



EC-48 2.5 Gbit/s External Cavity Directly Modulated Lasers

200 km, 400 km, and 650 km reach

The EC48 series directly modulated external cavity laser is a cost effective solution for 2.5 Gbits/s digital transmission up to 650 km in SMF-28 fiber. The laser is fabricated in a 14-pin hermetically sealed butterfly package that incorporates a bias tee circuit, an integrated thermoelectric cooler (TEC), a thermistor, and a back facet monitor photodiode. The EC48 provides substantially lower dispersion penalty and lower chirp than a directly modulated DFB. The wavelength stability is assured by design, eliminating the need for wavelength lockers and complex feedback control circuits.

Applications

- Metro and Long Haul DWDM, 100 GHz spaced networks
- SONET/SDH OC-48/STM16 ring and meshed applications
- Drop-side of DWDM long-haul transport equipment
- CATV networks
- Optical Test and Instrumentation
- Microwave Photonics
- Sensors

Features

- ITU wavelengths across C-band
- 100 GHz channel spacing
- SONET/SDH OC-48/STM16 ring and meshed applications
- Low dispersion provides up to 200-km, 400-km, and 650-km reach in SMF-28 fiber
- Low transient chirp provides unique narrow dynamic spectrum
- Excellent long-term wavelength stability eliminates the need for a wavelength locker

Performance Highlights

	Min	Typical	Max	Units
Optical Output Power	3	-	-	mW
Case Operating Temperature Range	-15	-	+75	°C
Center Wavelength (100 GHz ITU Grid)	1527	-	1570	nm
Spectral Width (- 20 dB)	-	-	.10	nm
Optical Isolation	30	-	-	dB
Side Mode Suppression Ratio				
CW	35	-	-	dB
Dynamic	30	-	-	dB
High Frequency Cutoff	3.5	-	-	GHz
Extinction Ratio				
EOL	8.5	-	-	dB
BOL	9.5	10	-	dB

See following pages for complete specifications and conditions.

For more information on this and other products:

Contact Sales at Ortel 626-293-3400, or visit www.emcore.com.

Absolute Maximum Ratings

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_c	Continuous	-15	75	°C
Forward Current	I_{LF}	CW		100	mA
Reverse Voltage	V_{LR}	Continuous		2	V
Photodiode Forward Current	I_{DF}	Continuous		2	mA
Photodiode Reverse Voltage	V_{DR}	Continuous		10	V
TEC current	I_{TEC}	(2)		1.8	A
TEC voltage	V_{TEC}	Continuous		3.5/3.3*	V
Fiber bend Radius	R		35		mm
Tensile Strength fiber to case	F			5	N
Lead Soldering Time	t_{sold}	< 260°C (3)		10	sec
Package mounting screw torque		(4)		0.12	m* N
Operating Humidity: non-condensing	X_{op}		5	95	%
Storage Humidity: non-condensing	X_{op}		5	95	%

- (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
- (2) TEC current should not exceed 2.0 A during turn on, and case temperature under any conditions should not change faster than 10 °C / min
- (3) Soldering iron only; no reflow or dip soldering allowed.
- (4) See mounting recommendations below

