

Professional high-speed optical transceiver

OPN-S1OD23-40LC2

16G FC / 100GHz DWDM / 40 km Digital Diagnostic SFP+ LC SINGLE-MODE TRANSCEIVER

PRODUCT FEATURES

- Up to 14.025 Gbps Bi-directional Data Links
 - Complaint to SFP+ MSA
- Compliance with Fibre Channel 1600-SM-LC-L
 - Maximum Link Length of 40 km
- Temperature-stabilized DWDM EML Transmitter
 - 14 dB Power Budget at Least
 - 100 GHz ITU Grid, C Band
- RX Rate Selection for 16G FC and 8G/4G FC
- Flexibility in RX data rate selection through either hardware or software control
 - SFF-8472 Digital Diagnostic Function
 - AC/AC Coupling according to MSA
 - Single +3.3 V Power Supply
 - RoHS 6/6 Compliant
 - 0 to 70°C Operating
- Class 1 Laser International Safety Standard IEC-60825 Compliant

APPLICATIONS

- Multi-rate 16x / 8x / 4x Fibre Channel
 - 10G FCoE

PRODUCT DESCRIPTION

The OPN-S1OD23-40LC2 series single mode transceiver is a small form factor pluggable module for bi-directional serial optical data communications such as 16x/8x/4x Fibre Channel. It is with the SFP+ 20-pin connector to allow hotplug 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 rate selection clock data recovery (CDR) IC.

ORDER INFORMATION

P/No.	Bit Rate (Gb/s)	FC	Distance (km)	Spacing (GHz)	Wavelength (nm)	Package	Case Temp (°C)	RoHS Compliant
OPN-S1OD23-40LC2	14.025	16G/8G/4G	40	100	DWDM*	SFP+ with DMI	0 to 70	Yes

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

Channel #	Product code	Frequency (THz)	Center Wavelength (nm)	Label
19	OPN-S1OD19-40LC2	191.9	1562.23	D19
20	OPN-S1OD20-40LC2	192.0	1561.42	D20
21	OPN-S1OD21-40LC2	192.1	1560.61	D21
22	OPN-S1OD22-40LC2	192.2	1559.79	D22
23	OPN-S1OD23-40LC2	192.3	1558.98	D23
24	OPN-S1OD24-40LC2	192.4	1558.17	D24
25	OPN-S1OD25-40LC2	192.5	1557.36	D25
26	OPN-S1OD26-40LC2	192.6	1556.55	D26
27	OPN-S1OD27-40LC2	192.7	1555.75	D27
28	OPN-S1OD28-40LC2	192.8	1554.94	D28
29	OPN-S1OD29-40LC2	192.9	1554.13	D29
30	OPN-S1OD30-40LC2	193.0	1553.33	D30
31	OPN-S1OD31-40LC2	193.1	1552.52	D31
32	OPN-S1OD32-40LC2	193.2	1551.72	D32

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33	OPN-S1OD33-40LC2	193.3	1550.92	D33
34	OPN-S1OD34-40LC2	193.4	1550.12	D34
35	OPN-S1OD35-40LC2	193.5	1549.32	D35
36	OPN-S1OD36-40LC2	193.6	1548.51	D36
37	OPN-S1OD37-40LC2	193.7	1547.72	D37
38	OPN-S1OD38-40LC2	193.8	1546.92	D38
39	OPN-S1OD39-40LC2	193.9	1546.12	D39
40	OPN-S1OD40-40LC2	194.0	1545.32	D40
41	OPN-S1OD41-40LC2	194.1	1544.53	D41
42	OPN-S1OD42-40LC2	194.2	1543.73	D42
43	OPN-S1OD43-40LC2	194.3	1542.94	D43
44	OPN-S1OD44-40LC2	194.4	1542.14	D44
45	OPN-S1OD45-40LC2	194.5	1541.35	D45
46	OPN-S1OD46-40LC2	194.6	1540.56	D46
47	OPN-S1OD47-40LC2	194.7	1539.77	D47
48	OPN-S1OD48-40LC2	194.8	1538.98	D48
49	OPN-S1OD49-40LC2	194.9	1538.19	D49
50	OPN-S1OD50-40LC2	195.0	1537.40	D50
51	OPN-S1OD51-40LC2	195.1	1536.61	D51
52	OPN-S1OD52-40LC2	195.2	1535.82	D52
53	OPN-S1OD53-40LC2	195.3	1535.04	D53
54	OPN-S1OD54-40LC2	195.4	1534.25	D54
55	OPN-S1OD55-40LC2	195.5	1533.47	D55
56	OPN-S1OD56-40LC2	195.6	1532.68	D56
57	OPN-S1OD57-40LC2	195.7	1531.90	D57
58	OPN-S1OD58-40LC2	195.8	1531.12	D58
59	OPN-S1OD59-40LC2	195.9	1530.33	D59
60	OPN-S1OD60-40LC2	196.0	1529.55	D60
61	OPN-S1OD61-40LC2	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	
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
Relative Humidity	RH	5		85	% / Non-condensing
Power Supply Current	I _{CC (TX+RX)}		350	550	mA
Data Rate		4.25	14.025		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	0		4	dBm	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	TDP			2	dB	
Relative Intensity Noise	RIN			-130	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. 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				-14	dBm	4
Receiver Overload	P _{MAX}	1	---		dBm	
LOS – Deasserted	LOS _D	---	---	-14	dBm	Transition: low to high
LOS – Asserted	LOS _A	-24	---	---	dBm	Transition: high to low
Wavelength of Operation	λ_c	1480		1580	nm	
Optical Return Loss	ORL			-27	dB	

