

Professional high-speed optical transceiver

OPN-S1HD41-40LC2 / OPN-S1HD41-40LC2I

10.3 Gbps / 40 km /100GHz 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
 - 100 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 70°C Operating: OPN-S1HD41-40LC2
- -50 to 85°C Operating: OPN-S1HD41-40LC2I
- 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-S1HD41-40LC2 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. 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 100GHz ITU Grid, C Band DWDM wavelength. A guaranteed minimum optical link budget of 14 dB is offered. The transmitter section uses temperature-stabilized DWDM 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	Distance (km)	Spacing (GHz)	Wavelength (nm)	Package	Case Temp (°C)	RoHS Compliant
OPN-S1HD41-40LC2	9.95 – 10.52	ER / EW	40	100	DWDM*	SFP+ with DMI	0 to 70	Yes
OPN-S1HD41-40LC2I	9.95 – 10.52	ER / EW	40	100	DWDM*	SFP+ with DMI	-50 to 85	Yes

*: XX: 100GHz ITU Grid wavelength (Please see below)

Channel #	Product code	Frequency (THz)	Center Wavelength (nm)	Label
19	OPN-S1HD19-40LC2	191.9	1562.23	D19
20	OPN-S1HD20-40LC2	192.0	1561.42	D20
21	OPN-S1HD21-40LC2	192.1	1560.61	D21
22	OPN-S1HD22-40LC2	192.2	1559.79	D22
23	OPN-S1HD23-40LC2	192.3	1558.98	D23
24	OPN-S1HD24-40LC2	192.4	1558.17	D24
25	OPN-S1HD25-40LC2	192.5	1557.36	D25
26	OPN-S1HD26-40LC2	192.6	1556.55	D26
27	OPN-S1HD27-40LC2	192.7	1555.75	D27
28	OPN-S1HD28-40LC2	192.8	1554.94	D28
29	OPN-S1HD29-40LC2	192.9	1554.13	D29
30	OPN-S1HD30-40LC2	193.0	1553.33	D30
31	OPN-S1HD31-40LC2	193.1	1552.52	D31
32	OPN-S1HD32-40LC2	193.2	1551.72	D32

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Channel #	Product code	Frequency (THz)	Center Wavelength (nm)	Label
33	OPN-S1HD33-40LC2	193.3	1550.92	D33
34	OPN-S1HD34-40LC2	193.4	1550.12	D34
35	OPN-S1HD35-40LC2	193.5	1549.32	D35
36	OPN-S1HD36-40LC2	193.6	1548.51	D36
37	OPN-S1HD37-40LC2	193.7	1547.72	D37
38	OPN-S1HD38-40LC2	193.8	1546.92	D38
39	OPN-S1HD39-40LC2	193.9	1546.12	D39
40	OPN-S1HD40-40LC2	194.0	1545.32	D40
41	OPN-S1HD41-40LC2	194.1	1544.53	D41
42	OPN-S1HD42-40LC2	194.2	1543.73	D42
43	OPN-S1HD43-40LC2	194.3	1542.94	D43
44	OPN-S1HD44-40LC2	194.4	1542.14	D44
45	OPN-S1HD45-40LC2	194.5	1541.35	D45
46	OPN-S1HD46-40LC2	194.6	1540.56	D46
47	OPN-S1HD47-40LC2	194.7	1539.77	D47
48	OPN-S1HD48-40LC2	194.8	1538.98	D48
49	OPN-S1HD49-40LC2	194.9	1538.19	D49
50	OPN-S1HD50-40LC2	195.0	1537.40	D50
51	OPN-S1HD51-40LC2	195.1	1536.61	D51
52	OPN-S1HD52-40LC2	195.2	1535.82	D52
53	OPN-S1HD53-40LC2	195.3	1535.04	D53
54	OPN-S1HD54-40LC2	195.4	1534.25	D54
55	OPN-S1HD55-40LC2	195.5	1533.47	D55
56	OPN-S1HD56-40LC2	195.6	1532.68	D56
57	OPN-S1HD57-40LC2	195.7	1531.90	D57
58	OPN-S1HD58-40LC2	195.8	1531.12	D58
59	OPN-S1HD59-40LC2	195.9	1530.33	D59
60	OPN-S1HD60-40LC2	196.0	1529.55	D60
61	OPN-S1HD61-40LC2	196.1	1528.77	D61

