

Professional high-speed optical transceiver

OPN-S1H159-40LC2M

10G Multirate / CWDM / 40 km Digital Diagnostic LC SFP+ SINGLE-MODE
TRANSCEIVER

PRODUCT FEATURES

- Support 9.95 Gbps to 11.1 Gbps
 - Complaint to SFP+ MSA
- Compliant to IEEE 802.3ae 10GBASE-ER
- Compliant with OC-192 IR-2 / SDH STM S-64.2b
 - Maximum Link Length of 40 km
- Temperature-stabilized 8-Wavelength CWDM EML Transmitter: from 1470 nm to 1610 nm
 - 15 dB Power Budget at Least
- SFF-8472 Digital Diagnostic Function
- AC/AC Coupling according to MSA
 - Single +3.3 V Power Supply
 - RoHS Compliant
 - 0 to 70°C Operating
- Class 1 Laser International Safety Standard IEC-60825 Compliant

APPLICATIONS

- 10GBASE-ER/EW
- OC-192 / STM-64 IR-2
- 40 km 10G Fibre Channel

PRODUCT DESCRIPTION

The OPN-S1H159-40LC2M series single mode transceiver is a small form factor pluggable module for bi-directional serial optical data communications such as IEEE 802.3ae 10GBASE-ER/EW and OC-192 / STM-64 IR-2. It is with the SFP 20-pin connector to allow hot plug capability. Digital diagnostic functions are available via an I²C. This module is designed for single mode fiber and operates at a nominal wavelength of CWDM wavelength. There are eight center wavelengths available from 1470 nm to 1610 nm, with each step 20 nm. A guaranteed minimum optical link budget of 15 dB is offered. The transmitter section uses a temperature-stabilized CWDM electrical-modulated laser (EML) and is a class 1 laser compliant according to International Safety Standard IEC-60825. The receiver section uses an integrated InGaAs detector preamplifier (IDP) mounted in an optical header and a limiting post-amplifier IC.

ORDER INFORMATION

P/No.	Bit Rate (Gb/s)	10G	Power Budget (dB)	Wavelength (nm)	Package	Temp. (°C)	RoHS Compliant
OPN-S1H159-40LC2M	9.95 – 11.1	Multirate*	> 15	CWDM*	SFP+ with DMI	0 to 70	Yes

*: multirate for SONET OC-192 IR-2, OC-192 IR-3, 10GBASE-ER/EW, 10G Fibre Channel, ITU-T G.709, 10GBASE-ER/EW+FEC

CWDM* Wavelength (0 to 70°C)

Central Wavelength	Min. (nm)	Typ. (nm)	Max. (nm)	Label	Central Wavelength	Min. (nm)	Typ. (nm)	Max. (nm)	Label
147	1464.5	1470	1477.5	C47	155	1544.5	1550	1557.5	C55
149	1484.5	1490	1497.5	C49	157	1564.5	1570	1577.5	C57
151	1504.5	1510	1517.5	C51	159	1584.5	1590	1597.5	C59
153	1524.5	1530	1537.5	C53	161	1604.5	1610	1617.5	C61

CWDM*: 8 Wavelengths from 1470 nm to 1610 nm, each step 20 nm.

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Absolute Maximum Ratings					
Parameter	Symbol	Min	Max	Units	Notes
Storage Temperature	Tstg	-50	85	°C	
Operating Case Temperature	Topr	0	70	°C	
Power Supply Voltage	Vcc	-0.5	3.6	V	

Recommended Operating Conditions					
Parameter	Symbol	Min	Typ	Max	Units / Notes
Power Supply Voltage	Vcc	3.135	3.3	3.465	V
Operating Case Temperature	Topr	0		70	°C
Power Supply Current	I _{CC(TX+RX)}		350	450	mA
Data Rate		9.95	10.3125	11.1	Gb/s

Transmitter Optical Specifications (0°C < Topr < 70°C, 3.13V < Vcc < 3.47V)						
Parameter	Symbol	Min	Typ	Max	Units	Notes
Average Launch Power	P _{o, AVG}	-1		3	dBm	1
Output Center Wavelength	λ	$\lambda_c - 5.5$	λ_c	$\lambda_c + 7.5$	nm	2
Output Spectrum Width	$\Delta\lambda$	---		1	nm	-20 dB width
Extinction Ratio	ER	8.2			dB	
Side Mode Suppression Ratio	SMSR	30			dB	
Transmitter and Dispersion Penalty @800 ps/nm @10.3Gb/s	TDP			3	dB	
Relative Intensity Noise	RIN			-128	dB/Hz	
Average Launch Power of OFF Transmitter				-30	dBm	

- Output power is power coupled into a 9/125 μ m single-mode fiber.
- ITU-T G.694.2 CWDM wavelength from 1470 nm to 1610 nm, each step 20 nm.

