

## SP-MR-LR2



## Features

- Single 3.3 V supply
- 80 km reach
- 26dB 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
- Digital Diagnostic SFF-8472 Rev. 9.3 compliant
- Telcordia GR-468 compliant
- White color coated bail latch
- RoHS 5/6 compliant (Lead Exemption)

## 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
Storage Temperature	$T_{st}$	-40	-	85	°C
Data Rate	DR	100	-	2700	Mbps

a) 20Hz to 155MHz

## Transmitter Specifications (Optical)

Parameter	Symbol	Min	Typical	Max	Unit
Optical Power	$P_{op}$	-2	0.5	3	dBm
Average Launch Power Of Off Tx	$P_{off}$	-	-	-30	dBm
Extinction Ratio	ER	8.2	-	-	dB
Eye Mask		-	-	-	IEEE 802.3Z, SONET/SDH compliant
Optical Jitter Generation	Jgen	-	-	0.007	UI
Optical Rise Time <sup>b</sup>	$t_r$	-	-	160	ps
Optical Fall Time <sup>b</sup>	$t_f$	-	-	160	ps
Mean Wavelength	$\lambda$	1500	1550	1580	nm
Spectral Width (20dB)	$\Delta\lambda$	-	-	1	nm
Dispersion Penalty (80 Km SMF) <sup>c</sup>	dp	-	1	2	dB
Relative Intensity Noise	RIN	-	-	-120	dB/Hz
Reflection Toleranced <sup>d</sup>	rp	-24	-	-	dB

b) 20%-80% values

c) Measured at BER of  $1e^{-10}$ , PRBS of  $2^{23}-1$ , at eye center

d) 1 dB degradation of receiver sensitivity

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## Transmitter Specifications (Electical)

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

Parameter	Symbol	Min	Typical	Max	Unit
Receive Power Low <sup>e</sup>	$R_{sens,low}$	-	-30	-28	dBm
Receive Power High <sup>e</sup>	$R_{sens,high}$	-9	-	-	dBm
Damage Threshold For Receiver	$P_{in,damage}$	4	-	-	dBm
Wavelength	$\lambda$	1200	-	1625	nm
Maximum Reflectance Of Receiver	$RX_r$	-	-	-27	dB
LOS Assert		-42	-	-	dBm
LOS De-assert		-	-	-28	dBm
LOS Hysteresis		0.5	-	-	dB

e)  $10^{-10}$  BER, PRBS 2<sup>23</sup>-1 for SONET,  $10^{-12}$  BER, PRBS 2<sup>7</sup>-1 for Gigabit Ethernet

## 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

## 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(-CDx)	-5 to 70	± 3	° C	Internal	$T_c(C) = T_{ad}(16 \text{ bit signed twos complement})/256$
Temperature(-RDx)	-20 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	-2 to 3	±3 dB	dBm	External	$TX\_PWR(\mu W) = TX\_PWR_{slope} * TX\_PWR_{ad}(16 \text{ bit unsigned integer}) + TX\_PWR_{offset}$
RX Power	-32 to -9	±3 dB	dBm	External	$RX\_PWR(\mu W) = A_0 + A_1 * x + A_2 * x^2 + A_3 * x^3 + A_4 * x^4$

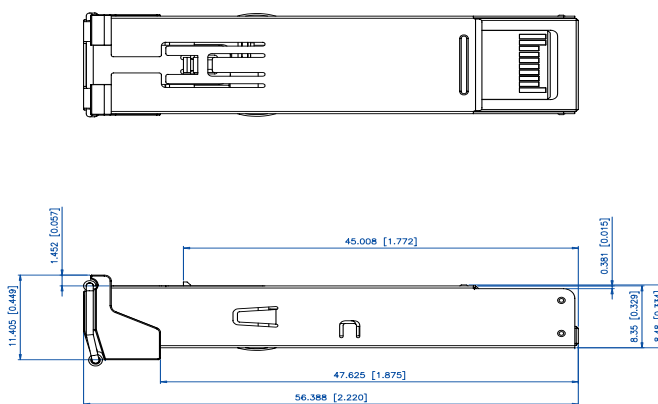
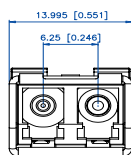
EEPROM Serial ID

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-MR-LR2-CDA	40	53	S
		41	50	P
		42	4D	M
		43	52	R
		44	4C	L
		45	52	R
		46	32	2
		47	43	C
		48	44	D
		49	41	A

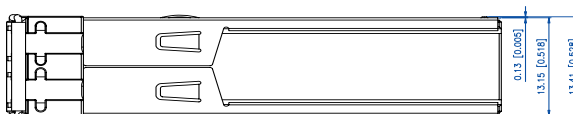
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Pin	Function	Notes
1	V <sub>ee</sub> T	TX GND
2	TX_FAULT	Open Collector
3	TX_DISABLE	Internally Pulled High
4	MOD_DEF2	Serial Data Input
5	MOD_DEF1	Serial Clock Input
6	MOD_DEF0	Internally Grounded
7	NC	Not Connected
8	LOS	Open Collector
9	V <sub>ee</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

Outline Drawing



Units in mm(inch)



SP-MR-LR2

Ordering Information

Available Options:

- SP-MR-LR2-CDA
- SP-MR-LR2-CNA
- SP-MR-LR2-RDA
- SP-MR-LR2-RNA

Part numbering Definition:

SP - MR - LR2 - Temperature Diagnostic Revision

- SP = Small Form Pluggable  
MR = Multi Rate  
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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