Professional high-speed optical transceiver

OPN-S1HD610-40LC2 / OPN-S1HD610-40LC2I

10.3 Gbps / 40 km / 50GHz DWDM Digital Diagnostic LC SFP+ SINGLE-MODE TRANSCEIVER

PRODUCT FEATURES

- Up to 10.5 Gb/s Bi-directional Data Links
- Complaint to SFP+ MSA
- Compliant to IEEE 802.3ae 10GBASE-ER/EW
- Maximum Link Length of 40 km
- Temperature-stabilized DWDM EML Transmitter
- 14 dB Power Budget at Least
- 50 GHz ITU Grid, C Band
- SFF-8472 Digital Diagnostic Function
- AC/AC Coupling according to MSA
- Single +3.3 V Power Supply
- RoHS Compliant
- 0 to 70ºC Operating: OPN-S1HD610-40LC2
- -50 to 85ºC Operating: OPN-S1HD610-40LC2I
- Class 1 Laser International Safety Standard IEC-60825Compliant

APPLICATIONS

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

PRODUCT DESCRIPTION

The OPN-S1HD610-40LC2I series single mode transceiver isa small form factor pluggable module for bi-directional serial optical data communications such as IEEE 802.3ae 10GBASE-ER/EW. It is with the SFP 20-pin connector toallow hot plug capability. Digital diagnostic functions areavailable via an I^2C. This module is designed for single mode fiber and operates at a nominal wavelength of 50GHz ITU Grid, C Band DWDM wavelength. A guaranteed minimum optical link budget of 14 dB is offered. The transmitter section uses temperature-stabilized DWDMelectrical-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	Distance (km)	Spacing (GHz)	Wavelength (nm)	Package	Case Temp (ºC)	RoHS Compliant
OPN-S1HD610-40LC2	9.95 – 10.52	ER / EW	40	50	DWDM*	SFP+ with DMI	0 to 70	Yes
OPN-S1HD610-40LC2I	9.95 – 10.52	ER / EW	40	50	DWDM*	SFP+ with DMI	-50 to 85	Yes

*XXX: 50GHz ITU Grid wavelength (Please see below)

Channel #	Product code	Frequency (THz)	Center Wavelength (nm)	Label
190	OPN-S1HD190-40LC2	191.90	1562.23	190
195	OPN-S1HD195-40LC2	191.95	1561.83	195
200	OPN-S1HD200-40LC2	192.00	1561.42	200
205	OPN-S1HD205-40LC2	192.05	1561.01	205
210	OPN-S1HD210-40LC2	192.10	1560.61	210
215	OPN-S1HD215-40LC2	192.15	1560.20	215
220	OPN-S1HD220-40LC2	192.20	1559.79	220
225	OPN-S1HD225-40LC2	192.25	1559.39	225
230	OPN-S1HD230-40LC2	192.30	1558.98	230
235	OPN-S1HD235-40LC2	192.35	1558.58	235
240	OPN-S1HD240-40LC2	192.40	1558.17	240
245	OPN-S1HD245-40LC2	192.45	1557.77	245
250	OPN-S1HD250-40LC2	192.50	1557.36	250

