

## T510MC & T51EMC Series

10Gb/s CWDM Electro-absorption Modulated Lasers (EML) TOSA

9 Pin Package with FPC flex circuit

40km and 80km (IR2 and LR2) CWDM Service

Commercial and Industrial Operating Temperatures



The Multiplex T510 & T51E series EML TOSA modules consists of a multi-quantum-well laser and a monolithically integrated electro-absorption (EA) modulator in a hermetically sealed metalized ceramic package. State-of-the-art, epoxy-free laser welding is utilized. The laser module also contains a thermoelectric cooler and a monitor photodiode.

The T510MC & T51EMC series are optimized to operate at a bit-rate of 9.95328Gb/s transmission. It's designed to be fully compliant with Telcordia GR-253-CORE OC-192 IR-2 and LR-2 for intermediate and long reach applications up to 40km and 80km respectively. The modules use a high performance EML platform operating from 1470nm to 1610nm. Careful control of the output signal for minimum "chirp" allows the T510MC series to provide superior performance and reach with standard single mode fiber.

An incorporated thermoelectric cooler keeps the laser chip at a well-controlled temperature. This allows the device to operate over a case temperature range of -5 °C to +80°C (or -40°C to +85°C for the extended temperature version).

The T510MC series modules come with a receptacle connector. Other connector types may be specified as options.

### Applications:

- T510MC & T51EMC series is designed for high-speed telecom and datacom transmissions over spans up to 80km in length in compliance with Telcordia GR-253-CORE (issue 3) LR-2 specifications.

### Features:

- TOSA package with industry standard FPC flex circuit and LC-type receptacle connector.
- Available for 8 standard CWDM channels on 6nm spacing.
- An extended temperature -40°C to +85°C option available.
- High-speed design optimized for modulation at 9.95328Gb/s.
- 50 ohm input impedance match.
- Integrated optical isolator.

### Compliance:

- Conforms to the requirements of the European Union Directive 2002/95/EC for the Restriction of Hazardous Substance (RoHS)

## Optical and Electrical Characteristics

PARAMETER	SYMBOL	CONDITION	MIN	TYP.	MAX	UNIT
<b>DFB Laser:</b>						
Set temperature for laser operation	$T_{set}$	Temperature set for TEC	35		45	°C
Threshold current	$I_{th}$	At $T_{set}$ , CW operation	5		20	mA
Operating current	$I_{op}$	At $T_{set}$ , BOL	40		100	mA
		At $T_{set}$ , EOL	60		150	mA
Laser forward bias voltage	$V_{op}$	At $T_{set}$ , $I_{op}$	1	1.3	2	V
Peak wavelength	$\lambda_o$	At $T_{set}$ , $I_{op}$ , and 9.95328 Gb/s, $2^{31} - 1$ PRBS NRZ modulated	1468 1488 1508 1528 1548 1568 1588 1608		1474 1494 1514 1534 1554 1574 1594 1614	nm
Side Mode Suppression Ratio	SMSR	At 9.95328 Gb/s, $2^{31} - 1$ PRBS NRZ modulated	35	45	-	dB
Peak Wavelength stability		APC operation 20 yrs and over case temperature	-0.08		+0.08	nm
Wavelength stability over temperature	$d\lambda_o/dT_c$	Change with case temperature -40 °C to +85 °C	-0.5	-0.3	+0.5	pm/°C
<b>EA Modulator:</b>						
Mark offset voltage	$V_{mark}$	On-level modulator voltage	-1		-0.01	V
Peak-to-peak RF drive voltage	$V_{pp}$	To meet ER, Pp, Pmod, etc.		2		V
Input Impedance	$Z_{in}$		45	50	55	$\Omega$
<b>Module:</b>						
RF Dynamic Extinction ratio	$Er$	At 9.95328 Gb/s, $2^{31} - 1$ PRBS NRZ modulated $V_{mark}$ biased, modulated with $V_{pp}$	9.0		-	dB
Monitor photodiode current	$I_{pd}$	At $T_{set}$ , $I_{op}$	0.05		1.5	mA
Monitor Dark current	$I_d$	$V_{bias} = -5V$			0.1	$\mu A$
Modulated fiber output	$P_{mod}$	At 9.95328 Gb/s, $2^{31} - 1$ PRBS NRZ modulated 80km 40km	-1		2	dBm
Optical isolation	-	From output fiber to device, module at $T_{set}$	30		-	dB
Case temperature	$T_{case}$	Operating case temperature	-5		80	°C
Transmission penalty due to dispersion	$Pp$	80km at 9.95328 Gb/s, $2^{31} - 1$ PRBS NRZ modulated, 1600 ps/nm dispersion. BER = $10^{-12}$	-		2	dB
		40km at 9.95328 Gb/s, $2^{31} - 1$ PRBS NRZ modulated, 800 ps/nm dispersion. BER = $10^{-12}$	-		2	

