Temperature	TS	-40		85	°C	
Case Operating Temperature	TOP	0		70	°C	

Recommended Operating Conditions

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Operating Case Temperature	T _{OP}	0		70	°C	Commercial
		-40		85		Industrial
Power Supply Voltage	V _{CC}	3.135	3.3	3.465	V	
Power Supply Current	I _{CC}			300	mA	
Data Rate			155		Mb/s	
Control Input Voltage High		2		V _{CC}	V	
Control Input Voltage Low		0		0.8	V	
Link Distance (SMF)	D			150	km	9/125um

Electrical Characteristics

Parameter	Symbol	Min.	Typ	Max.	Unit	Ref.
Supply Voltage	V _{CC}	3.15	3.3	3.6	V	
Supply Current	I _{CC}		185	250	mA	
Transmitter						
Input differential impedance	R _{in}		100		Ω	1
Single ended data input swing	V _{in,pp}	250		1200	mV	
Transmit Disable Voltage	V _D	V _{CC} -1.3		V _{CC}	V	
Transmit Enable Voltage	V _{EN}	V _{EE}		V _{EE} + 0.8	V	2
Transmit Disable Assert Time				10	us	
Receiver						
Single ended data output swing	V _{out,pp}	250		800	mV	3
Data output rise time	t _r		100	175	ps	4
Data output fall time	t _f		100	175	ps	4
LOS Fault	V _{LOS} fault	V _{CC} -0.5		V _{CC} HOST	V	5
LOS Normal	V _{LOS} norm	V _{EE}		V _{EE} +0.5	V	5
Power Supply Rejection	PSR	100			mVpp	6

Notes:

1. Connected directly to TX data input PINs. AC coupled thereafter.
2. Or open circuit.
3. into 100ohms differential termination.
4. 20 – 80 %
5. Loss Of Signal is LVTTTL. Logic 0 indicates normal operation; logic 1 indicates no signal detected.
6. Receiver sensitivity is compliant with power supply sinusoidal modulation of 20 Hz to 1.5 MHz up to specified value applied through the recommended power supply filtering network.

Optical Characteristics

Parameter	Symbol	Min.	Typ	Max.	Unit	Ref.
Transmitter						
Output Opt. Pwr (End of Life)	POUT	1		5.0	dBm	1
Optical Wavelength	λ	1520	1550	1580	nm	
Wavelength Temperature Dependence			0.08	0.125	nm/°C	
Spectral Width (-20dB)	σ			3.0	nm	
Optical Extinction Ratio	ER	10			dB	
Sidemode Suppression ratio	SSRmin	30			dB	
Optical Rise/Fall Time	tr/ tf		100	160	ps	
RIN	RIN			-120	dB/Hz	
Transmitter Jitter (peak to peak)				100	ps	
Receiver						
Average Rx Sensitivity @ Gigabit Ethernet	RSSENS3			-34.0	dBm	2
Maximum Input Power	PMAX	-9.0			dBm	
Optical Center Wavelength	λ_C	1260	1310	1620	nm	
LOS De - Assert	LOSD			-36	dBm	
LOS Assert	LOSA	-45			dBm	
LOS Hysteresis			1.0		dB	
Receiver Jitter Generation @155Mbps				160	ps	3

Notes:

1. Class 1 Laser Safety per FDA/CDRH and IEC-825-1 regulations.
2. with worst-case extinction ratio. Measured with a PRBS 27-1 test pattern, @155Mb/s, BER<10⁻¹².
3. Jitter added by receiver (peak to peak). Measured at -18.0dBm average Rx sensitivity, PRBS 27-1 test pattern.

