

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

### FGT9xx-Txxx-00

#### Description:

The Fiber-Grid FGT9xx 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 FGT9xx series are optimized to operate at a bit-rate up to 11.3Gbps 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 FGT9xx series modules come with a receptacle connector. Other connector types may be specified as options.

#### Features:

- 9 Pin Package with FPC flex circuit
- 40km and 80km (IR2 and LR2) CWDM Service
- 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 up to 11.3Gbps.
- 50 ohm input impedance match.
- Integrated optical isolator.

#### Applications:

- FGT9xx 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.

**Compliance:**

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

**Specification:**

<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	$V_{RL}$	CW	-	2	V
Laser Diode Forward Current	$I_{FL}$	CW	-	150	mA
Optical Output Power	P	CW	-	10	mW
Laser Chip Temperature	$T_{LD}$		30	50	°C
Modulator Reverse Voltage	$V_{MR}$		-	5	V
Modulator Forward Voltage	$V_{MF}$		-	1	V
Photodiode Reverse Voltage	$V_{RPD}$		-	10	V
Photodiode Forward Current	$I_{FPD}$		-	1	mA
Thermoelectric Cooler Current	$I_{TEC}$		-0.9	0.9	A
Thermoelectric Cooler Voltage	$V_{TEC}$		-2.8	2.8	V
Thermistor Voltage	$V_{Th}$		-	5	V
Thermistor Current	$I_{Th}$		-	2	mA
Operating Case Temperature Range <sup>1</sup>	$T_{Opr}$	Standard Temperature	-10	+85	°C
		Extended Temperature	-45	+95	
Storage Case Temperature Range	$T_{stg}$		-40	+85	°C

**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 10.7Gbps, 2 <sup>31</sup> - 1 PRBS NRZ modulated	1468		1474	nm
			1488		1494	
			1508		1514	
			1528		1534	
			1548		1554	
			1568		1574	
			1588		1594	
Side Mode Suppression Ratio	SMSR	At 10.7Gbps, 2 <sup>31</sup> - 1 PRBS NRZ	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	-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	Ω
<b>Module:</b>						
RF Dynamic Extinction ratio	$E_r$	At 10.7Gbps, 2 <sup>31</sup> - 1 PRBS NRZ modulated	9.0		-	dB
Monitor photodiode current	$I_{pd}$	At $T_{set}, I_{op}$	0.05		1.5	mA
Monitor Dark current	$I_d$	Vbias = -5V			0.1	μA
Modulated fiber output	$P_{mod}$	At 10.7Gbps, 2 <sup>31</sup> - 1 PRBS NRZ modulated 80km	-1		2	dBm
Optical isolation	-	From output fiber to device, module at	30		-	dB
Case temperature	$T_{case}$	Operating case temperature	-5		80	°C
Transmission penalty due to dispersion	$P_p$	80km at 10.7Gbps, 2 <sup>31</sup> - 1 PRBS NRZ modulated,	-		2	dB
		40km at 10.7Gbps, 2 <sup>31</sup> - 1 PRBS NRZ modulated,	-		2	
TEC thermal capacity <sup>3</sup>	$\Delta TEC$	At $T_{set}, I_{op}$ $\Delta TEC = T_{case} - T_{set}$ Standard Temperature	-50 -85		45 55	°C
TEC current	$I_{tec}$	At $T_{set}, I_{op}$ EOL Standard Temperature	-		0.5	A
		Extended Temperature	-		0.7	
TEC voltage	$V_{tec}$	At $T_{set}, I_{op}$ EOL Standard Temperature	-		2.5	V
		Extended Temperature	-		2.8	
TEC AC resistance	$R_{tec}$	At $T_{set}, I_{op}$ EOL			3.0	Ohm
TEC power dissipation	$P_{tec}$	At $T_{set}, I_{op}$ EOL Standard Temperature	-		0.8	W
		Extended Temperature	-		1.0	
Thermistor Resistance	$R_{th}$	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

