

## SP-48-LR2



### Features

- Compliant with OC48/STM-16 Standards
- Single 3.3 V supply
- 80 km reach
- 26 dB min, 30.5 dB typical link budget
- Commercial and Reduced Industrial temperature available
- 1550nm DFB Laser
- APD Receiver
- SFP MSA SFF-8074i compliant
- GR 253/STM G.957 compliant
- Telcordia GR-468 compliant
- Digital Diagnostic SFF-8472 Rev. 9.3 compliant
- White color coated bail latch
- RoHS 5/6 compliant (Lead Exemption)

### General Operating

Parameter	Symbol	Min.	Typ.	Max.	Unit
Supply Voltage	V <sub>cc</sub>	3.135	3.3	3.465	V
Total Current	I <sub>cc</sub>	-	-	300	mA
Power Supply Noise Rejection <sup>a</sup>	PSR	100	-	-	mVp-p
Operating Temperature(-Cxx)	T <sub>opr</sub>	-5	-	70	°C
Operating Temperature(-Rxx)	T <sub>opr</sub>	-20	-	85	°C
Storage Temperature	T <sub>stg</sub>	-40	-	85	°C
Data Rate OC48/STM-16	DR	-	2488.32	-	Mbps

a) 20Hz to 155MHz

### Transmitter Specifications, Optical

Parameter	Symbol	Min	Typical	Max	Unit
Optical Power	P <sub>op</sub>	-2	0.5	3	dBm
Average Launch Power of Off Tx	P <sub>off</sub>	-	-	-30	dBm
Extinction Ratio	ER	8.2	-	-	dB
Eye Mask		SONET/SDH compliant			
Optical Jitter Generation	T <sub>J</sub>	-	-	0.007	UI
Optical Rise Time <sup>b</sup>	t <sub>r</sub>	-	-	160	ps
Optical Fall Time <sup>b</sup>	t <sub>f</sub>	-	-	160	ps
Mean Wavelength	λ	1500	1550	1580	nm
Spectral Width (20dB)	Δλ	-	-	1	nm
Dispersion Penalty 1600ps/nm <sup>c</sup>	dp	-	1	2	dB
Relative Intensity Noise	RIN	-	-	-120	dB/Hz
Reflectance Tolerance <sup>d</sup>	rp	-24	-	-	dB

b) 20%-80% values

c) Measured at BER of 1e<sup>-10</sup>, PRBS of 2<sup>23</sup>-1, at eye center

d) 1dB degradation of receiver sensitivity

## SP-48-LR2

## Transmitter Specifications , Electrical

Parameter	Symbol	Min	Typical	Max	Unit
Input Differential Impedence	$R_{in}$	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, Optical

Parameter	Symbol	Min	Typical	Max	Unit
Receiver Power Lowe	$R_{sens,low}$	-	-30	-28	dBm
Receiver Power High <sup>e</sup>	$R_{sens,high}$	-6	-	-	dBm
Damage Threshold for Receiver	$P_{in, damage}$	4	-	-	dBm
Wavelength <sup>f</sup>	$\lambda$	1500	1550	1580	nm
Maximum Reflectance of Receiver	$RX_r$	-	-	-27	dB
LOS Assert	-	-42	-	-	dBm
LOS De-assert	-	-	-	-28	dBm
LOS Hysteresis	-	0.5	-	-	dB

e) At  $10^{-10}$  BER, PRBS 2<sup>23</sup>-1

f) Operational over 1200-1625 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	$t_r$	-	-	175	ps
Data Output Fall Time	$t_f$	-	-	175	ps

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### Timing and Electrical

Parameter	Symbol	Min	Typical	Max	Unit
Tx Disable Negate time	t_on	-	-	1	ms
Tx Disable assert time	t_off	-	-	10	µs
Time to initialize, including reset of Tx fault	t_init	-	-	300	ms
Tx fault Assert time	t_fault	-	-	100	µs
Tx Disable to reset	t_reset	10	-	-	µs
LOS Assert time	t_loss_on	-	-	100	µs
LOS De-assert time	t_loss_off	-	-	100	µs
Serial ID Clock Rate	f_serial_clock	-	-	100	KHz
RX_LOS Voltage (high)	Rx_LOS <sub>H</sub>	2	-	-	V
RX_LOS Voltage (low)	Rx_LOS <sub>L</sub>	-	-	0.8	V
LOS output voltage-Fault	V <sub>LOS</sub> fault	2	-	V <sub>cc</sub>	V
LOS output voltage-Normal	V <sub>LOS</sub> normal	V <sub>ee</sub>	-	V <sub>ee</sub> + 0.5	V
MOD_DEF (0:2)-High	V <sub>h</sub>	2	-	V <sub>cc</sub>	V
MOD_DEF (0:2)-Low	V <sub>l</sub>	V <sub>ee</sub>	-	V <sub>ee</sub> + 0.5	V

