



Professional high-speed optical transceiver

OPN-SLD23-240LC2 / OPN-SLD23-240LC2I

155Mbps / 240km / 100GHz DWDM Digital Diagnostic LC SFP SINGLE-MODE TRANSCEIVER

PRODUCT FEATURES

- Hot-Pluggable SFP Footprint LC Optical Transceiver
- Small Form-Factor Pluggable (SFP) MSA compatible
 - Compliant with SONET OC-3 / SDH STM-1
 - Distance up to 240km
- Temperature-stabilized DWDM DML Transmitter
 - 50 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 Operation: OPN-SLD23-240LC2
- -50 to 85°C Operation : OPN-SLD23-240LC2I
- Class 1 Laser International Safety Standard IEC-60825Compliant

APPLICATIONS

- ATM Switches and Routers
- SONET / SDH Switch Infrastructure
 - Fast Ethernet Applications

DESCRIPTION

The OPN-SLD23-240LC2 series single mode transceiver is a small form factor pluggable module for bi-directional serial optical data communications such as SONET OC-3 /SDH STM-1 and Fast Ethernet. 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 50 dB is offered. The transmitter section uses temperature-stabilized DWDM directly modulated laser (DML) and is class 1 laser compliant according to International Safety Standard IEC-60825. The receiver section uses an integrated InGaAs Avalanche photodetector preamplifier (IDP) mounted in an optical header and a limiting post-amplifier IC.

ORDER INFORMATION

P/No.	Bit Rate (Mb/s)	SONET /SDH	Distance (km)	Spacing (GHz)	Wavelength (nm)	Package	Temp (°C)	RoHS Compliant
OPN-SLD23-240LC2	125 / 155		240	100	DWDM*	LC SFP with DMI	0 to 70	Yes
OPN-SLD23-240LC2I	125 / 155		240	100	DWDM*	LC SFP with DMI	-50 to 85	Yes

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

Channel #	Product code	Frequency (THz)	Center Wavelength (nm)	Label
20	OPN-SLD23-240LC2	192.0	1561.42	D20
21	OPN-SLD21-240LC2	192.1	1560.61	D21
22	OPN-SLD22-240LC2	192.2	1559.79	D22
23	OPN-SLD23-240LC2	192.3	1558.98	D23
24	OPN-SLD24-240LC2	192.4	1558.17	D24
25	OPN-SLD25-240LC2	192.5	1557.36	D25
26	OPN-SLD26-240LC2	192.6	1556.55	D26
27	OPN-SLD27-240LC2	192.7	1555.75	D27
28	OPN-SLD28-240LC2	192.8	1554.94	D28
29	OPN-SLD29-240LC2	192.9	1554.13	D29
30	OPN-SLD30-240LC2	193.0	1553.33	D30
31	OPN-SLD31-240LC2	193.1	1552.52	D31
32	OPN-SLD32-240LC2	193.2	1551.72	D32



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33	OPN-SLD33-240LC2	193.3	1550.92	D33
34	OPN-SLD34-240LC2	193.4	1550.12	D34
35	OPN-SLD35-240LC2	193.5	1549.32	D35
36	OPN-SLD36-240LC2	193.6	1548.51	D36
37	OPN-SLD37-240LC2	193.7	1547.72	D37
38	OPN-SLD38-240LC2	193.8	1546.92	D38
39	OPN-SLD39-240LC2	193.9	1546.12	D39
40	OPN-SLD40-240LC2	194.0	1545.32	D40
41	OPN-SLD41-240LC2	194.1	1544.53	D41
42	OPN-SLD42-240LC2	194.2	1543.73	D42
43	OPN-SLD43-240LC2	194.3	1542.94	D43
44	OPN-SLD44-240LC2	194.4	1542.14	D44
45	OPN-SLD45-240LC2	194.5	1541.35	D45
46	OPN-SLD46-240LC2	194.6	1540.56	D46
47	OPN-SLD47-240LC2	194.7	1539.77	D47
48	OPN-SLD48-240LC2	194.8	1538.98	D48
49	OPN-SLD49-240LC2	194.9	1538.19	D49
50	OPN-SLD50-240LC2	195.0	1537.40	D50
51	OPN-SLD51-240LC2	195.1	1536.61	D51
52	OPN-SLD52-240LC2	195.2	1535.82	D52
53	OPN-SLD53-240LC2	195.3	1535.04	D53
54	OPN-SLD54-240LC2	195.4	1534.25	D54
55	OPN-SLD55-240LC2	195.5	1533.47	D55
56	OPN-SLD56-240LC2	195.6	1532.68	D56
57	OPN-SLD57-240LC2	195.7	1531.90	D57
58	OPN-SLD58-240LC2	195.8	1531.12	D58
59	OPN-SLD59-240LC2	195.9	1530.33	D59
60	OPN-SLD60-240LC2	196.0	1529.55	D60