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Channel #	Product code	Frequency (THz)	Center Wavelength (nm)	Label
255	OPN-S1HD255-40LC2	192.55	1556.96	255
260	OPN-S1HD260-40LC2	192.60	1556.55	260
265	OPN-S1HD265-40LC2	192.65	1556.15	265
270	OPN-S1HD270-40LC2	192.70	1555.75	270
275	OPN-S1HD275-40LC2	192.75	1555.34	275
280	OPN-S1HD280-40LC2	192.80	1554.94	280
285	OPN-S1HD285-40LC2	192.85	1554.54	285
290	OPN-S1HD290-40LC2	192.90	1554.13	290
295	OPN-S1HD295-40LC2	192.95	1553.73	295
300	OPN-S1HD300-40LC2	193.00	1553.33	300
305	OPN-S1HD305-40LC2	193.05	1552.93	305
310	OPN-S1HD310-40LC2	193.10	1552.52	310
315	OPN-S1HD315-40LC2	193.15	1552.12	315
320	OPN-S1HD320-40LC2	193.20	1551.72	320
325	OPN-S1HD325-40LC2	193.25	1551.32	325
330	OPN-S1HD330-40LC2	193.30	1550.92	330
335	OPN-S1HD335-40LC2	193.35	1550.52	335
340	OPN-S1HD340-40LC2	193.40	1550.12	340
345	OPN-S1HD345-40LC2	193.45	1549.72	345
350	OPN-S1HD350-40LC2	193.50	1549.32	350
355	OPN-S1HD355-40LC2	193.55	1548.91	355
360	OPN-S1HD360-40LC2	193.60	1548.51	360
365	OPN-S1HD365-40LC2	193.65	1548.11	365
370	OPN-S1HD370-40LC2	193.70	1547.72	370
375	OPN-S1HD375-40LC2	193.75	1547.32	375
380	OPN-S1HD380-40LC2	193.80	1546.92	380
385	OPN-S1HD385-40LC2	193.85	1546.52	385
390	OPN-S1HD390-40LC2	193.90	1546.12	390
395	OPN-S1HD395-40LC2	193.95	1545.72	395
400	OPN-S1HD400-40LC2	194.00	1545.32	400
405	OPN-S1HD405-40LC2	194.05	1544.92	405
410	OPN-S1HD410-40LC2	194.10	1544.53	410
415	OPN-S1HD415-40LC2	194.15	1544.13	415
420	OPN-S1HD420-40LC2	194.20	1543.73	420
425	OPN-S1HD425-40LC2	194.25	1543.33	425
430	OPN-S1HD430-40LC2	194.30	1542.94	430
435	OPN-S1HD435-40LC2	194.35	1542.54	435
440	OPN-S1HD440-40LC2	194.40	1542.14	440
445	OPN-S1HD445-40LC2	194.45	1541.75	445
450	OPN-S1HD450-40LC2	194.50	1541.35	450
455	OPN-S1HD455-40LC2	194.55	1540.95	455
460	OPN-S1HD460-40LC2	194.60	1540.56	460
465	OPN-S1HD465-40LC2	194.65	1540.16	465
470	OPN-S1HD470-40LC2	194.70	1539.77	470
475	OPN-S1HD475-40LC2	194.75	1539.37	475
480	OPN-S1HD480-40LC2	194.80	1538.98	480
485	OPN-S1HD485-40LC2	194.85	1538.58	485
490	OPN-S1HD490-40LC2	194.90	1538.19	490
495	OPN-S1HD495-40LC2	194.95	1537.79	495
500	OPN-S1HD500-40LC2	195.00	1537.40	500
505	OPN-S1HD505-40LC2	195.05	1537.00	505
510	OPN-S1HD510-40LC2	195.10	1536.61	510
515	OPN-S1HD515-40LC2	195.15	1536.22	515
520	OPN-S1HD520-40LC2	195.20	1535.82	520
525	OPN-S1HD525-40LC2	195.25	1535.43	525
530	OPN-S1HD530-40LC2	195.30	1535.04	530
535	OPN-S1HD535-40LC2	195.35	1534.64	535
540	OPN-S1HD540-40LC2	195.40	1534.25	540
545	OPN-S1HD545-40LC2	195.45	1533.86	545
550	OPN-S1HD550-40LC2	195.50	1533.47	550
555	OPN-S1HD555-40LC2	195.55	1533.07	555

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Channel #	Product code	Frequency (THz)	Center Wavelength (nm)	Label
560	OPN-S1HD560-40LC2	195.60	1532.68	560
565	OPN-S1HD565-40LC2	195.65	1532.29	565
570	OPN-S1HD570-40LC2	195.70	1531.90	570
575	OPN-S1HD575-40LC2	195.75	1531.51	575
580	OPN-S1HD580-40LC2	195.80	1531.12	580
585	OPN-S1HD585-40LC2	195.85	1530.72	585
590	OPN-S1HD590-40LC2	195.90	1530.33	590
595	OPN-S1HD595-40LC2	195.95	1529.94	595
600	OPN-S1HD600-40LC2	196.00	1529.55	600
605	OPN-S1HD605-40LC2	196.05	1529.16	605
610	OPN-S1HD610-40LC2	196.10	1528.77	610

Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Units	Notes
Storage Temperature	Tstg	-50	85	°C	
Relative Humidity	RH	5	85	%	Non-condensing
Operating Case Temperature	Topr	0 -50	70 85	°C	OPN-S1HD610-40LC2 OPN-S1HD610-40LC2I
Power Supply Voltage	Vcc	-0.5	3.6	V	
Receiver Input Optical Power	Mip		3	dBm	Average power

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 -50		70 85	°C/OPN-S1HD610-40LC2 °C/OPN-S1HD610-40LC2I
Relative Humidity	RH	5		85	% / Non-condensing
Power Supply Current	$I_{CC\ (TX+RX)}$		320	500	mA/OPN-S1HD610-40LC2
			320	650	mA/OPN-S1HD610-40LC2I
Data Rate			9.95 / 10.3	10.5	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	$Po_{,\ AVG}$	-2		2	dBm	1
Optical Modulation Amplitude	$Po_{,\ OMA}$	-1.7				1
Extinction Ratio	ER	8.2			dB	
Center Wavelength Spacing			50		GHz	
Transmitter Center Wavelength -- over life time	λc	X-60	X	X+60	pm	2
Output Spectrum Width	Δλ	---		1	nm	-20 dB width
Side Mode Suppression Ratio	SMSR	30			dB	
Transmitter and Dispersion Penalty @ -500 to 1600 ps/nm	TDP			2	dB	
Relative Intensity Noise	RIN			-128	dB/Hz	
Average Launch Power of OFF Transmitter				-30	dBm	