## T510MC & T51EMC Series

TEC thermal capacity <sup>3</sup>	$\Delta\text{TEC}$	At $T_{\text{set}}, I_{\text{op}}$ $\Delta\text{TEC} = T_{\text{case}} - T_{\text{set}}$ Standard Temperature Extended Temperature	-50 -85		45 55	°C
TEC current	$I_{\text{tec}}$	At $T_{\text{set}}, I_{\text{op}}$ EOL Standard Temperature Extended Temperature	- -		0.5 0.7	A
TEC voltage	$V_{\text{tec}}$	At $T_{\text{set}}, I_{\text{op}}$ EOL Standard Temperature Extended Temperature	- -		2.5 2.8	V
TEC AC resistance	$R_{\text{tec}}$	At $T_{\text{set}}, I_{\text{op}}$ EOL			3.0	Ohm
TEC power dissipation	$P_{\text{tec}}$	At $T_{\text{set}}, I_{\text{op}}$ EOL Standard Temperature Extended Temperature	- -		0.8 1.0	W
Thermistor Resistance	$R_{\text{th}}$	At 25 °C	9.5	10.0	10.5	kΩ
Thermistor B Constant			3800	3900	4000	
Connector Type		LC Receptacle				
Lead Soldering time	t	Soldering temperature 260 °C			10	s

**Table Notes:** 1. Vmark is the top rail DC voltage applied to the modulator.  
2. All modules are tested to pass the SONET OC-192 eye-mask criteria.  
3. Optimal thermal contact between the TOSA housing and the application heat-sink is required

<b>Absolute Maximum Operating Ratings</b> Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. Exposure to absolute maximum ratings for extended periods can adversely affect device reliability.					
PARAMETER	SYMBOL	CONDITION	MIN	MAX	UNIT
Laser Diode Reverse Voltage	$V_{\text{RL}}$	CW	-	2	V
Laser Diode Forward Current	$I_{\text{FL}}$	CW	-	150	mA
Optical Output Power	P	CW	-	10	mW
Laser Chip Temperature	$T_{\text{LD}}$		30	50	°C
Modulator Reverse Voltage	$V_{\text{MR}}$		-	5	V
Modulator Forward Voltage	$V_{\text{MF}}$		-	1	V
Photodiode Reverse Voltage	$V_{\text{RPD}}$		-	10	V
Photodiode Forward Current	$I_{\text{FPD}}$		-	1	mA
Thermoelectric Cooler Current	$I_{\text{TEC}}$		-0.9	0.9	A
Thermoelectric Cooler Voltage	$V_{\text{TEC}}$		-2.8	2.8	V
Thermistor Voltage	$V_{\text{Th}}$		-	5	V
Thermistor Current	$I_{\text{Th}}$		-	2	mA
Operating Case Temperature Range <sup>1</sup>	$T_{\text{Opr}}$	Standard Temperature Extended Temperature	-10 -45	+85 +95	°C
Storage Case Temperature Range	$T_{\text{stg}}$		-40	+85	°C

