

## SP-12-LR1



## Features

- Compliant with OC12/STM-4 Standards
- Single 3.3 V supply
- 25 dB min. link budget
- 1310nm FP Laser, 40 km reach
- SFP MSA SFF-8074i compliant
- Bellcore GR-468 compliant
- Color coded bail latch: Red
- RoHS-5/6 compliant product(lead exemption)
- Digital Diagnostic SFF-8472 Compliant

## General operating

Parameter	Symbol	Min.	Typical	Max.	Unit
Supply Voltage	$V_{CC}$	3.135	3.3	3.465	V
Total Current	$I_{CC}$	-	-	300	mA
Power Supply Noise Rejection <sup>a</sup>	PSR	100	-	-	mV <sub>p-p</sub>
Operating Temperature (-CXX)	$T_{op}$	-5	-	70	°C
Operating Temperature (-RXX)	$T_{op}$	-20	-	85	°C
Operating Temperature (-TXX)	$T_{op}$	-40	-	85	°C
Storage Temperature	$T_{st}$	-40	-	85	°C
Data Rate OC 12/STM-2	DR	-	622	-	Mbps

a) 20Hz to 155MHz

## Transmitter Specifications

Parameter	Symbol	Min	Typical	Max	Unit
Optical Power	$P_{OP}$	-3	0	+2	dBm
Average Launch Power Of Off Tx	$P_{Off}$	-	-	-30	dBm
Extinction Ratio	ER	8.2	-	-	dB
Eye Mask		-	-	-	SONET/SDH compliant
Optical Jitter Generation	$J_{gen}$	-	-	0.002	UI
Optical Rise Time <sup>b</sup>	$t_r$	-	-	500	ps
Optical Fall Time <sup>b</sup>	$t_f$	-	-	500	ps
Mean Wavelength	$\lambda$	1296	1310	1330	nm
Spectral Width (RMS)	$\Delta\lambda$	-	-	1.7	nm
Dispersion Penalty (at 40 Km)		-	0.5	1	dB
Relative Intensity Noise	RIN	-	-	-120	dB/Hz

b) 20%-80% values

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## Transmitter Specifications (Electrical)

Parameter	Symbol	Min	Typical	Max	Unit
Input Differential Impedance	$R_{in}$	80	100	120	$\Omega$
PECL Single Ended Data Input Swing	$V_{in,p-p}$	250	-	1200	mV
TxFault_Fault	$V_{fault}$	2	-	$V_{cc}$	V
TxFault_Normal	$V_{normal}$	$V_{ee}$	-	$V_{ee}+0.5$	V
TxDisable_Disable	$V_d$	2	-	$V_{cc}$	V
TxDisable_Enable	$V_{en}$	$V_{ee}$	-	$V_{ee}+0.8$	V

## Receiver Specifications

Parameter	Symbol	Min	Typical	Max	Unit
Receive Power Low <sup>c</sup>	$R_{sens,low}$	-	-30	-28	dBm
Receive Power High	$R_{sens,high}$	-8	-	-	dBm
Damage Threshold For Receiver	$P_{in,damage}$	0	-	-	dBm
Wavelength <sup>d</sup>	$\lambda$	1260	1310	1360	nm
LOS Assert		-38	-	-	dBm
LOS De-assert		-	-	-28	dBm
LOS Hysteresis		0.5	-	-	dB

c)  $10^{-12}$  at nominal wavelength

d) Operational over 1200 to 1625 nm range

## Electrical Output

Parameter	Symbol	Min	Typical	Max	Unit
PECL Single Ended Data Output Swing	$V_{out,p-p}$	185	-	800	mV
Data Output Rise Time	$t_r$	-	-	500	ps
Data Output Fall Time	$t_f$	-	-	500	ps

## Timing and Electrical

Parameter	Symbol	Min	Typical	Max	Unit
Tx Disable Negate Time	$t_{on}$	-	-	1	ms
Tx Disable Assert Time	$t_{off}$	-	-	10	$\mu$ s
Time To Initialize, Including Reset Of Tx Fault	$t_{init}$	-	-	300	ms
Tx Fault Assert Time	$t_{fault}$	-	-	100	$\mu$ s
Tx Disable To Reset	$t_{reset}$	10	-	-	$\mu$ s
Los Assert Time	$t_{loss_{on}}$	-	-	100	$\mu$ s
Los De-assert Time	$t_{loss_{off}}$	-	-	100	$\mu$ s
Serial ID Clock Rate	$f_{serial\_clock}$	-	-	100	KHz
RX_LOS Voltage (High)		2	-	-	V
RX_LOS Voltage (Low)		-	-	0.8	V
LOS Output Voltage-Fault	$V_{LOS\ fault}$	2	-	$V_{cc}$	V
LOS Output Voltage-Normal	$V_{LOS\ normal}$	$V_{ee}$	-	$V_{ee}+0.5$	V
MOD_DEF (0:2)-High	$V_h$	2	-	$V_{cc}$	V
MOD_DEF (0:2)-LOW	$V_l$	$V_{ee}$	-	$V_{ee}+0.5$	V