* 400-km

Electrical/Optical Characteristics

Parameters	Symbol	Conditions/Notes	MIN	Typ	MAX	Unit
Peak Optical Output Power	P_{peak}		3	-	-	mW
Slope efficiency	η	CW output power 3 mW	0.064	-	-	mW/mA
Threshold Current	I_{TH}		-	15	25	mA
Forward Voltage	V_F	CW output power 3 mW	-	1.3	1.8	V
Monitor Current	I_{MON}	CW output power 3 mW	0.04	-	0.4	mA
Monitor photodiode tracking error	TE	$-10 < T_C < +70 \text{ }^\circ\text{C}$	-	-	± 0.5	dB
TEC set temperature	T_s	Specified for every laser	17		35	$^\circ\text{C}$
Center wavelength (100 GHz ITU grid)	λ_c	TEC temperature at the recommended value T_s	1527	-	1570	nm
Spectral Width (at -20dB)	$\Delta\lambda$	2.5 Gbits/s, ER = 10 dB; (1)	-	-	0.10	nm
Wavelength drift with case (-10 to 70 $^\circ\text{C}$) temperature	$\Delta\lambda_{T_c}$	TEC temperature at T_s	-	-	± 30	pm
Wavelength offset from DWDM ITU grid	$\Delta\lambda_{offset}$	TEC temperature at T_s	-	-	± 40	pm
Variation in Center Wavelength from ITU grid over ambient temperature, EOL	$\Delta\lambda_T$	$-10 < T_C < +70 \text{ }^\circ\text{C}$, <20 years at the rated power			± 0.08	nm
Wavelength Temperature coefficient	$\Delta\lambda/\Delta T$	$T_s \pm 1 \text{ }^\circ\text{C}$		15	30	pm/ $^\circ\text{C}$
Wavelength Current coefficient	$\Delta\lambda/\Delta I$			1.5	2	pm/mA
Optical isolation		$-10 < T_C < +70 \text{ }^\circ\text{C}$	30			dB
Relative Intensity Noise	RIN	CW, output power 3mW			- 135	dB/Hz
Side Mode Suppression Ratio	SMSR					
CW		CW, $P_{out} > 1 \text{ mW}$	35			dB
Dynamic		2.5 Gbits/s NRZ, ER = 9.5 dB	30			dB
High frequency cutoff		S_{21} at -3 dB	3.5			GHz
Rise/Fall time (20 - 80%)	t_r, t_f	2.5 Gbits/s; PRBS $2^{23}-1$; NRZ; ER ≥ 9.5 ;			150	ps
Input Impedance	Z_{in}		22	25	28	Ω
Extinction Ratio	ER	$-10 < T_C < +70 \text{ }^\circ\text{C}$; (2)				
EOL			8.5			dB
BOL			9.5	10		dB
Power Penalty at OSNR = 29dB		(2), (3), (4)			2	dB

(1): Time-Averaged spectrum measured with Ando OSA, 10 pm resolution, 1 nm span.

(2): Measured with 100 GHz DWDM MUX/DEMUX or comparable optical filters.

(3): 650km SMF-28 fiber (Dispersion = 11700 ps/nm); 2.5 Gbits/s; PRBS = $2^{23}-1$; BER = 1×10^{-11} ; ER ≥ 9.5 dB;

(4): Power Penalty = [total power penalty at the end of the 650km link at OSNR = 29dB] – [Baseline penalty measured back-to-back at OSNR = 29dB]

