

### TDM and WDM Applications

### FEATURES

- 7-Pin Package with Either GPO or K Connector RF Input
- High Frequency RF Connector Package with 50  $\Omega$  RF Impedance
- InGaAsP Monolithically Integrated DFB Laser and Modulator Chip
- Low Drive Voltage ( $\leq 2$  Vpp)
- Very Low Dispersion Penalty Up to 80 km for 10 Gb/s Operation (up to 1600 ps/nm)
- Wavelength Selection According to ITU-G.692

### APPLICATIONS

- Metro SONET/SDH and DWDM Equipment
- Long-Haul WDM Power Consumption/Size/Cost Optimized Equipment
- Terminals for Submarine WDM Transmission Systems
- STM-64 (Intra-Office, Short-Haul and Long-Haul) and OC-192 (Short-Reach, Intermediate-Reach and Long-Reach) Size Optimized Transceiver and Transponder

The PowerSource™ 1915 LMM contains an DFB laser with monolithically integrated electro-absorption modulator (EA-ILM). The modulation voltage is applied to the modulator section while the DFB laser operates CW. Without the complexity of LiNbO<sub>3</sub> external modulators, the PowerSource™ 1915 LMM is dedicated to STM64/OC-192 bit rate with reduced size and reduced cost. This device allows 10 Gb/s data transmission with an extinction ratio higher than 10 dB and less than 2 V modulation voltage. The PowerSource™ 1915 LMM is optimized for 10 Gb/s TDM and WDM transmission systems supporting dispersion up to 1600 ps/nm.



### OPTICAL CHARACTERISTICS

Table 1

Parameter	Sym	Conditions	Min	Max	Unit
Case Operating Temperature	T <sub>c</sub>		0	70	°C
Threshold Current	I <sub>th</sub>	CW, V <sub>bias</sub> = 0 V	5	35	mA
Operating Current	I <sub>f</sub>	WDM Applications, CW, V <sub>bias</sub>	55	85	mA
		Single Channel Applications, CW, V <sub>bias</sub>	60	100	mA
Optical Output Power	P <sub>ave</sub>	I <sub>f</sub> , V <sub>mod</sub> , [1] [2] [3]	-2	+2	dBm
Laser Forward Voltage	V <sub>f</sub>	CW, I <sub>f</sub> , V <sub>bias</sub> = 0 V		2	V
Modulator Bias Voltage	V <sub>bias</sub>	See [1] [3]	-2	0	V
Modulator Drive Voltage	V <sub>mod</sub>	See [1] [3]		2	V
Dynamic Extinction Ratio	DER	I <sub>f</sub> , [1] [2] [3]	10		dB
Emission Wavelength	$\lambda$	See Table 3	1529.55	1569.59	nm
Laser Chip Temperature Range for Tunability	Twave	See [3]	20	35	°C
Side Mode Suppression	SMSR	See [1] [3]	40		dB
Cut Off Frequency	S21	- 3 dB, V <sub>bias</sub> @ I <sub>f</sub>	8		GHz
RF Return Loss	S11	DC to 6 GHz	10		dB
	S11	6 to 10 GHz		6	dB
Dispersion Penalty	$\Delta S$	See [1] [2] [3]		2	dB
Rise Time / Fall Time	Tr/Tf	See [1] 10%, 90%		45	ps
Monitor Diode Current	I <sub>m</sub>	I <sub>f</sub> , V = - 5 V	20	1500	$\mu$ A
TEC Current	I <sub>t</sub>	$\Delta T$ = 50 °C, I <sub>f</sub> +20%(EOL) T <sub>c</sub> = 70 °C, V <sub>bias</sub> = - 1 V		1.3	A
TEC Voltage	V <sub>t</sub>	$\Delta T$ = 50 °C, I <sub>f</sub> +20%(EOL) T <sub>c</sub> = 70 °C, V <sub>bias</sub> = - 1 V		2.5	V
Thermistor Resistance	R <sub>TH</sub>	Tsubmount = 25 °C	9.5	10.5	k $\Omega$
Thermistor Coefficient	$\beta$	Tsubmount = 25 °C	3800	4000	K

All limits start of life Tcase in the range [0°C ; 70°C], Tsubmount = Twave for WDM applications and Tsubmount = 25°C for Single Channel applications, monitor bias = - 5 V, unless otherwise stated.

[1] BER = 10<sup>-10</sup>; 9.953 Gbit/s modulation; 2<sup>23</sup>-1 PRBS; NZR line code.

[2] 1600 ps/nm dispersion assuming fiber with an average dispersion of 18 ps/nm/km @ 1550 nm.

[3] For WDM application Tsubmount = Twave. Twave is the chip temperature required to meet target wavelength (see table 3).