**Table Notes:** 1. Optimal thermal contact between the TOSA housing and the application heat-sink is required.

## Ordering information:

T51	X	M	C	XX	X	X	X
	Temp Range: 0 = -5°C to +80°C E = -40°C to +85°C	Data Rate: M= 9.95328 Gb/s	Wavelength: C = CWDM applications	CWDM channel: 2 digits in the middle of peak wavelength 47=1471nm 49=1491nm 51=1511nm 53=1531nm 55=1551nm 57=1571nm 59=1591nm 61=1611nm	Connector: M=Receptacle (LA). P= Receptacle (SC). R=Receptacle (LC) S=Pigtail SC F=Pigtail FC L=Pigtail LC A=Pigtail SA-APC B=Pigtail FA-APC C=Pigtail LC-APC M=Pigtail MU	Reach: L = 40km L = 80km	Customized Information 0= Bare Lead 6 = FPC type See note #1

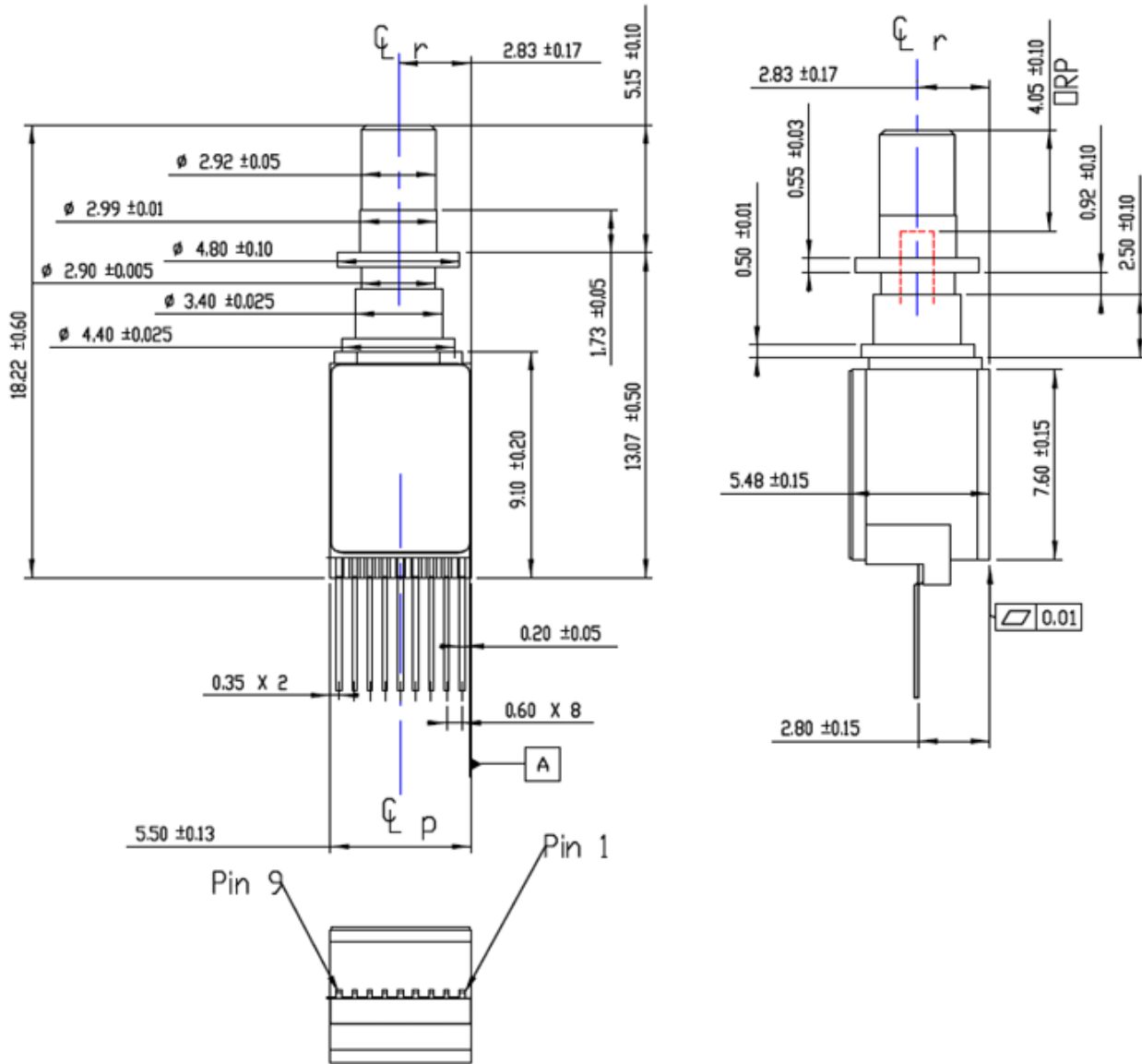
Note #1 - Details of FPC types can be obtained by contacting Multiplex. Custom FPC types are available upon request.