### Diagnostics

Parameter	Range	Accuracy	Unit	Calibration	Formula
Temperature(-CDx)	-5 to 70	±3	°C	Internal	T <sub>c</sub> (C) = T <sub>ad</sub> (16 bit signed twos complement)/256
Temperature(-RDx)	-20 to 85	±3	°C	Internal	T <sub>c</sub> (C) = T <sub>ad</sub> (16 bit signed twos complement)/256
Voltage	0 to V <sub>cc</sub>	0.1	V	Internal	V(Volts) = V <sub>ad</sub> (16 bit unsigned integer)*0.1
Bias Current	0 to 120	5	mA	External	I(mA) = I <sub>slope</sub> * I <sub>ad</sub> (16 bit unsigned integer)+I <sub>offset</sub>
Tx Power	-2 to 3	±3dB	dBm	External	Tx_PWR(µW) = Tx_PWR <sub>slope</sub> *Tx_PWR <sub>ad</sub> (16 bit unsigned integer)+Tx_PWR <sub>offset</sub>
Rx Power	-32 to -6	±3dB	dBm	External	Rx_PWR(µW) = A <sub>0</sub> +A <sub>1</sub> *x+A <sub>2</sub> *x <sup>2</sup> +A <sub>3</sub> *x <sup>3</sup> +A <sub>4</sub> *x <sup>4</sup>

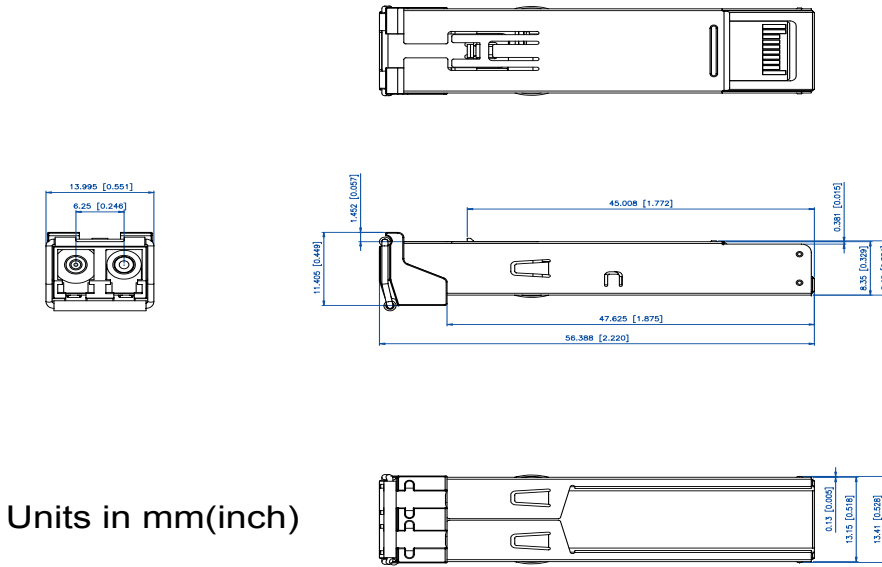
## SP-48-LR2

EEPROM Serial ID				
Name of Field	Description of Field	Address	Hex	ASCII
Vendor Name	SFPVendor 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 Lumentio Inc.	37	00	
		38	06	
		39	B5	
Vendor PN	Part number in ASCII, e.g. SP-48-LR2-CDA	40	53	S
		41	50	P
		42	34	4
		43	38	8
		44	4C	L
		45	52	R
		46	32	2
		47	43	C
		48	44	D
49	41	A		