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-SLD23-240LC2
		-50	85		OPN-SLD23-240LC2I
Power Supply Voltage	Vcc	-0.5	3.6	V	

Recommended Operating Conditions

Parameter	Symbol	Min	Typ	Max	Units / Notes
Power Supply Voltage	Vcc	3.13	3.3	3.47	V
Operating Case Temperature	Topr	0		70	°C / OPN-SLD23-240LC2
		-50		85	°C / OPN-SLD23-240LC2I
Relative Humidity	RH	5		85	% / Non-condensing
Power Supply Current	I _{CC} (TX+RX)			430	mA / OPN-SLD23-240LC2
				600	mA / OPN-SLD23-240LC2I
Data Rate			125/155	200	Mb/s

Transmitter Specifications (0°C < Topr < 70°C, 3.13V < Vcc < 3.47V)

Parameter	Symbol	Min	Typ	Max	Units	Notes
Optical						
Average Launch Power	P _{o, AVG}	+5	---	+8	dBm	1
Center Wavelength Spacing			100		GHz	2
Transmitter Center Wavelength -- over life time	λ _c	X-100	X	X+100	pm	3
Output Spectrum Width	Δλ	---		1	nm	-20 dB width
Side Mode Suppression Ratio	SMSR	30			dB	
Extinction Ratio	E _R	10	---	---	dB	
Optical Rise Time	t _r			2	ns	10% to 90% Values



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Optical Fall Time	t_f			2	ns	10% to 90% Values
Relative Intensity Noise	RIN			-120	dB/Hz	
Electrical						
Data Input Current -- Low	I_{IL}	-350			μA	
Data Input Current -- High	I_{IH}			350	μA	
Differential Input Voltage	$V_{IH} - V_{IL}$	0.5		2.4	V	Peak-to-Peak
TX Disable Input Voltage -- Low	$T_{DIS, L}$	0		0.5	V	4
TX Disable Input Voltage -- High	$T_{DIS, H}$	2.0		V_{CC}	V	4
TX Disable Assert Time	T_{ASSERT}			10	μs	
TX Disable Deassert Time	$T_{DEASSERT}$			1	ms	
TX Fault Output Voltage -- Low	T_{FaultL}	0		0.8	V	5
TX Fault Output Voltage -- High	T_{FaultH}	2.0		$V_{CC}+0.3$	V	5

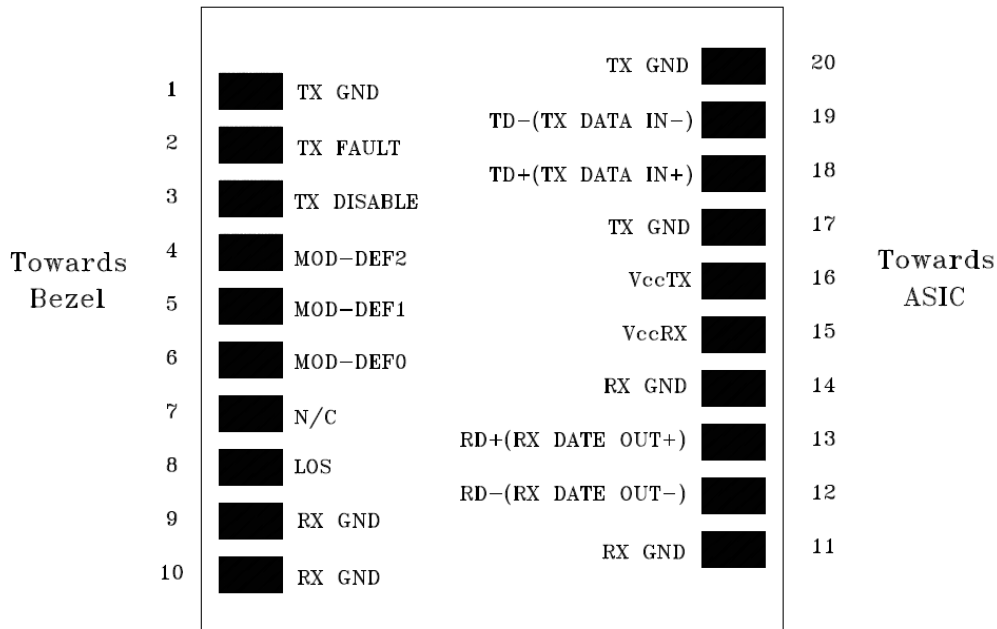
1. Output power is power coupled into a 9/125 μm single-mode fiber.
2. Corresponds to approximately 0.8 nm.
3. X = specified ITU Grid wavelength
4. There is an internal 4.7K to 10K ohm pull-up resistor to V_{CCTX} .
5. Open collector compatible, 4.7K to 10K ohm pull-up to V_{CC} (Host Supply Voltage).