1. Output power is power coupled into a 9/125 μm single-mode fiber.
2. X = specified ITU Grid wavelength.

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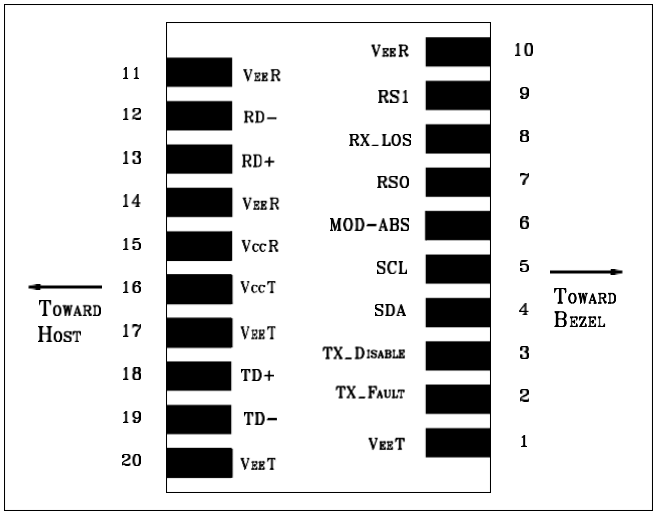
Receiver Optical Specifications (0ºC < Topr < 70ºC, 3.13V < Vcc < 3.47V)						
Parameter	**Symbol**	**Min**	**Typ**	**Max**	**Units**	**Notes**
Sensitivity				-16	dBm	3
Stressed Receiver Sensitivity, OMA				-11.3	dBm	
Receiver Overload	P_{MAX}	-1	---		dBm	
LOS -- Deasserted	LOS_D	---	---	-16	dBm	Transition: low to high
LOS -- Asserted	LOS_A	-28	---	---	dBm	Transition: high to low
Wavelength of Operation	λc	1480		1580	nm	
Optical Return Loss	ORL			-27	dB	

3. Measured with worst ER; BER < 10^{-12} and PRBS 2^{31}-1. Equivalent to -14.3 dBm OMA at ER=8.2 dB.

Electrical Characteristics						
Parameter	**Symbol**	**Min**	**Typ**	**Max**	**Units**	**Notes**
High-Speed Signal (CML) Interface Specification						
Input Data Rate			9.95 / 10.3	10.5	Gb/s	
Differential Input Impedance	Rin		100		Ω	
Differential Data Input Amplitude		120		820	mVpp	Internally AC coupled
Output Data Rate			9.95 / 10.3	10.5	Gb/s	
Differential Output Impedance	Rout		100		Ω	
Differential Data Output Amplitude		350	600	850	mVpp	Internally AC coupled
Low-Speed Signal (LVTTL) Interface Specification						
Input High Voltage		2.0		Vcc+0.3	V	
Input Low Voltage		GND		0.8	V	
Output High Voltage		2.4		Vcc	V	
Output Low Voltage		GND		0.5	V	

CONNECTION DIAGRAM



PIN	Signal Name	Description	PIN	Signal Name	Description
1	$V_{EE}T$	Transmitter Signal Ground	11	$V_{EE}R$	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