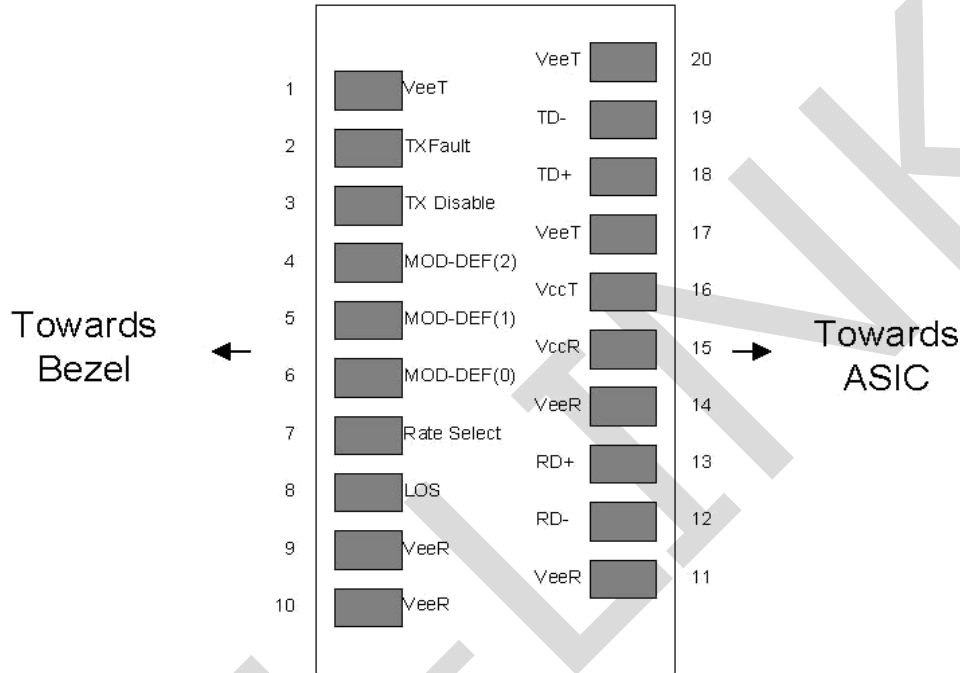
Digital Diagnostics

The following digital diagnostic characteristics are defined over the Recommended Operating Environment unless otherwise specified. It is compliant to SFF-8472 Rev10.2 with internal calibration mode. For external calibration mode please contact our sales staff.

Parameter	Symbol	Min.	Max	Unit	Notes
Temperature monitor absolute error	DMI_Temp	-3	3	degC	Over operating temp
Supply voltage monitor absolute error	DMI_VCC	-0.15	0.15	V	Full operating range

RX power monitor absolute error	DMI_RX	-3	3	dB	
Bias current monitor	DMI_bias	-10%	10%	mA	
TX power monitor absolute error	DMI_TX	-3	3	dB	

Pin Diagram



Pin Definitions

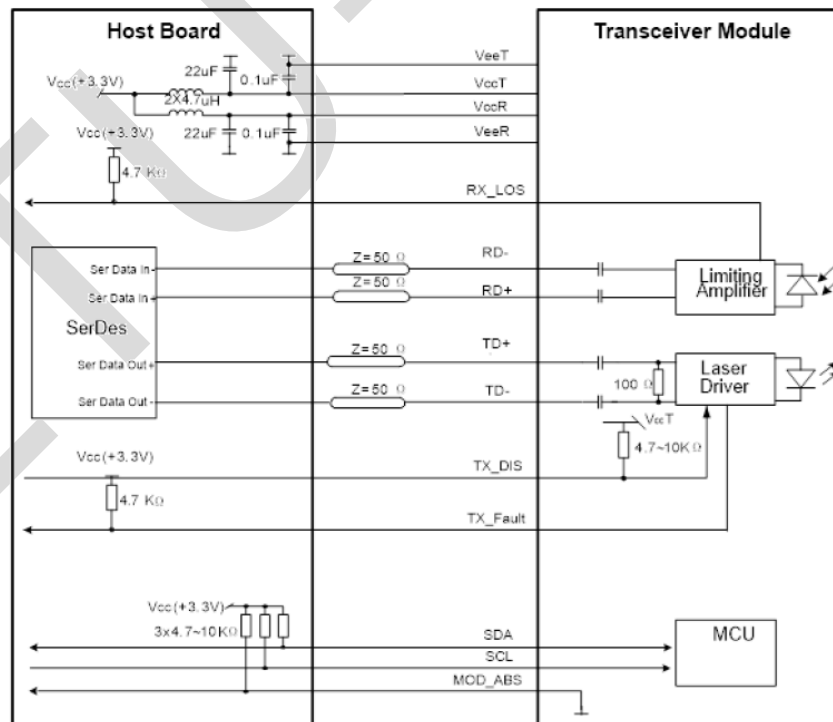
Pin	Symbol	Name/Description	Ref.
1	V _{EET}	Transmitter Ground (Common with Receiver Ground)	1
2	T _{FAULT}	Transmitter Fault.	2
3	T _{DIS}	Transmitter Disable. Laser output disabled on high or open.	3
4	MOD_DEF(2)	Module Definition 2. Data line for Serial ID.	4
5	MOD_DEF(1)	Module Definition 1. Clock line for Serial ID.	4
6	MOD_DEF(0)	Module Definition 0. Grounded within the module.	4
7	Rate Select	No connection required	
8	LOS	Loss of Signal indication. Logic 0 indicates normal operation.	5
9	V _{EER}	Receiver Ground (Common with Transmitter Ground)	1
10	V _{EER}	Receiver Ground (Common with Transmitter Ground)	1
11	V _{EER}	Receiver Ground (Common with Transmitter Ground)	1
12	RD-	Receiver Inverted DATA out. AC Coupled	
13	RD+	Receiver Non-inverted DATA out. AC Coupled	
14	V _{EER}	Receiver Ground (Common with Transmitter Ground)	1

