1935 F/R/W Coaxial DFB Laser Diode

O-Band CWDM 5 MHz – 4000 MHz

DATASHEET | AUGUST 2012 FIBER OPTICS



Applications

- Video Signal Distribution in HFC and FTTx Nodes
- Signal Distribution in L-Band and Wireless Remoting Links
- High Linearity, Low Power Fiber Links

Features

- Linear DFB Laser Design
- Ouput Power Up to 10 dBm Available
- Bandwidth 47 – 1002 MHz
- RoHS Compliance
- Optical Isolator
- Low Power Consumption
- Monitor Photodiode

EMCORE's Model 1935 DFB lasers offer a low cost solution for linear fiber optic links. These components can be cooled with external thermo-electric coolers for high stability, or run without TEC's to reduce power consumption. The DFB laser builds upon Ortel's long history of high performance, leading edge designs in CATV, wireless, and high speed digital applications. The laser diode devices are packaged in a compact hermetic assembly together with monitor photodiode and isolator, for flexible integration into various transmitter configurations.

Performance Highlights

Parameters	Min	Typical	Max	Units
Operating Case Temperature Range	-40	-	85	°C
Optical Output Power (1)	3	-	4.9	dBm
	5	-	5.9	
	6	-	8.9	
	9	-	9.9	
	10	-	11.9	
Frequency Range	5	-	4000	MHz
Carrier-to-Noise Ratio (79 channels) (1)	51	-	-	dB
Composite Second Order (79 channels) (1)				dBc
Standard Linearity	-	-	-57	
Enhanced Linearity	-	-	-60	
Composite Triple Beat (79 channels) (1)				dBc
Standard Linearity	-	-	-65	
Enhanced Linearity	-	-	-68	
Optical Return Loss (1)	45	-	-	dB
Side Mode Suppression Ratio, CW (1)	30	-	-	dB

1. Performance at Tcase = 25°C

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Absolute Maximum Ratings[1]

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of the data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect device reliability.

Parameters	Symbol	Condition/Notes	Min	Max	Unit
Storage Temperature	T_{STG}	Non-Operating	-40	85	°C
Operating Case Temperature	T_{OP}	Continuous	-40	85	°C
Laser Diode Forward Current	I_{OP}	CW	-	150	mA
Laser Diode Reverse Voltage	V_R	Continuous	-	1.0	V
Photodiode Forward Current	I_{MPD}	Continuous	-	2	mA
Photodiode Reverse Voltage	$V_{MPD,R}$	Continuous	-	10	V
Average RF Input Power	PIN	60 Seconds	-	62	dBmV
Lead Soldering Temperature/Time	-	-	-	260/10	°C/sec
Relative Humidity	RH	Continuous	-	85	%
ESD	-	Human Body Model	-500	+500	V

1. Absolute maximum data are limited to system design only; proper device performance is not guaranteed over rating listed above. Operation beyond these maximum conditions may degrade device performance, lead to device failure, shorter lifetime, and will invalidate the device warranty.

Electrical/Optical Characteristics

Parameters	Symbol	Conditions/Notes	Min	Typ	Max	Unit
Optical Output Power	P_O	3 dBm Version 5 dBm Version 6 dBm Version 9 dBm Version 10 dBm Version	3 5 6 9 10	- - - - -	4.9 5.9 8.9 9.9 11.9	dBm
Threshold Current	I_{TH}	T_{case} = 25ºC T_{case} = 45ºC	- -	8 13	15 20	mA
Laser Bias Current	I_{OP}		-	-	80	mA
Forward Voltage	V_F	I_{op}	-	1.17	1.8	V
Slope Efficiency	SE	T_{case} = 25ºC, I_{op}	0.07	-	0.3	mW/mA
Thermal Slope Efficiency	TSE	SE(Tc)/SE(25ºC) T_{case} = -20ºC to 85ºC	0.4	-	1.2	-
Laser Input Impedance	Z	-	2	4	8	Ω
MPD Current	I_{MPD}	V_{MPD} = 5V, I_{op}	50	-	2000	µA
MPD Dark Current	I_D	V_{MPD} = 5V, I_{op} = 0 T_{case} = 25ºC	-	-	50	nA
Relative Intensity Noise	RIN	CW, I_{op}, T_{case} = 25ºC 5 MHz - 1002 MHz	-	-	-150	dB/Hz

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Electrical/Optical Characteristics (continued)