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Diagnostics

Parameter	Range	Accuracy	Unit	Calibration	Formula
Temperature (-CDA)	-5 to 70	±3	°C	Internal	$T_c(C) = T_{ad}(16 \text{ bit signed twos complement})/256$
Temperature (-RDA)	-20 to 85	±3	°C	Internal	$T_c(C) = T_{ad}(16 \text{ bit signed twos complement})/256$
Temperature (-TDA)	-40 to 85	±3	°C	Internal	$T_c(C) = T_{ad}(16 \text{ bit signed twos complement})/256$
Voltage	0 to $V_{CC}$	±0.1	V	Internal	$V(\text{Volts}) = V_{ad}(16 \text{ bit unsigned integer}) * 0.1$
Bias current	0 to 120	±5	mA	External	$I(\text{mA}) = I_{slope} * I_{ad}(16 \text{ bit unsigned integer}) + I_{offset}$
TX Power	-3 to +2	±3 dB	dBm	External	$TX\_PWR(\mu W) = TX\_PWR_{slope} * TX\_PWR_{ad}(16 \text{ bit unsigned integer}) + TX\_PWR_{offset}$
RX Power	-28 to -8	±3 dB	dBm	External	$RX\_PWR(\mu W) = A_0 + A_1 * x + A_2 * x^2 + A_3 * x^3 + A_4 * x^4$

EEPROM Serial ID

Name of Field	Description of Field	Address	Hex	ASCII
Vendor Name	SFP Vendor name(ASCII)	20	4C	L
		21	55	U
		22	4D	M
		23	49	I
		24	4E	N
		25	45	E
		26	4E	N
		27	54	T
		28	4F	O
		29	49	I
		30	43	C
Vendor OUI	IEEE vendor OUI code for LuminentOIC Inc.	37	00	
		38	06	
		39	B5	
Vendor PN	Part number in ASCII, e.g. SP-12-LR1-CNA	40	53	S
		41	50	P
		42	31	1
		43	32	2
		44	4C	L
		45	52	R
		46	31	1
		47	43	C
		48	4E	N
49	41	A		

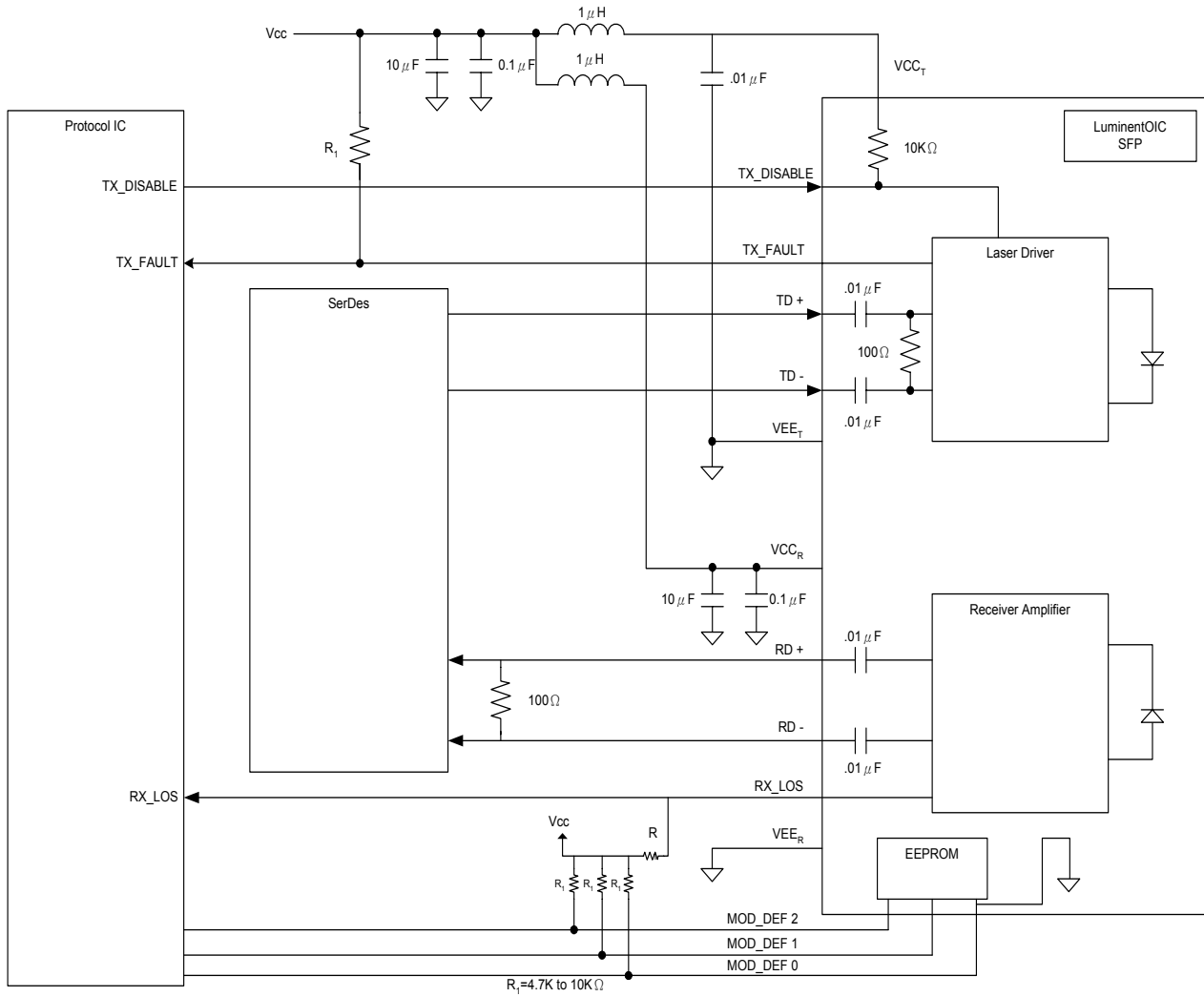
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## Pinout Definitions