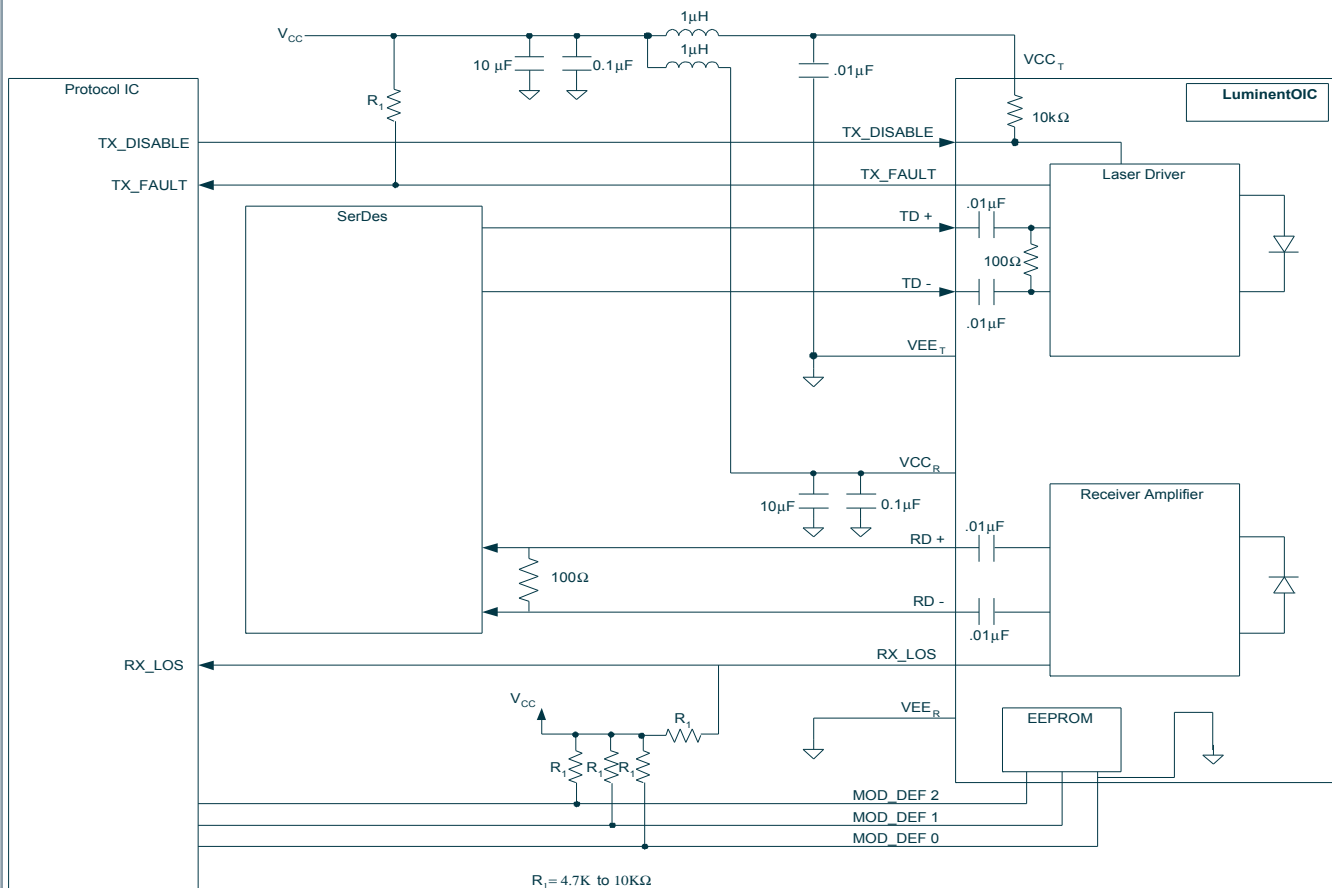
Pinout Definitions		
Pin	Function	Notes
1	V <sub>ee</sub> T	TX GND
2	TX_FAULT	Open Collector
3	TX_DISABLE	Internally Pulled High
4	MOD_DEF2	Serial Data Input
5	MOD_DEF1	Serial Clock Input
6	MOD_DEF0	Internally Grounded
7	NC	Not Connected
8	LOS	Open Collector
9	V <sub>ee</sub> R	RX Ground
10	V <sub>ee</sub> R	RX Ground
11	V <sub>ee</sub> R	RX Ground
12	RXD-	RX Data Negative
13	RXD+	RX Data Positive
14	V <sub>ee</sub> R	RX GND
15	V <sub>CC</sub> R	RX Power
16	V <sub>CC</sub> T	TX Power
17	V <sub>ee</sub> T	TX GND
18	TXD+	TX Data Positive
19	TXD-	TX Data Negative
20	V <sub>ee</sub> T	TX GND

SP-48-LR2

Outline Drawing



Suggested Transceiver Interface



SP-48-LR2

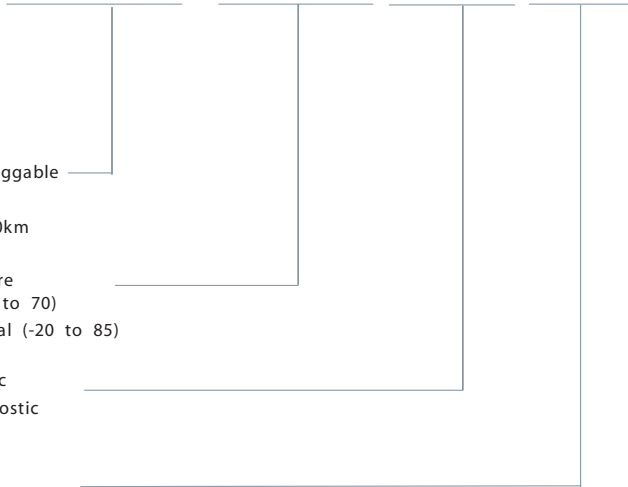
Ordering Information

Available Options:

- SP-48-LR2-CDA
- SP-48-LR2-CNA
- SP-48-LR2-RDA
- SP-48-LR2-RNA

Part numbering Definition:

SP - 48 - LR2 - Temperature Diagnostic Revision



- SP = Small Form Pluggable
- 48 = OC48
- LR2 = Long reach 80km
- Operating Temperature
- C = Commercial (-5 to 70)
- R = Reduced Industrial (-20 to 85)
- 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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