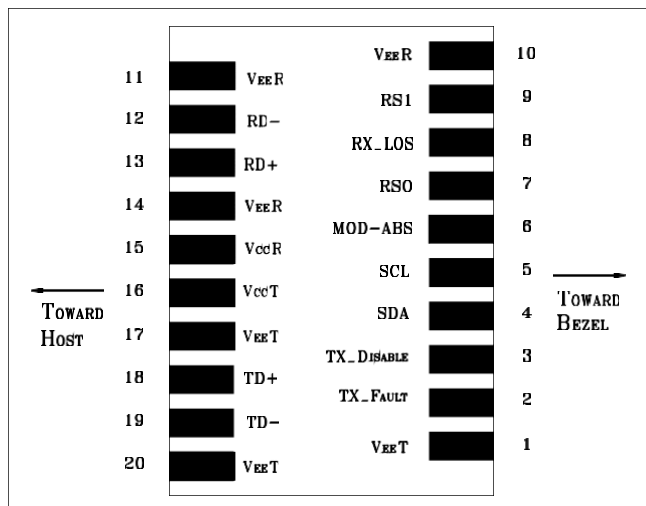
4. Measured with worst ER; BER < 10⁻¹² and PRBS 2³¹-1. Equivalent to -14.3 dBm OMA at ER=8.2 dB.

Electrical Characteristics						
Parameter	Symbol	Min	Typ	Max	Units	Notes
High-Speed Signal (CML) Interface Specification						
Input Data Rate		4.25	14.025		Gb/s	
TX Clock Tolerance		-100		+100	ppm	5
Differential Input Impedance	Rin		100		Ω	
Differential Data Input Amplitude		150		1200	mVpp	Internally AC coupled
Output Data Rate		4.25	14.025		Gb/s	
RX Clock Tolerance		-100		+100	ppm	5
Differential Output Impedance	Rout		100		Ω	
Differential Data Output Amplitude		350	600	700	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	

5. Clock tolerance for 14.025 Gb/s, 8.5Gb/s and 4.25 Gb/s.

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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: Open or Low: 8.5 or 4.25 Gb/s FC. High: enable CDR for 16GFC.	17	VEE T	Transmitter Signal Ground
8	RX_LOS	Loss of Signal Out (OC).	18	TD+	Transmitter Data In
9	RS1	TX Rate Select (LVTTTL). 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 connection (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.