### MAJOR CHARACTERISTICS

Fig. 1. Return Loss Response

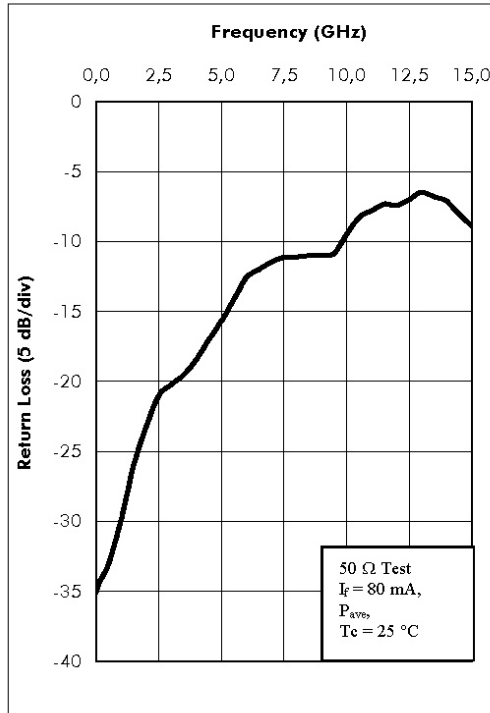


Fig. 2. Typical Bit Error Rate

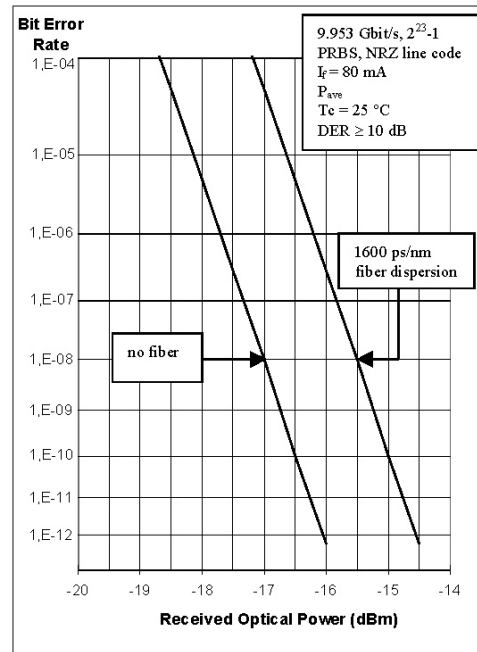


Fig. 3 Typical Extinction Ratio vs. Bias Voltage

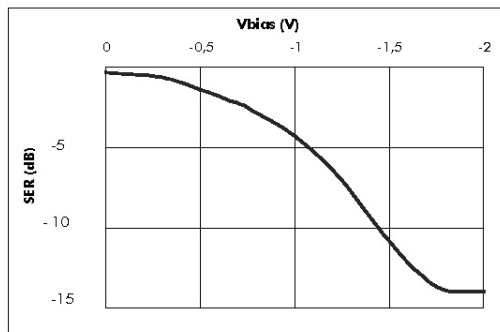
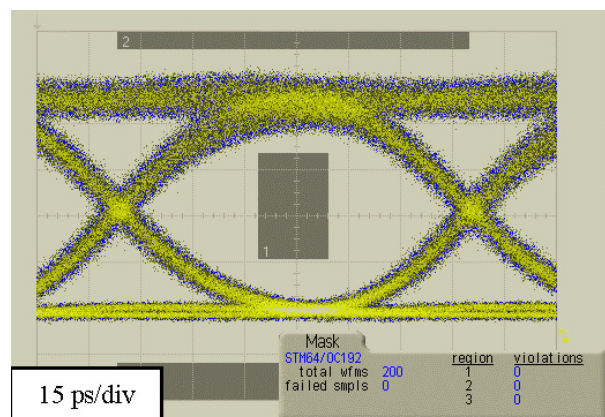


Fig. 4 Typical Filtered Output Eye Diagram with a Driver circuit (without fiber; see recommended circuit in Application Note)

9.953 Gb/s, 223 -1 PRBS NRZ,  $T_c = 25$  °C,  
 $T_{submount} = T_{wave}$ ,  $I_f = 80$  mA,  $P_{ave}$  and DER  $\geq 10$  dB



### QUALIFICATION, RELIABILITY AND STANDARDS

Avanex Handling policy for all products is to carry out a complete qualification program. This qualification is based on manufacturers' qualification in agreement with Telcordia GR-468-Core (generic reliability assurance requirements for optoelectronic devices used in Telecommunications equipment - central office level), MIL STD 883E (Test method and procedures for microelectronics) and following the standards ITU-T G652 and G-691. All products pass strict tests before shipping. Failure criteria are defined during the product qualification process.

### DEVICE MARKING

The device shall be legibly and permanently marked with the following information:

Avanex logo

Product family name: 1915 LMM

Product code: 3CN number (see Ordering Information section)

Serial number

### SHIPMENT PACKAGING

Each device is individually packed in an anti-static container and in such a manner as to prevent damage in transit.