Parameters	Symbol	Conditions/Notes	Min	Typ	Max	Unit
Tracking Error	ΔPf	I_{MON} = const ER = 10log(P_O/2.0) [dB]	-1	-	+1	dB
Optical Isolation, T_{case} = 25ºC	ISO	Double Isolator	45	-	-	dB
Spectral Width (-20 dB)	Δλ	I_{op}	-	0.1	1.0	nm
Side Mode Suppression Ratio	SMSR	I_{op}	30	45	-	dB
Optical Return Loss	ORL	T_{case} = 25ºC	35	-	-	dB

1. Referenced to base of TO header.

Forward Path RF Characteristics

1935F Performance Parameter	Symbol	Conditions/Notes	Min	Typ	Max	Unit
Frequency Response Flatness [1]	$\|S_{21}\|$	47 MHz – 1002 MHz 5 MHz – 4000 MHz	- -	- -	1 4	dB_{p-p}
Response Up-tilt [1]		47 MHz < f < 1002 MHz	-1		3	dB
Carrier-to-Noise Ratio [2,3,4]	CNR	I_{op}	51	-	-	dB
Composite Second Order [2,3,4] Standard Linearity Enhanced Linearity	CSO	I_{op} T_{case} = 25ºC	- -	- -	-57 -60	dBc
Composite Triple Beat [2,3,4] Standard Linearity Enhanced Linearity	CTB	I_{op} T_{case} = 25ºC	- -	- -	-65 -68	dBc

1. I_{op}, T_{case} = 25°C. Test with the laser Input pin matched to a 50Ω system.
2. 3.7% OMI, 79 NTSC unmodulated carriers (50 MHz to 550 MHz). 10 km fiber.
3. Received power = 0 dBm.
4. I_{op}, T_{case} = 25°C. Test with the laser Input pin matched to a 75Ω system.

Return Path RF Characteristics

1935R Performance Parameters	Symbol	Conditions/Notes	Min	Typ	Max	Unit
Frequency Response Flatness [1]	$\|S_{21}\|$	5 MHz - 200 MHz	-	-	1	dB_{p-p}
Second Order Distortion [2] Standard Linearity Enhanced Linearity	DSO	P_F = 3 dBm, OMI = 10% each 2-tone test: f1=7MHz, f2=56MHz 20 km of fiber (7.5 dB total loss with connector) f1 + f2	- -	- -	-52 -58	dBc
Third Order Distortion [2] Standard Linearity Enhanced Linearity	DTB	P_F = 3 dBm, OMI = 10% each 2-tone test: f1=7MHz, f2=56MHz 20 km of fiber (7.5 dB total loss with connector) 2f2-f1	- -	- -	-63 -65	dBc

1. I_{op}, T_{case} = 25°C. Test with the laser Input pin matched to a 50Ω system.
2. I_{op}, T_{case} = 25°C. Test with laser input pin matched to a 75Ω system.

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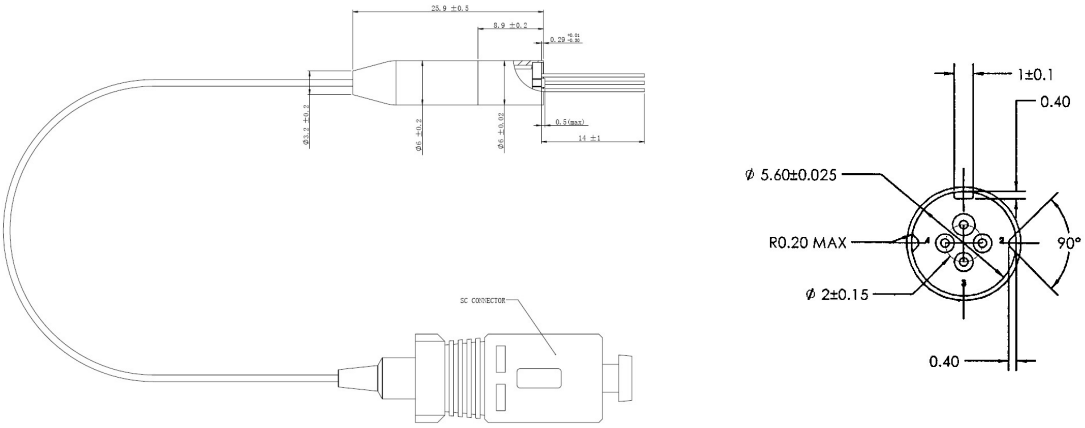
O-Band CWDM 5 MHz – 4000 MHz