Example: T510MC49RL0 has an operating range of -5°C to + 80°C, CWDM 1491nm, 9.95328Gb/s 80km application with LC receptacle with package bare-lead.

## ITU Grid Wavelengths, Frequencies, Channels and ordering codes

Note – actual ordering codes may change depending on the device configuration selected as per the above table.

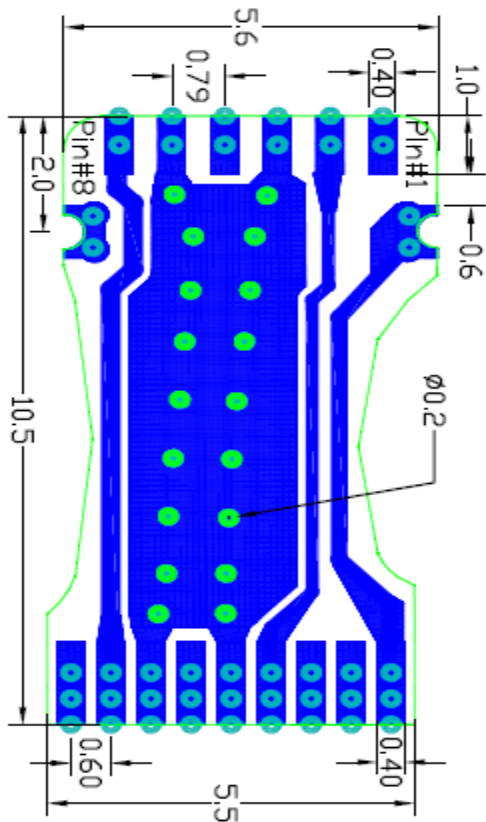
Wavelength (nm)	Code
1471	T510MC47RL0
1491	T510MC49RL0
1511	T510MC51RL0
1531	T510MC53RL0
1551	T510MC55RL0
1571	T510MC57RL0
1591	T510MC59RL0
1611	T510MC61RL0



## Pin Configuration

Pin Number	Description
1	Thermoelectric Cooler (-)
2	Thermoelectric Cooler (+)
3	Ground
4	Modulator RF in
5	Ground
6	Back Facet Monitor
7	Laser Anode
8	Not Connected
9	Thermistor

## T510MC & T51EMC Series



### Pin Configuration

Pin Number	Description
1	Thermoelectric Cooler (-)
2	Thermoelectric Cooler (+)
3	Ground
4	Modulator RF in
5	Ground
6	Back Facet Monitor
7	Laser Anode
8	Thermistor

FPC Type 6 is shown for illustrative purposes.

### WARRANTY

Multiplex warrants all standard laser products, when used within the operating limits, against defects in material and workmanship for a period of one year from date of shipment.

### QUALITY

Multiplex is qualified to International Standard ISO 9001:2008.



*Multiplex, Inc.*

Photonics for Communications

**Multiplex, Inc.**

5000 Hadley Road

South Plainfield, NJ 07080 USA

Tel: 908.757.8817 Fax: 908.769.4288

[www.multiplexinc.com](http://www.multiplexinc.com)