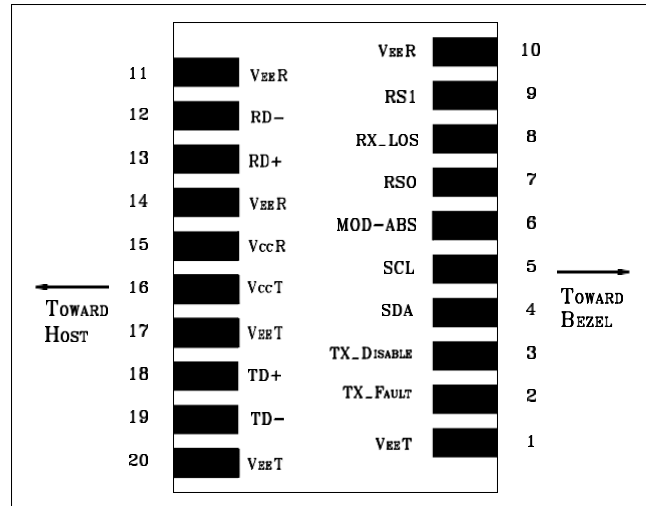
Receiver Optical Specifications (-50°C < Topr < 85°C, 3.13V < Vcc < 3.47V)						
Parameter	Symbol	Min	Typ	Max	Units	Notes
Sensitivity				-16	dBm	3 / Average Power
Receiver Overload	P _{MAX}	-1	---		dBm	
LOS -- Deasserted	LOS _D	---	---	-16	dBm	Transition: low to high
LOS -- Asserted	LOS _A	-28	---	---	dBm	Transition: high to low
Wavelength of Operation	λ_c	1260		1620	nm	
Optical Return Loss	ORL			-27	dB	

- Measured with average power; BER < 10⁻¹² and PRBS 2³¹-1.

Electrical Characteristics						
Parameter	Symbol	Min	Typ	Max	Units	Notes
High-Speed Signal (CML) Interface Specification						
Input Data Rate		9.95	10.3125	11.1	Gb/s	
Differential Input Impedance	R _{in}		100		Ω	
Differential Data Input Amplitude		120		820	mVpp	Internally AC coupled
Output Data Rate		9.95	10.3125	11.1	Gb/s	
Differential Output Impedance	R _{out}		100		Ω	
Differential Data Output Amplitude		350	600	850	mVpp	Internally AC coupled
Low-Speed Signal (LVTTTL) Interface Specification						
Input High Voltage		2.0		V _{cc} +0.3	V	
Input Low Voltage		GND		0.8	V	
Output High Voltage		2.4		V _{cc}	V	
Output Low Voltage		GND		0.5	V	

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CONNECTION DIAGRAM



PIN	Signal Name	Description	PIN	Signal Name	Description
1	VEE T	Transmitter Signal Ground	11	VEE R	Receiver Signal Ground
2	TX_Fault	Transmitter Fault Indication. Logic “1” Output = Laser Fault. Logic “0” Output = Normal Operation	12	RD-	Inverse Receiver Data Out
3	TX_Disable	Logic “1” Input (or no connection) = Laser off, Logic “0” = Laser on.	13	RD+	Receiver Data Out
4	SDA	Modulation Definition 2 – Two wires serial ID Interface	14	VEE R	Receiver Signal Ground
5	SCL	Modulation Definition 1 – Two wires serial ID Interface	15	VCC R	Receiver Power – 3.3V±5%
6	MOD-ABS	Modulation Definition 0 – Ground in Module	16	VCC T	Transmitter Power – 3.3V±5%
7	RS0	RX Rate Select (LVTTL). This pin has an internal 30k pulldown to ground. A signal on this pin will not affect module performance.	17	VEE T	Transmitter Signal Ground
8	RX_LOS	Loss of Signal Out (OC).	18	TD+	Transmitter Data In
9	RS1	TX Rate Select (LVTTL). This pin has an internal 30k pulldown to ground. A signal on this pin will not affect module performance.	19	TD-	Inverse Transmitter Data In
10	VEE R	Receiver Signal Ground	20	VEE T	Transmitter Signal Ground