Wide Bandwidth Path RF Characteristics

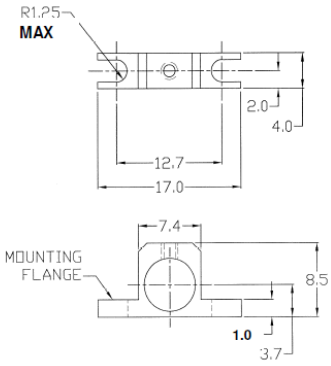
1935W Performance Parameters	Symbol	Conditions/Notes	Min	Typ	Max	Unit
Frequency Response Flatness [1]	$\|S_{21}\|$	900 MHz – 4000 MHz	-	-	4	dB_{p-p}
Input Third Order Intercept [2]	IIP3	Standard Linearity, I_{bb}	30	-	-	dBm
1dB Compression Point [3]	P_{1dB}	I_{bb}	16	-	-	dBm

1. I_{op}, T_{case} = 25°C. Test with the laser Input pin matched to a 50Ω system.
2. IIP3 is measured at I_{bb} where I_{bb} is the bias point at which simultaneously the laser at its best linearity and the optical power is within specification. Test Frequency F1 = 2700MHz, F2 = 2703MHz, RF in = 0dBm/frequency. 0km fiber.
3. Test at 2700MHz. 0km fiber.

Package Outline Drawing (dimensions are in mm)



Mounting Bracket



NOTES:

1. UNIT: mm
2. TOLERANCE: ±0.1mm UNLESS OTHERWISE SPECIFIED

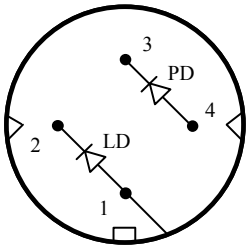
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Reliability/Quality

Designed to meet qualification requirements of Telcordia™ (Bellcore) GR-468-CORE.

Schematic and Pinout

Schematic and Pinout A



Pinout A

Bottom View

Pin Definitions for Pinout A

Pin	Description
1	LD Anode, Case Ground
2	LD Cathode
3	PD Cathode
4	PD Anode

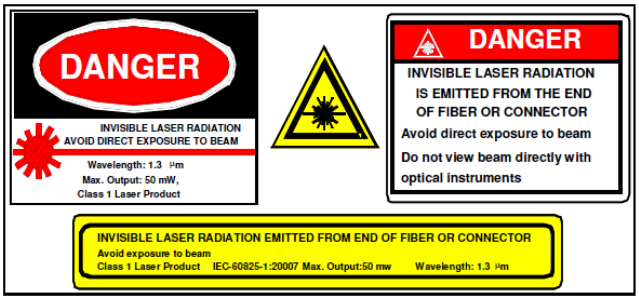
Laser Safety

This product meets the appropriate standard in Title 21 of the Code of Federal Regulations (CFR). FDA/CDRH Class 1 laser product. This device has been classified with the FDA/CDRH under accession number 0220191.

All version of this laser are Class 1 laser product, tested according to IEC 60825-1:2007/EN 60825-1:2007

Single-mode fiber pigtail with SC/APC connectors (standard).
Wavelength = 1.3 μm.
Maximum power = 50 mW.
Because of size constraints, laser safety labeling (including an FDA class 1 label) is not affixed to the module, but attached to the outside of the shipping carton. Product is not shipped with power supply.

Caution: Use of controls, adjustments and procedures other than those specified herein may result in hazardous laser radiation exposure.



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Ordering Code Definitions

1935x - a - bb - c - dddd - ww - yy - z

Family Name
1935F: Forward Path
1935R: Return Path
1935W: Wideband

Distortion Performance
a = A: Standard Linearity
a = B: Enhanced Linearity (**not available for 1935W**)

Optical Isolator
bb = DI: Double Isolator (**only available for optical 3 – 6dBm**)
bb = SI: Single Isolator

Pinout
c = A: Pinout A

O-Band Wavelength
dddd = 1271:1271 nm
dddd = 1291:1291 nm
dddd = 1311:1311 nm
dddd = 1331:1331 nm
dddd = 1351:1351 nm
dddd = 1371:1371 nm

Fiber Length, Optical Connector
ww = FA: FC/APC, 900 micron buffer, 1.0 – 1.4 meter
ww = SA: SC/APC, 900 micron buffer, 1.0 – 1.4 meter

Optical Output Power
yy = 03: 3 dBm (2 mW)
yy = 05: 5 dBm (3 mW)
yy = 06: 6 dBm (4 mW)
yy = 09: 9 dBm (8 mW) – (**only available for 1935F and 1935W**)
yy = 10: 10 dBm (10 mW) – (**only available for 1935F and 1935W**)

Mounting Bracket
z = B: Mounting Bracket
z = N: No Mounting Bracket

Example

1935F-B-DI-A-1271-SA-10-N: Forward Path Uncooled O-Band CWDM Coaxial Laser, Enhanced Linearity, Double Isolator, Pinout A, 1271 nm, SC/APC optical connector, 10 dBm optical power, no mounting bracket.

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