The packing shall include the following information:

Avanex logo

Product family name: PowerSource™ 1915 LMM

Product code: 3CN number (see Ordering Information section)

Serial number

Hazard warning label (ESD)

Laser Safety Class Label

### DELIVERABLE DATA

The following data shall be supplied with each device for **WDM and Single Channel applications**:  $L(I)$  /  $V(I)$  /  $I_m(I)$  curves  
Values for  $V_{mod}$ ,  $V_{on}$  (On-state voltage [0 data]),  $V_{bias}$  (bias voltage), DER, S0 (received optical power without fiber),  $\Delta S$  and  $P_{ave} @ I_f$

DER and dispersion penalty ( $\Delta S$ )

**For Single Channel applications:**

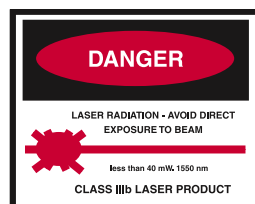
Plot of SER vs  $V_{mod}$  over the range 0 V to -3 V @  $I_f = 80$  mA and  $T_{case} = T_{submount} = 25^\circ\text{C}$

**For WDM applications:**

Plot of SER vs  $V_{mod}$  over the range 0 V to -3 V @  $I_f$ ,  $T_{wave}$  and  $T_c = 25^\circ\text{C}$

### LASER SAFETY INFORMATION

Take appropriate precautions to prevent undue exposure to naked eye. This product is classified Class 3A Laser Product according to IEC-60825-1. FDA/CDRH Class IIb laser product. All versions are Class IIb laser products per CDRH, 21 CFR 1040 Laser. Safety requirements under accession number 0120546-00.



### HANDLING

This product is sensitive to electrostatic discharge and should not be handled except at a static free workstation. Take precautions to prevent ESD; use wrist straps, grounded work surfaces and recognized anti-static techniques when handling the PowerSource™ 1915 LMM module. Handle the laser module by its package only, never hold it by its pigtail. Care should be taken to avoid supply transient and over voltage. Over voltage above the maximum specified in absolute maximum rating section may cause permanent damage to the device.

# PowerSource™ 1915 LMM

10 Gb/s Digital Electro-Absorption Laser Module - 1600 ps/nm Application



## ORDERING INFORMATION

PowerSource™ 1915 LMM - 1600 ps/nm Application

Application	Part Number	Electrical Connector	Optical Connector
Single Channel	3CN00772AA	K type	FC/PC
WDM	3CN00772##	K type	FC/PC
Single Channel	3CN00773AA	K type	LC/PC
WDM	3CN00773##	K type	LC/PC
Single Channel	3CN00774AA	K type	SC/PC
WDM	3CN00774##	K type	SC/PC
Single Channel	3CN00775AA	GPO type	FC/PC
WDM	3CN00775##	GPO type	FC/PC
Single Channel	3CN00776AA	GPO type	LC/PC
WDM	3CN00776##	GPO type	LC/PC
Single Channel	3CN00777AA	GPO type	SC/PC
WDM	3CN00777##	GPO type	SC/PC

Table 3

$\lambda$ (nm)	THz	Code ##	$\lambda$ (nm)	THz	Code##
1529.55	196.00	BP	1550.12	193.40	DT
1530.33	195.90	BR	1550.92	193.30	DV
1531.12	195.80	BT	1551.72	193.20	DX
1531.90	195.70	BV	1552.52	193.10	DZ
1532.68	195.60	BX	1553.33	193.00	EB
1533.47	195.50	BZ	1554.12	192.90	ED
1534.25	195.40	CB	1554.94	192.80	EF
1535.04	195.30	CD	1555.75	192.70	EH
1535.82	195.20	CF	1556.55	192.60	EK
1536.61	195.10	CH	1557.36	192.50	EM
1537.40	195.00	CK	1558.17	192.40	EP
1538.19	194.90	CM	1558.98	192.30	ER
1538.98	194.80	CP	1559.79	192.20	ET
1539.77	194.70	CR	1560.61	192.10	EV
1540.56	194.60	CT	1561.42	192.00	EX
1541.35	194.50	CV	1562.23	191.90	EZ
1542.14	194.40	CX	1563.05	191.80	FB
1542.94	194.30	CZ	1563.86	191.70	FD
1543.73	194.20	DB	1564.68	191.60	FF
1544.53	194.10	DD	1565.49	191.50	FH
1545.32	194.00	DF	1566.31	191.40	FK
1546.12	193.90	DH	1567.13	191.30	FM
1546.92	193.80	DK	1567.95	191.20	FP
1547.72	193.70	DM	1568.77	191.10	FS
1548.51	193.60	DP	1569.59	191.00	FU
1549.32	193.50	DR			

All wavelengths referenced to vacuum and Twave for WDM applications.



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