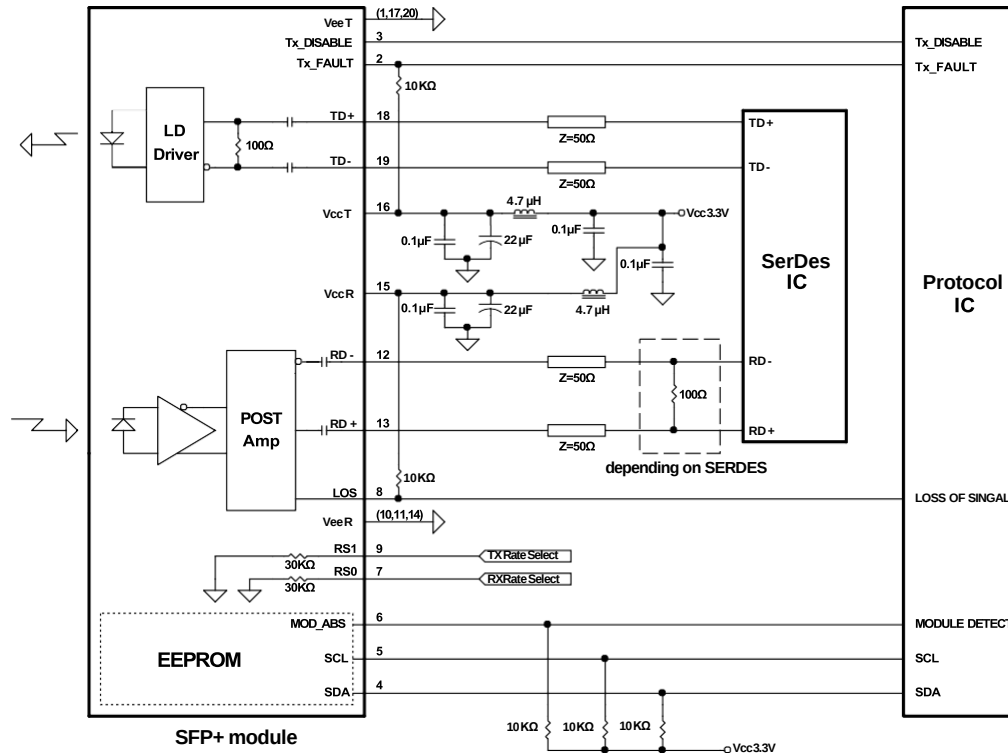
MODULE DEFINITION

Module Definition	PIN 4	PIN 5	PIN 6	Interpretation by Host
4	SDA	SCL	MOD-ABS	Serial module definition protocol

Module Definition 4 specifies a serial definition protocol. For this definition, upon power up, SDA and SCL appear as no connector (NC) and MOD-ABS is TTL LOW. When the host system detects this condition, it activates the serial protocol. The protocol uses the 2-wire serial CMOS E²PROM protocol of the ATMEL AT24C01A/02/04 family of components.

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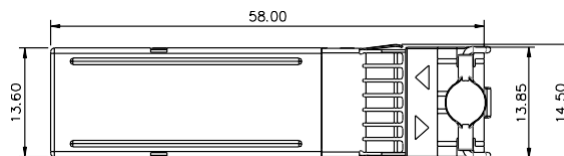
RECOMMENDED CIRCUIT SCHEMATIC



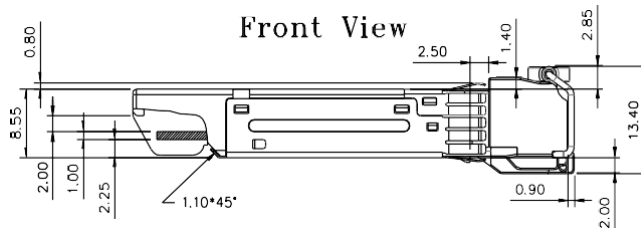
PACKAGE DIAGRAM

Units in mm

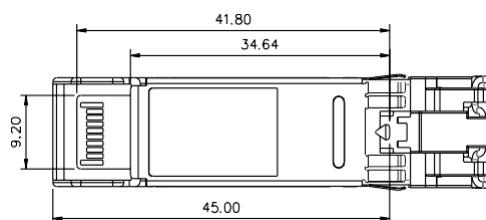
Top View



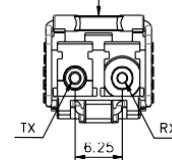
Front View



Bottom View



LATCH COLOR
Red



Side View

Note: Specifications subject to change without notice.