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	70	°C	OPN-S1HD41-40LC2
		-50	85		OPN-S1HD41-40LC2I
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		70	°C / OPN-S1HD41-40LC2
		-50		85	°C / OPN-S1HD41-40LC2I
Relative Humidity	RH	5	85	%	Non-condensing
Power Supply Current	I _{CC(TX+RX)}		320	500	mA/OPN-S1HD41-40LC2
			320	650	mA/OPN-S1HD41-40LC2I
Data Rate			9.95 / 10.3	10.5	Gb/s

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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			100		GHz	2
Transmitter Center Wavelength -- over life time	λ_c	X-100	X	X+100	pm	3
Output Spectrum Width	$\Delta\lambda$	---		1	nm	-20 dB width
Side Mode Suppression Ratio	SMSR	30			dB	
Transmitter and Dispersion Penalty @800 ps/nm @10.3Gb/s	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 μ m single-mode fiber.
2. Corresponds to approximately 0.8 nm.
3. X = specified ITU Grid wavelength.

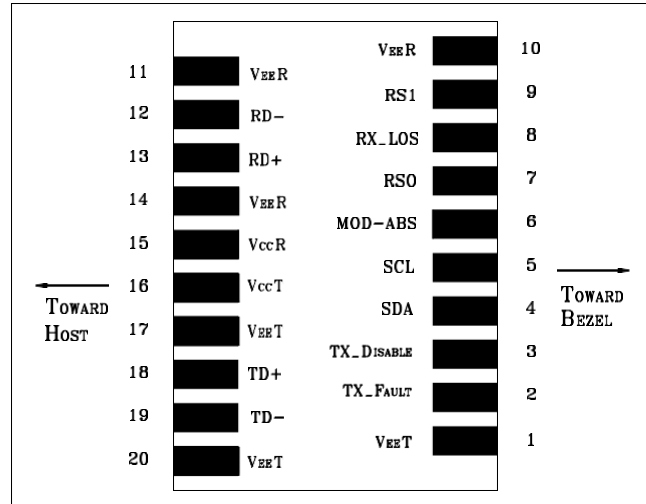
Receiver Optical Specifications (0°C < Topr < 70°C, 3.13V < Vcc < 3.47V)						
Parameter	Symbol	Min	Typ	Max	Units	Notes
Sensitivity				-16	dBm	4
Stressed Receiver Sensitivity, OMA				-11.3		
Receiver Overload	P _{MAX}	-1	---		dBm	
LOS -- Deasserted	LOS _D	---	---	-16	dBm	Transition: low to high
LOS -- Asserted	LOS _A	-28	---	---	dBm	Transition: high to low
Wavelength of Operation	λ_c	1480		1580	nm	
Optical Return Loss	ORL			-27	dB	

4. Measured with worst ER; BER < 10⁻¹² and PRBS 2³¹-1. 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 (LVTTTL) 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	

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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