Receiver Specifications (0°C < Topr < 70°C, 3.13V < Vcc < 3.47V)						
Parameter	Symbol	Min	Typ	Max	Units	Notes
Optical						
Sensitivity	Sens			-45	dBm	6
Maximum Input Power	P_{in}	-10			dBm	6
Signal Detect -- Asserted	P_A	---		-45	dBm	Transition: low to high
Signal Detect -- Deasserted	P_D	-55	---	---	dBm	Transition: high to low
Signal Detect -- Hysteresis		1.0	---		dB	
Wavelength of Operation		1100	---	1620	nm	
Electrical						
Differential Output Voltage	$V_{OH} - V_{OL}$	0.6		2.0	V	
Output LOS Voltage -- Low	V_{OL}	0		0.8	V	7
Output LOS Voltage -- High	V_{OH}	2.0		$V_{CC}+0.3$	V	7

6. Measured at PRBS 2²³-1 at BER 1E-10. Receiver sensitivity is better than -45dBm at 155 Mbps and 125 Mbps. However, due to the resolution limitation of Digital Diagnostic Monitoring, the effect readout range for the RX received power at EEPROM A2 is from -10 to -34 dBm.
7. Open collector compatible, 4.7K to 10K ohm pull-up to V_{CC} (Host Supply Voltage)

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CONNECTION DIAGRAM



PIN	Signal Name	Description	PIN	Signal Name	Description
1	TX GND	Transmitter Ground	11	RX GND	Receiver Ground
2	TX Fault	Transmitter Fault Indication	12	RX DATA OUT-	Inverse Receiver Data Out
3	TX Disable	Transmitter Disable (Module disables on high or open)	13	RX DATA OUT+	Receiver Data Out
4	MOD-DFE2	Modulation Definition 2 – Two wires serial ID Interface	14	RX GND	Receiver Ground
5	MOD-DEF1	Modulation Definition 1 – Two wires serial ID Interface	15	Vcc RX	Receiver Power – 3.3V±5%
6	MOD-DEF0	Modulation Definition 0 – Ground in Module	16	Vcc TX	Transmitter Power – 3.3V±5%
7	N/C	Not Connected	17	TX GND	Transmitter Ground
8	LOS	Loss of Signal	18	TX DATA IN+	Transmitter Data In
9	RX GND	Receiver Ground	19	TX DATA IN-	Inverse Transmitter Data In
10	RX GND	Receiver Ground	20	TX GND	Transmitter Ground

MODULE DEFINITION

Module Definition	MOD-DEF2 PIN 4	MOD-DEF1 PIN 5	MOD-DEF0 PIN 6	Interpretation by Host
4	SDA	SCL	LV-TTL Low	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.

The diagram illustrates the internal architecture of an SFP module and its electrical connections to an external system. The module is divided into three main functional blocks: the LD Driver, the POST Amp, and the EEPROM.

- LD Driver:** Receives Tx_DISABLE and Tx_FAULT signals. It drives the TD+ and TD- lines, which are terminated with 50Ω resistors (Z=50Ω) at the SerDes IC. A 100Ω resistor is shown in series with the TD+ line.
- POST Amp:** Receives RD- and RD+ signals. It drives the RD- and RD+ lines, which are terminated with 50Ω resistors (Z=50Ω) at the SerDes IC. A 100Ω resistor is shown in series with the RD+ line. The LOS (Loss of Signal) signal is also connected to the module's LOS pin.
- EEPROM:** Contains MOD_DEF(0), MOD_DEF(1), and MOD_DEF(2) signals. It is connected to the SCL (Serial Clock) and SDA (Serial Data) lines. The SCL and SDA lines are terminated with 4.7K to 10KΩ resistors at the module's SCL and SDA pins.

The SerDes IC is the central component that interfaces the module's internal signals with the external system's SerDes IC. It is connected to the TD+, TD-, RD-, and RD+ lines. The SerDes IC also provides VccT and VccR power planes, which are connected to the module's VccT and VccR pins. The SerDes IC is terminated with 50Ω resistors (Z=50Ω) at the module's SerDes IC pins.

The external system (Protocol IC) provides Tx_DISABLE, Tx_FAULT, and LOS signals. It also provides Vcc 3.3V power to the module's VccT and VccR pins. The Protocol IC is connected to the SCL and SDA lines, which are terminated with 4.7K to 10KΩ resistors at the module's SCL and SDA pins.

Units in mm

Front View

Dimensions: 0.80, 8.55, 2.00, 1.00, 2.25, 1.10*45°, 2.50, 1.40, 2.85, 13.40, 0.90, 12.00

Technical drawing of the top view of the device. The overall width is 41.80. The width of the main body is 34.64. The height of the device is 9.20. The overall length is 45.00. The drawing shows a rectangular body with a handle on the right side and a connector on the left side.

A cross-sectional view of a 2-cylinder engine. Two valves are labeled TX and RX. A dimension line indicates a distance of 6.25 mm between the valve stems.

Side View

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