Thermal Specifications

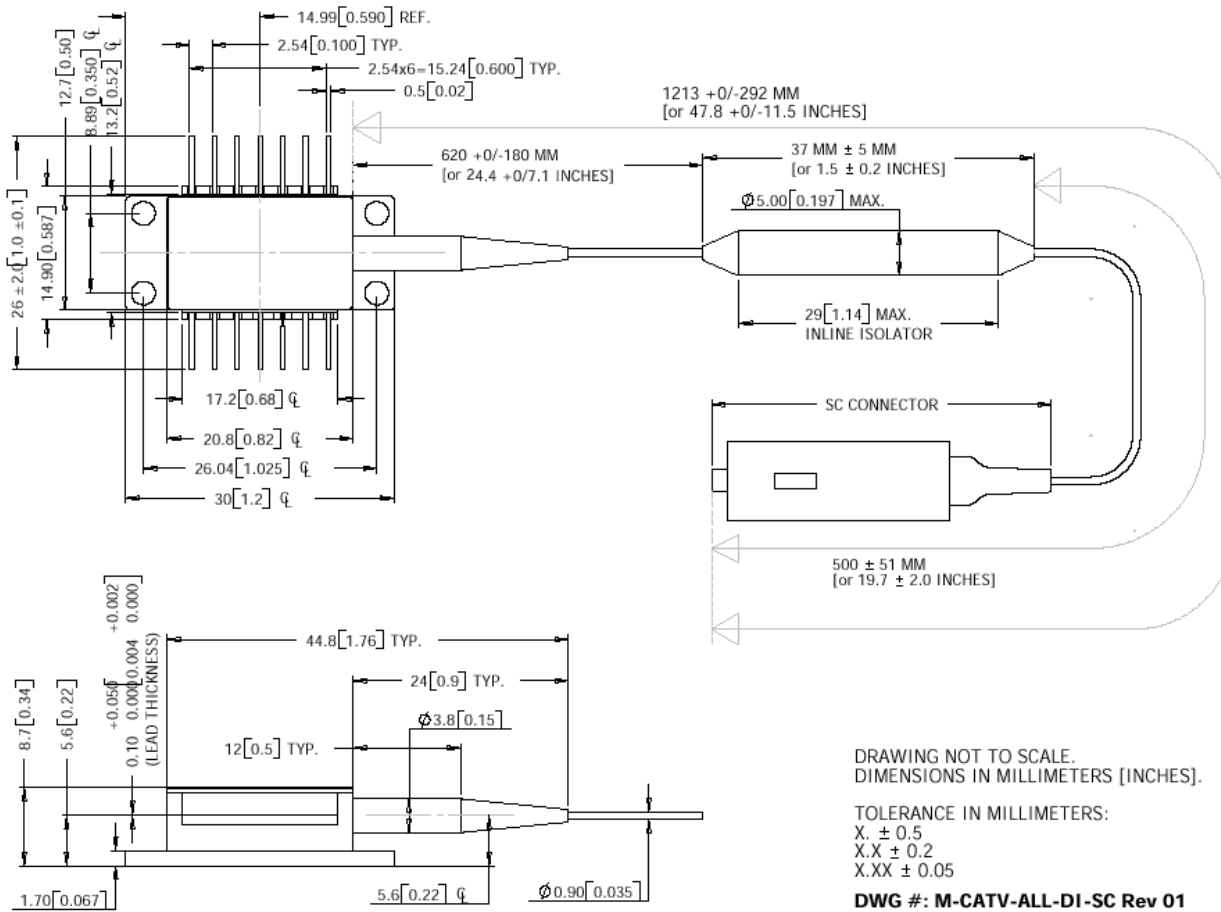
Parameters	Symbol	Conditions/Notes	MIN	Typ	MAX	Unit
TEC current	I_{TEC}	At $T_s, T_c = 70^\circ\text{C}$	-	-	1.5	A
TEC voltage	V_{TEC}	At $T_s, T_c = 70^\circ\text{C}$	-	-	3.0	V
TEC capacity	ΔT	$T_c = 70^\circ\text{C}$	55	-	-	$^\circ\text{C}$
Thermistor Resistance	R_{th}	$T_L = 25^\circ\text{C}$	9.5	10	10.5	k Ω
Thermistor Beta constant	β	(1)		3891		K

(1): Additional information on Resistance vs. Temperature Multipliers available on request.

Fiber Pigtail Specifications

Parameters	Conditions/Notes	MIN	Typ	MAX	Unit
Fiber Type	Single mode fiber Corning SMF-28 TM				
Mode field diameter		9	10.4	11	μm
Cladding diameter		123.5	125	126.5	μm
Outer diameter of buffer		-	900	-	μm
Length of pigtail		1	-	-	m
Optical connector	(see ordering information)				

Outline Drawing



Pin Assignments

Pin No	Functions
1.	Thermistor
2.	Thermistor
3.	Laser DC bias Cathode (-)
4.	Photodetector Anode (-)
5.	Photodetector Cathode (+)
6.	TEC (+)
7.	TEC (-)
8.	Not Connected
9.	Case Ground
10.	Case Ground
11.	Laser Anode (+)
12.	Laser RF Cathode (-)
13.	Laser Anode (+)
14.	Case Ground