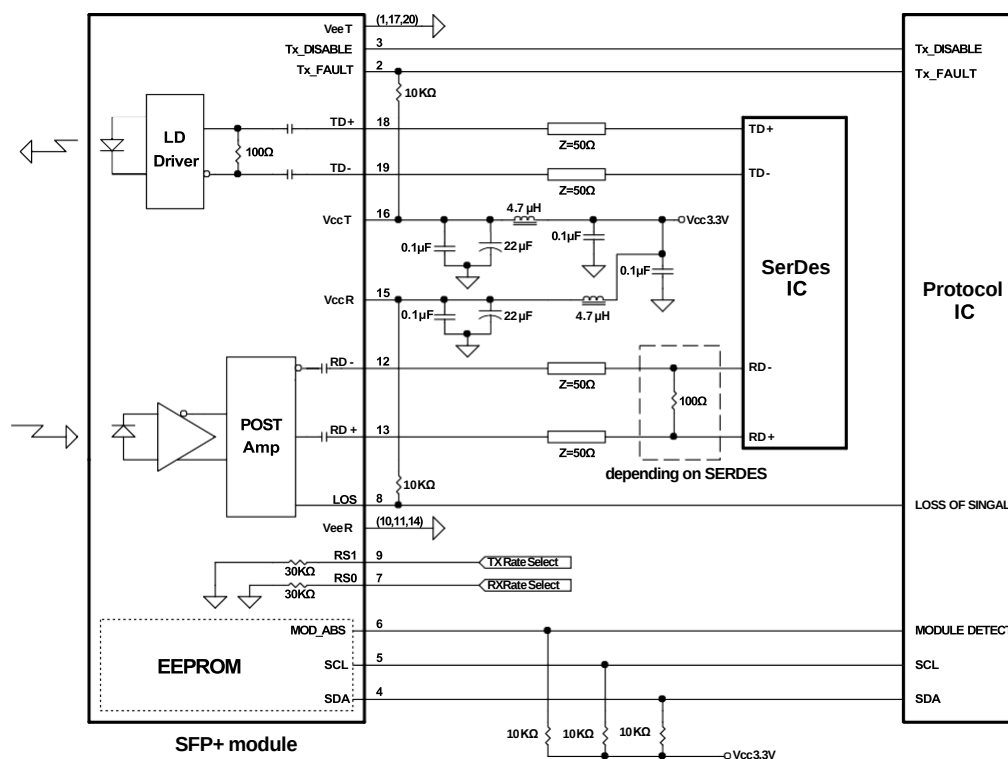
MODULE DEFINITION

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.

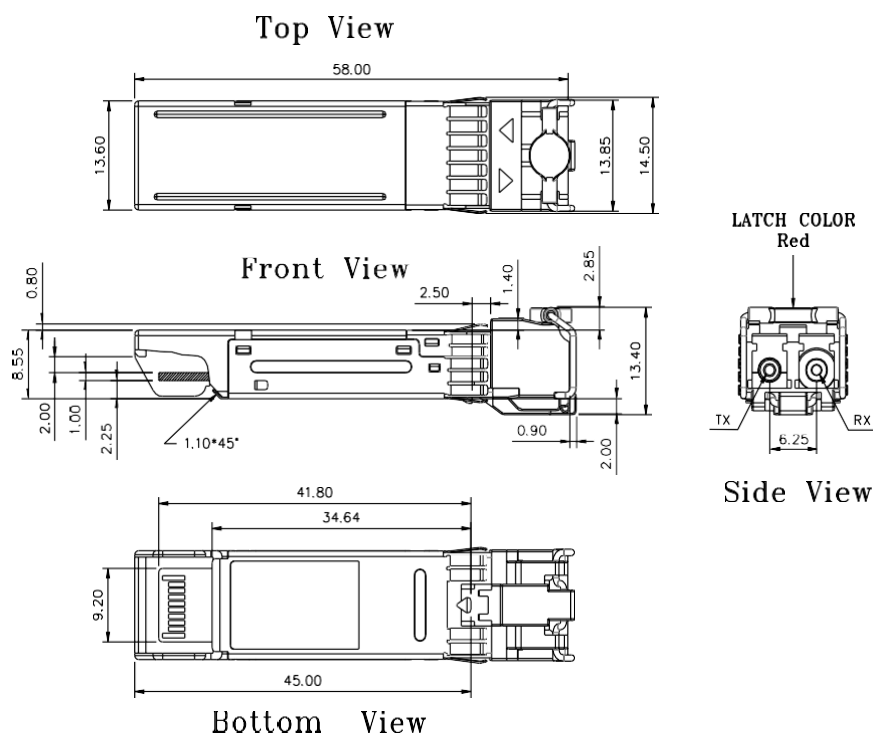
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RECOMMENDED CIRCUIT SCHEMATIC



PACKAGE DIAGRAM

Units in mm



Note: Specifications subject to change without notice.