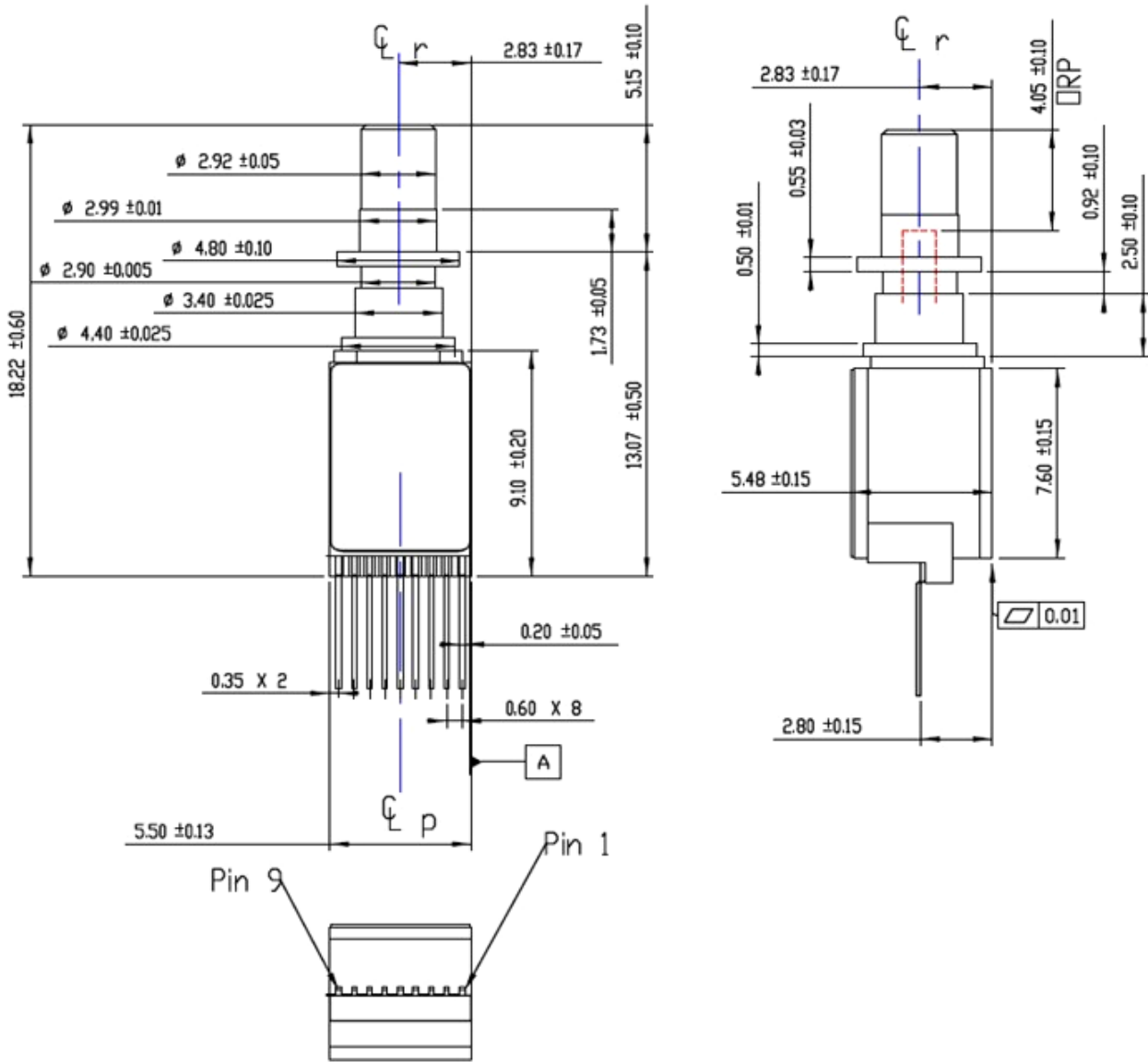
**Table Notes:** 1. Vmark is the top rail DC voltage applied to the modulator.

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

### Dimension and pin assignment

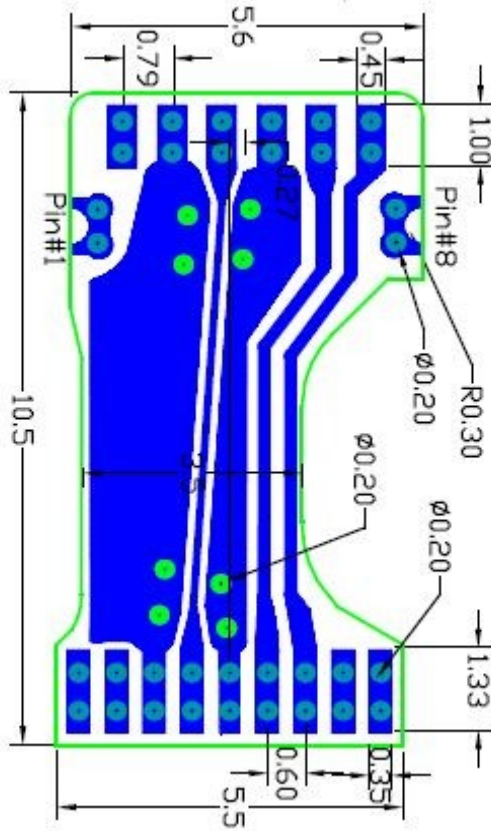
Unit: mm



### Pin Description:

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

FPC Type 6 is shown for illustrative purposes



#### Pin Configuration

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#### Ordering information:

FG	T9	<input type="checkbox"/> <input type="checkbox"/>	-	T	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-	<input type="checkbox"/> <input type="checkbox"/>
	<b>Package:</b>	<b>CWDM channel:</b>		<b>Data Rate:</b>	<b>Reach:</b>	<b>Temp Range:</b>	<b>Connector:</b>		<b>Customized Information</b>
	T9= 9Pin package	2 digits in the middle of peak wavelength 47=1471nm 49=1491nm 51=1511nm 53=1531nm 55=1551nm 57=1571nm 59=1591nm 61=1611nm		T= 10.7Gbps	4 = 40km 8 = 80km	2 = -5~ +80°C 3 = -40~+85°C	A=Receptacle(LA) S=Receptacle(SC) L=Receptacle(LC) 1=Pigtail SC 3=Pigtail FC 7=Pigtail LC 2=Pigtail SA-APC 4=Pigtail FA-APC 8=Pigtail LC-APC M=Pigtail MU		00= Bare Lead 06 = 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, 10.7Gbps 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	FGT947-T42L-00
1491	FGT949-T42L-00
1511	FGT951-T42L-00
1531	FGT953-T42L-00
1551	FGT955-T42L-00
1571	FGT957-T42L-00
1591	FGT959-T42L-00
1611	FGT961-T42L-00

## 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.