Pin	Function	Notes
1	$V_{eeT}$	TX Ground
2	TX_FAULT	Open Collector
3	TX_DISABLE	Internally Pulled High
4	MOD_DEF2	Serial Data Input
5	MOD_DEF1	Serial Clock Input
6	MOD_DEF0	Internally Grounded
7	NC	Not Connected
8	LOS	Open Collector
9	$V_{eeR}$	RX Ground
10	$V_{eeR}$	RX Ground
11	$V_{eeR}$	RX Ground
12	RXD-	RX Data Negative
13	RXD+	RX Data Positive
14	$V_{eeR}$	RX Ground
15	$V_{ccR}$	RX Power
16	$V_{ccT}$	TX Power
17	$V_{eeT}$	TX Ground
18	TXD+	TX Data Positive
19	TXD-	TX Data Negative
20	$V_{eeT}$	TX Ground

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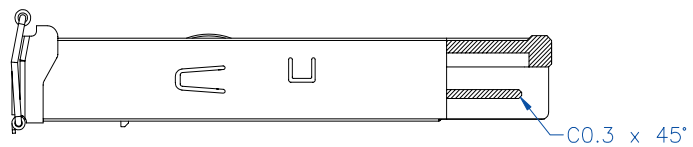
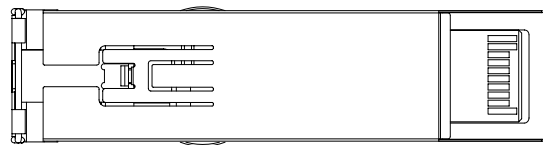
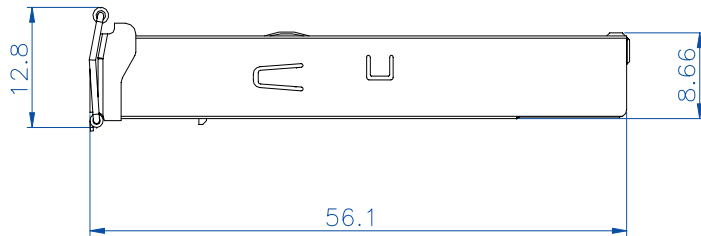
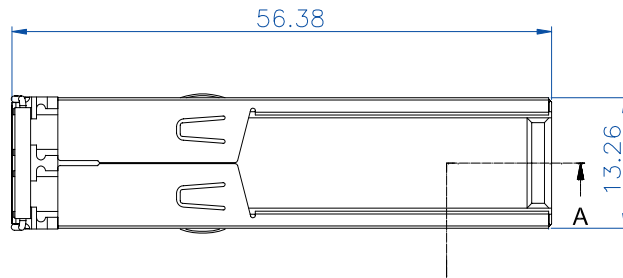
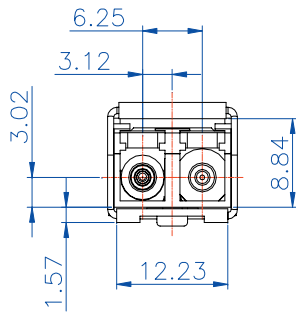
Suggested Transceiver Interface



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Outline drawing

Units in mm



Section A-A

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Ordering Information

**Available Options:**

- SP-12-LR1-CNA
- SP-12-LR1-CDA
- SP-12-LR1-RNA
- SP-12-LR1-RDA
- SP-12-LR1-TNA
- SP-12-LR1-TDA

Part numbering Definition:

SP - 12 - LR1 - Temperature Diagnostic Revision

- **SP = Small Form Pluggable**  
 12 = OC12, 622 Mbps  
 LR1 = Long Reach 40 km
- **Operating Temperature**  
 C = Commercial (-5 to 70°C)  
 R = Reduced (-20 to 85°C)  
 T = Industrial (-40 to 85°C)
- **D = Digital Diagnostic**  
 N = No Digital Diagnostic
- **Design Revision**

Warnings:

**Handling Precautions:** This device is susceptible to damage as a result of electrostatic discharge (ESD). A static free environment is highly recommended. Follow guidelines according to proper ESD procedures.  
**Laser Safety:** Radiation emitted by laser devices can be dangerous to human eyes. Avoid eye exposure to direct or indirect radiation.

Legal Notes:

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