Pin	Symbol	Name/Description	Ref.
15	V_{CCR}	Receiver Power Supply	
16	V_{CCT}	Transmitter Power Supply	
17	V_{EET}	Transmitter Ground (Common with Receiver Ground)	1
18	TD+	Transmitter Non-Inverted DATA in. AC Coupled.	
19	TD-	Transmitter Inverted DATA in. AC Coupled.	
20	V_{EET}	Transmitter Ground (Common with Receiver Ground)	1

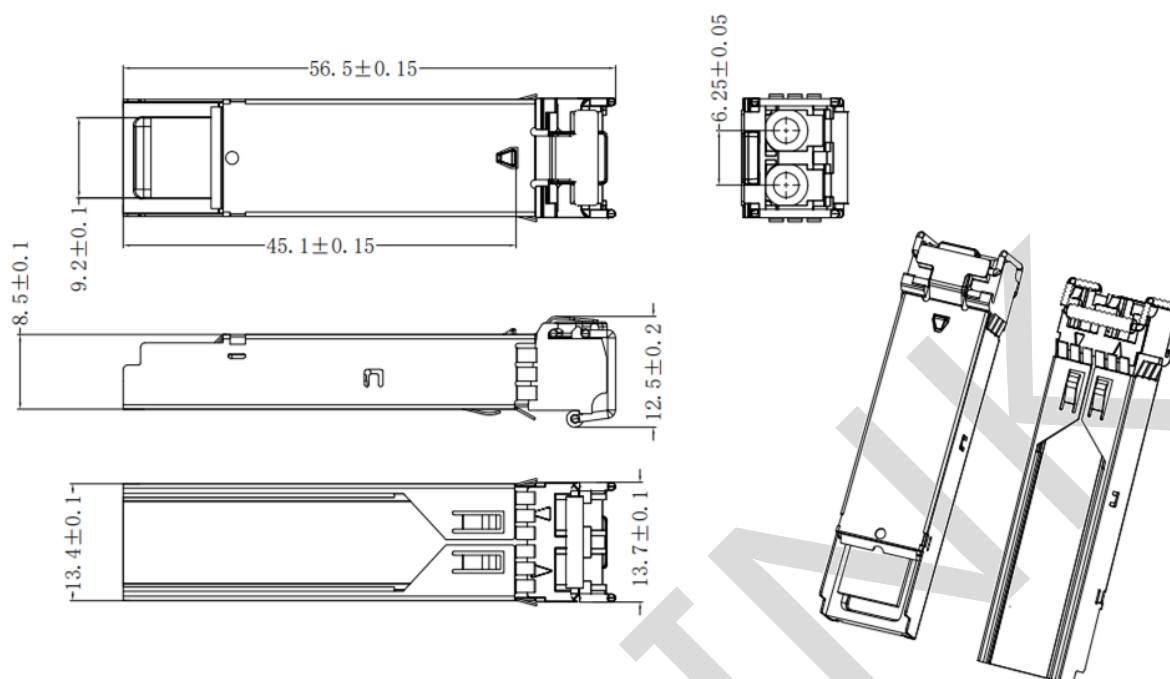
Notes:

1. Circuit ground is internally isolated from chassis ground.
2. T_{FAULT} is an open collector/drain output, which should be pulled up with a 4.7k – 10k Ohms resistor on the host board if intended for use. Pull up voltage should be between 2.0V to $V_{cc} + 0.3V$. A high output indicates a transmitter fault caused by either the TX bias current or the TX output power exceeding the preset alarm thresholds. A low output indicates normal operation. In the low state, the output is pulled to <0.8V.
3. Laser output disabled on $T_{DIS} > 2.0V$ or open, enabled on $T_{DIS} < 0.8V$.
4. Should be pulled up with 4.7k - 10kohms on host board to a voltage between 2.0V and 3.6V. MOD_DEF (0) pulls line low to indicate module is plugged in.
5. LOS is open collector output. Should be pulled up with 4.7k – 10 kohms on host board to a voltage between 2.0V and 3.6V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.

Recommended Interface Circuit



Mechanical Diagram



Revision History

Version No.	Date	Description
1.0	February 12, 2015	Preliminary datasheet
2.0	October 11, 2021	Product upgrades
3.0	July 26, 2024	Format change

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