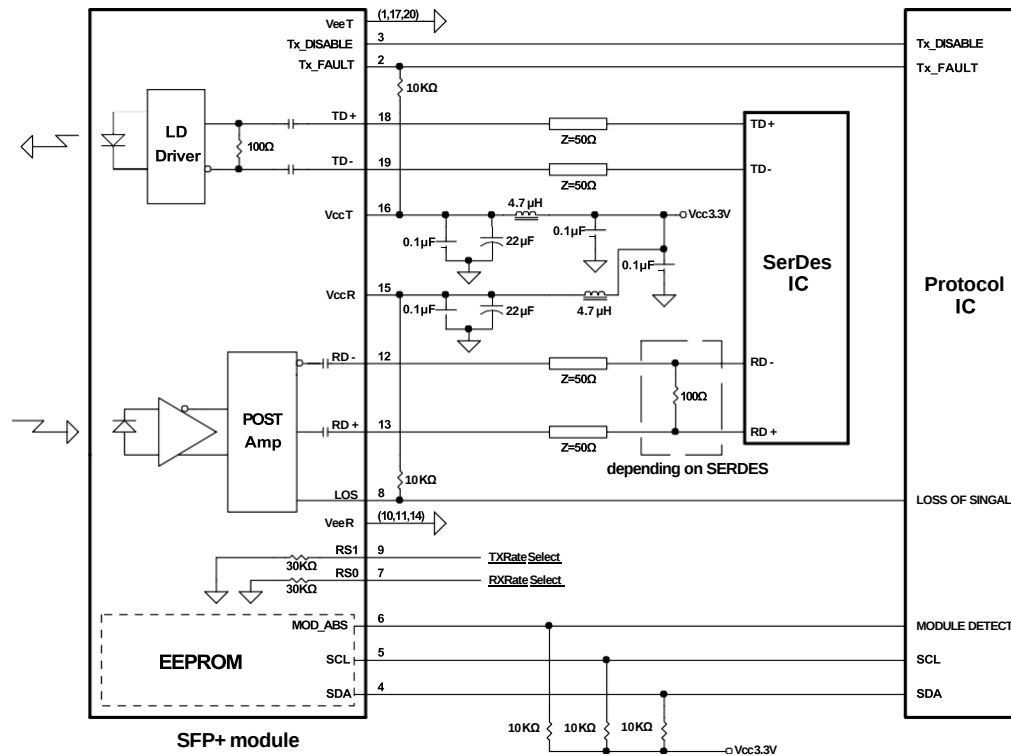
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RX Rate Select Control

RX rate can be independently controlled by either RS0 input pin (Hardware) or via register write to soft RS0 select bit (Software). RS0 input pin (pin 7) is used to select RX rate. Status of RS0 input pin logic level is reflected to register byte 110 bit 4 on address A2h. RX rate can also be controlled by register write to soft RS0 select bit (byte 110 bit 3 on address A2h). Power on default of soft RS0 select bit is logic low. Hardware and software control inputs are OR'd to allow flexible control. See following RX operation logic table:

RS0 Control Input		RX Speed	RX CDR
RS0 Input Pin (Hardware: Pin 7)	Soft RS0 Select Bit (Software: Byte 110 Bit 3, A2h)		
0	0	4G/8G FC	Bypassed
0	1	16G FC	Enabled
1	0		
1	1		

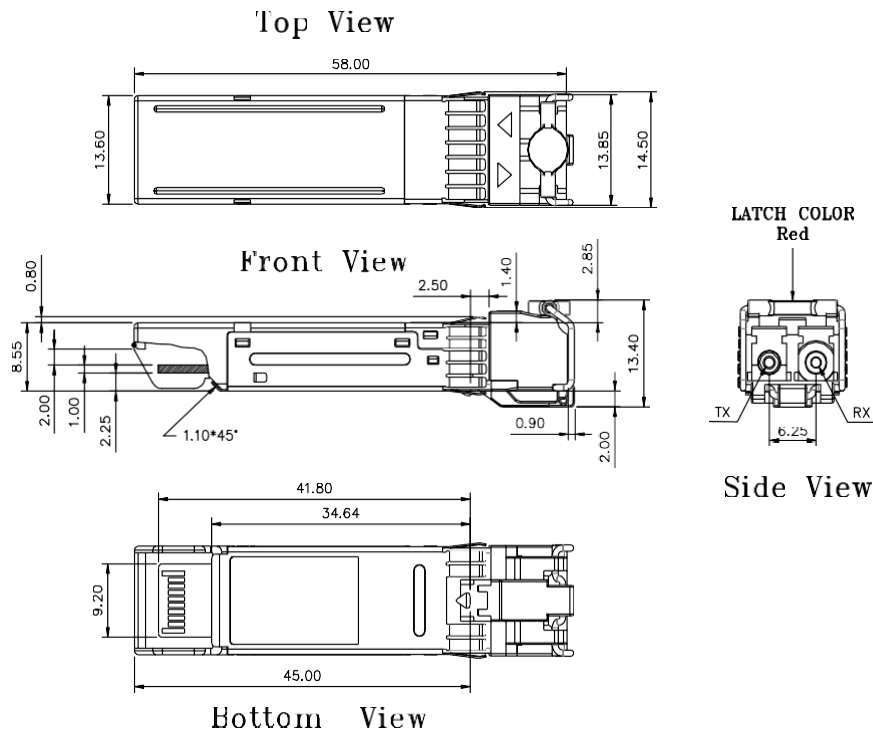
RECOMMENDED CIRCUIT SCHEMATIC



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PACKAGE DIAGRAM

Units in mm



Note: Specifications subject to change without notice.