ITU Grid Channel Numbering

Channel	Wavelength (nm)	Channel	Wavelength (nm)	Channel	Wavelength (nm)
62	1527.99	46	1540.56	30	1553.33
61	1528.77	45	1541.35	29	1554.13
60	1529.55	44	1542.14	28	1554.94
59	1530.33	43	1542.94	27	1555.75
58	1531.12	42	1543.73	26	1556.56
57	1531.90	41	1544.53	25	1557.36
56	1532.68	40	1545.32	24	1558.17
55	1533.47	39	1546.12	23	1558.98
54	1534.25	38	1546.92	22	1559.79
53	1535.04	37	1547.72	21	1560.61
52	1535.82	36	1548.51	20	1561.42
51	1536.61	35	1549.32	19	1562.23
50	1537.40	34	1550.12	18	1563.05
49	1538.19	33	1550.92	17	1563.86
48	1538.98	32	1551.72	16	1564.68
47	1539.77	31	1552.52	15	1565.50

Reliability/Quality

Designed to meet qualification requirements of Telcordia (Bellcore) GR468-Core and operating reliability <500 FITs (Assumes laser die submount held at <40°C by internal thermoelectric cooler, mean forward current of 50mA, and end of life limits based on 10mA increase in I_{th} and 25% change in laser efficiency).

Handling and Mounting

1. The Laser should be mounted on a heat sink at least 13 x 35 mm in size with surface finish better than 1 μm and flatness better than 25μm. It is recommended that the laser be mechanically mounted to the heat sink using M2-3 mm (#2-56) screws. Apply torque 0.1-0.11 m*N (0.8-1 lb*in). It is also recommended to use thermally conductive grease between the laser package and heat sink.
2. The fiber pigtail must not be subject to a bend radius below 35mm. The fiber is unable to withstand temperatures in excess of 120 °C without degradation. Avoid high temperature contact during soldering

Laser Safety

Class IIIb Laser Product

This product meets the appropriate standard in Title 21 of the Code of Federal Regulations (CFR). FDA/CDRH Class IIIb laser product. This device has been classified with the FDA/CDRH under accession number 0220309.

Single-mode fiber pigtail with SC/APC connectors (standard)

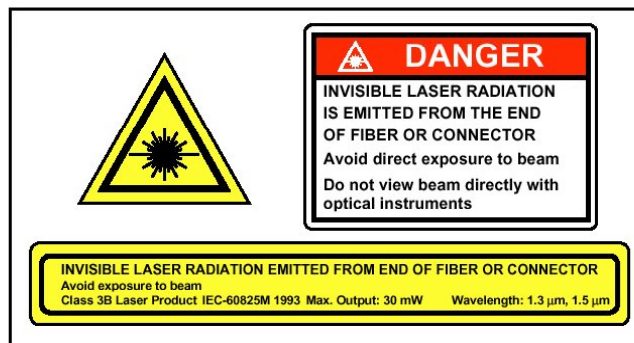
Wavelength = 1.5 μm .

Maximum power = 100 mW.

Because of size constraints, laser safety labeling (including an FDA class IIIb label) is not affixed to the module, but attached to the outside of the shipping carton.