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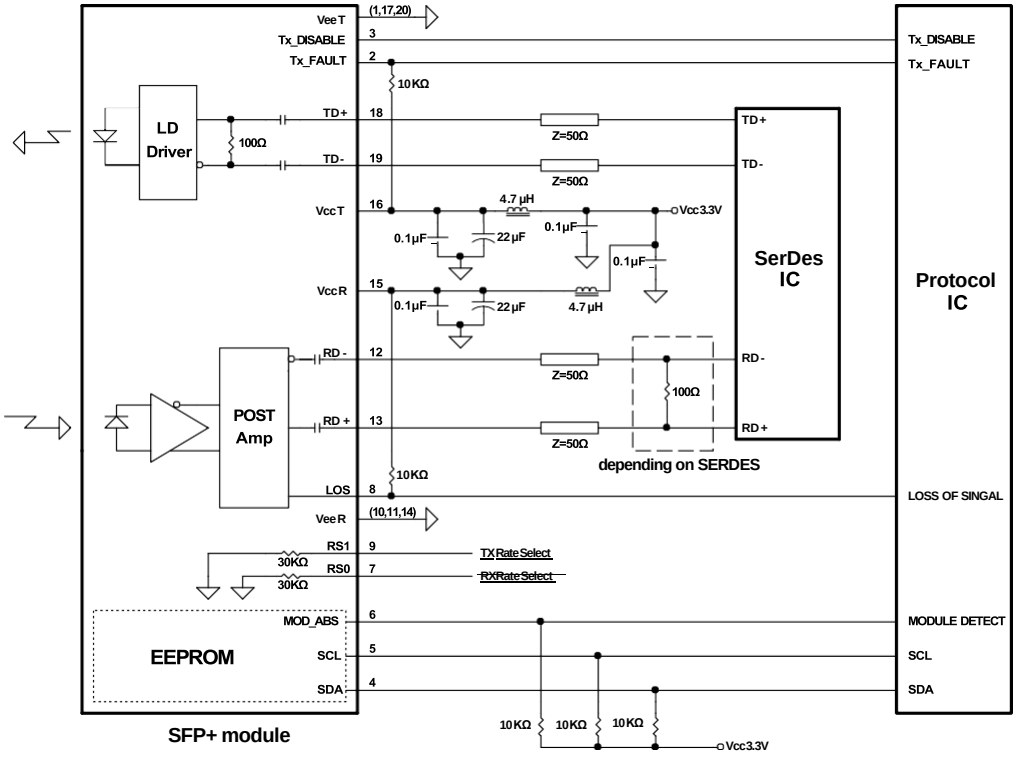
4	SDA	Modulation Definition 2 – Two wires serial ID Interface	14	$V_{EE}R$	Receiver Signal Ground
5	SCL	Modulation Definition 1 – Two wires serial ID Interface	15	$V_{CC}R$	Receiver Power – 3.3V±5%
6	MOD-ABS	Modulation Definition 0 – Ground in Module	16	$V_{CC}T$	Transmitter Power – 3.3V±5%
7	RS0	RX Rate Select (LVTTL). This pin has an internal 30k pulldown to ground. A signal on this pin will not affect module performance.	17	$V_{EE}T$	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	$V_{EE}R$	Receiver Signal Ground	20	$V_{EE}T$	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 E^2PROM protocol of the ATMEL AT24C01A/02/04 family of components.

RECOMMENDED CIRCUIT SCHEMATIC



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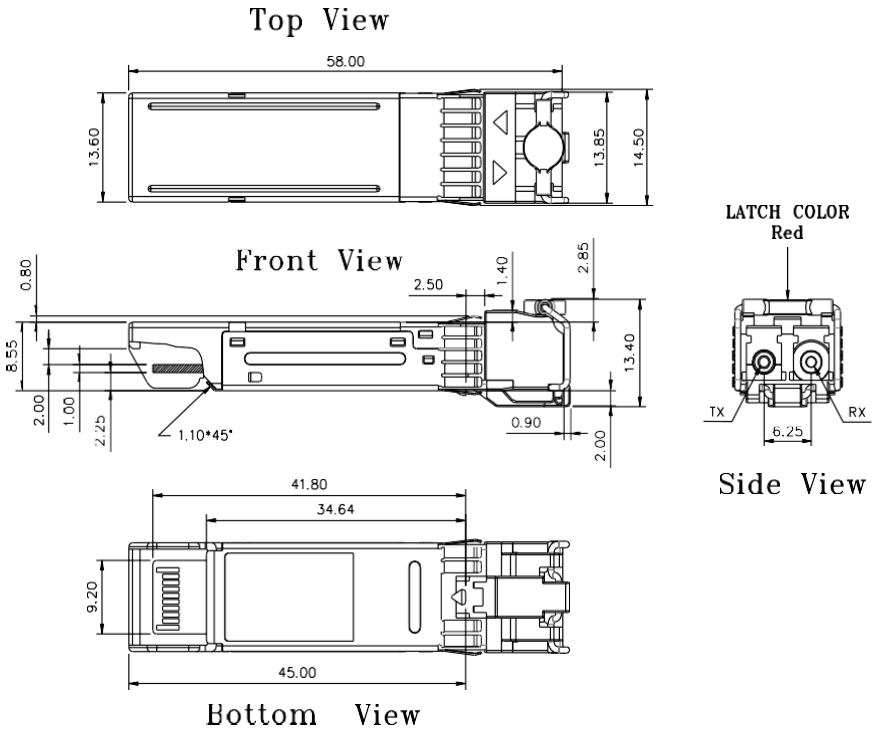
PACKAGE DIAGRAM

Units in mm



Note: Specifications subject to change without notice.