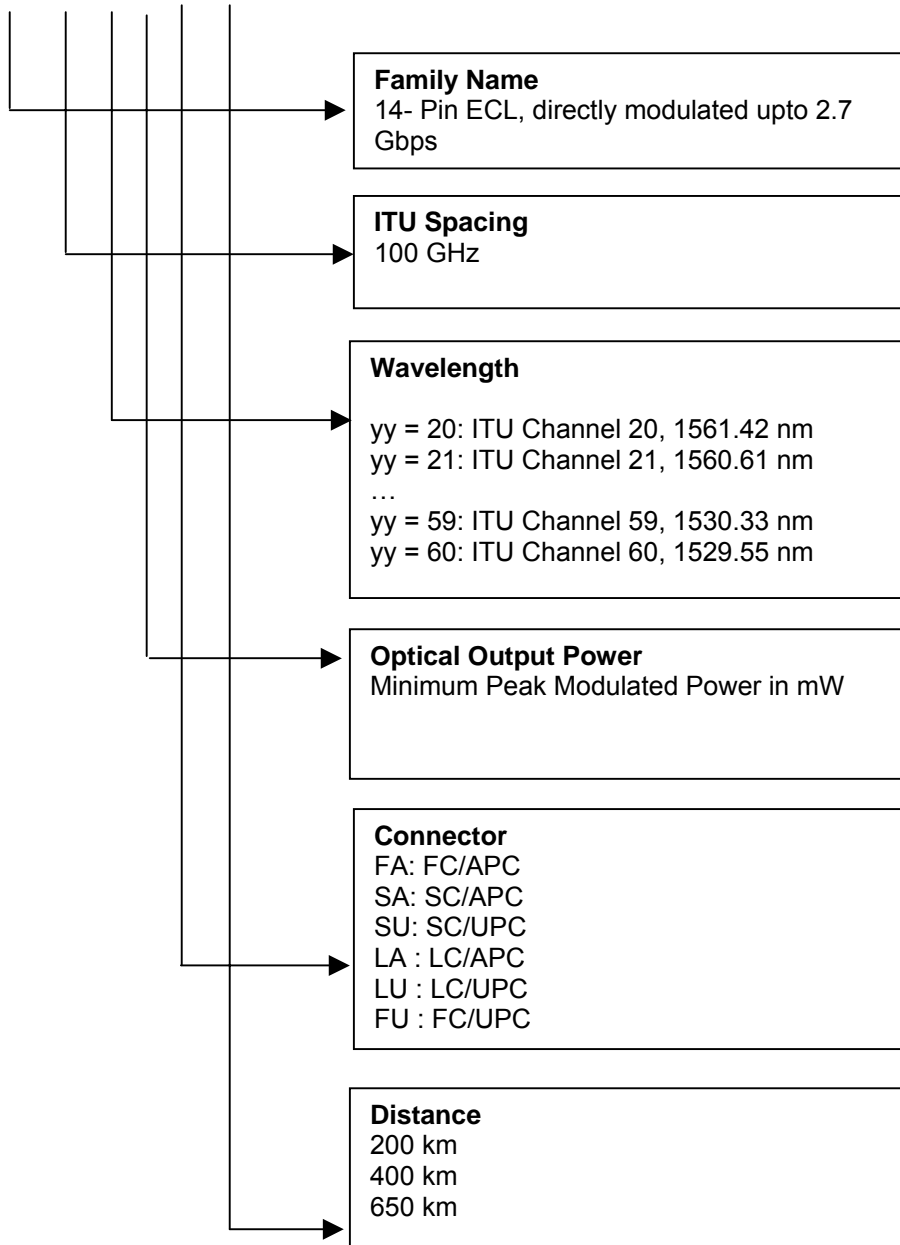
Product is not shipped with power supply.

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



Ordering Code Definitions

EC48-100- xx-03-xx-xxx



Example

EC48-100-43-03-FA-400: EC48, ITU channel 43, 1542.94 nm, 3 mW minimum output power, FC/APC, 400 Kms

Information contained herein is deemed to be reliable and accurate as of issue date. EMCORE reserves the right to change the design or specifications of the product at any time without notice. Ortel, the Ortel logo, EMCORE, and the EMCORE logo are trademarks of EMCORE Corporation.



Ortel, a division of EMCORE

2015 West Chestnut Street
Alhambra, California 91803-1542
Tel: 626-293-3400
Fax: 626-293-3428
www.emcore.com

