

# 2.5 Gb/s Buried Het 4x100GHz Tunable Laser with extended reach option

## LC25T


This laser module employs the Bookham gain coupled SLMQW buried heterostructure DFB laser chip, and has been designed specifically for use in Wavelength Division Multiplexed (WDM) 2.5 Gb/s long distance optical fibre trunk systems.

The device is packaged in a hermetically sealed 14-pin butterfly package incorporating an isolator and monitor photodiode for control of the power of the laser over life and all operating conditions.

The module is tunable by means of the internal thermo-electric cooler over four adjacent 100 GHz ITU WDM channels with a case temperature of 70°C, or over two adjacent 100 GHz channels with a case temperature of 85°C

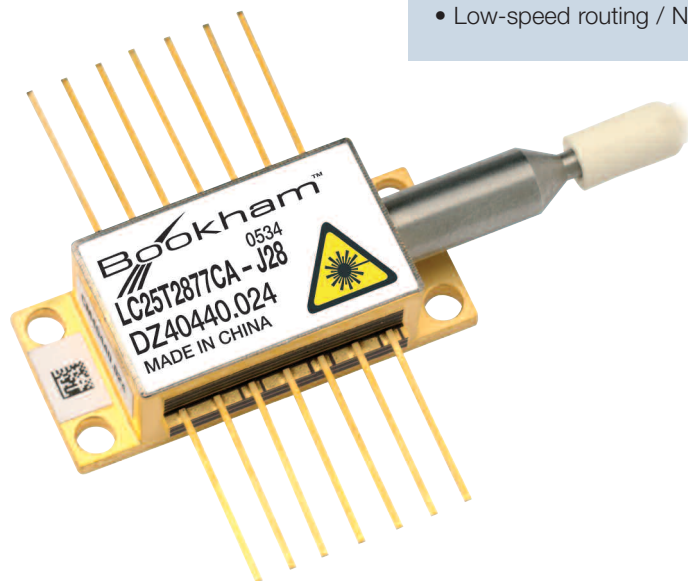
The device is available with a number of power options and wavelength schemes, which are customizable to individual customer specification.

### Features:

- 2.5 Gb/s Operation
- Tunable over four separate channels at 100 GHz channel spacing
- +/-95pm wavelength stability over life
- Entire C band ITU wavelengths available (1528 to 1563 nm)
- Narrow spectral line-width
- Hermetically sealed 14-pin butterfly package with optical isolator
- Internal TEC with precision NTC thermistor
- Extended reach performance up to 360 km with low dispersion penalty
- RoHS compliant 

### Applications:

- Cost effective metropolitan or long haul networks
- Stock inventory / Spares reduction
- Network protection
- Low-speed routing / Networks reconfiguration



## Parameters

Parameter	Conditions	Min	Typ	Max	Unit
Threshold current ( $I_{th}$ )			10	22	mA
Slope efficiency	2 mW	0.04		0.09	mW/mA
	3 mW	0.06		0.13	mW/mA
	4 mW	0.08		0.17	mW/mA
	High Power [1]	0.143		0.43	mW/mA
RF input reflection coef ( $S_{11}$ )	[2]			-10	dB
Forward voltage			1.3	1.8	V
Peak wavelength ( $\lambda_p$ )	[3]	1527		1563	nm
Dispersion penalty	[4]			2	dB
Time averaged spectral linewidth	-20 dB		0.4	0.6	nm
Side-mode suppression		34	40		dB
Optical rise/fall time	[5]			125	ps
Monitor photo current		50	250	1200	$\mu$ A
Monitor dark current				100	nA
Thermistor resistance		4.07		20.7	k $\Omega$
Heatpump current	$\Delta T = 64^\circ\text{C}$			1000	mA
Heatpump voltage	$\Delta T = 64^\circ\text{C}$			2.4	V
Change of $\lambda$ with laser temp.	8 to $50^\circ\text{C}$		0.09		nm/ $^\circ\text{C}$
Change of $\lambda$ over life and operating conditions	[6]	-45		+145	pm

[1] The high power version provides 10 mW peak output power for 175 km applications and 7 mW peak output power for 360 km applications.

[2] 50  $\Omega$  measurement system, f = dc - 3 GHz.

[3] Submount temperature between  $8^\circ\text{C}$  &  $50^\circ\text{C}$  start of life to achieve required  $\lambda_p$ .

[4] Dispersion penalty is compliant to a link length of 175 km or 360 km using an extinction ratio of 10dB. Fibre dispersion characteristics are derived from the following equation:

$$D(\lambda) = \frac{So}{4} \left( \lambda - \frac{\lambda_0^4}{\lambda^3} \right) \text{ps}/(\text{nm.km})$$

where  $So = 0.092 \text{ ps}/(\text{nm}^2 \text{ km})$  and  $\lambda_0 = 1302 \text{ nm}$ .

[5] Measurements determined from 20 - 80% Pk - Pk

[6] For more information on wavelength control and drift over life refer to application note DR1670. To give symmetrical wavelength performance about the ITU channel wavelength (+/-95pm) offset the laser wavelength by -50pm at start of life set up.

## Absolute Maximum Ratings

Parameter	Min	Max	Unit
Case operating temperature (with 2 x 100 GHz tuning)	-20	85	°C
Case operating temperature (with 4 x 100 GHz tuning)	-20	70	°C
Laser submount operating temperature	8	50	°C
Storage temperature	-40	85	°C
Laser current above $I_{th}$		100	mA
Laser reverse voltage		1.0	V
Laser reverse current		10	μA
Monitor diode bias		-10	V
Heat Pump Current		1	A
Heatpump voltage		2.4	V
Fibre bend radius	30		mm

## Reliability/Quality

Meets Qualification requirements of Telcordia / Bellcore GR468-Core for central office environment.

Operating reliability <500 FITs<sup>1</sup> in 15 years.

1 - Assumes laser die submount is held within the range 8°C to 50°C by the internal thermoelectric cooler and the product is deployed in equal quantities on each of the four channels with a mean forward current of 35 mA. End of life limits based on 10 mA increase in  $I_{th}$  and 25% change in laser efficiency. FIT rate data for other end of life criteria, including minimum extinction ratio requirements, are available on request.

## Outline Drawing

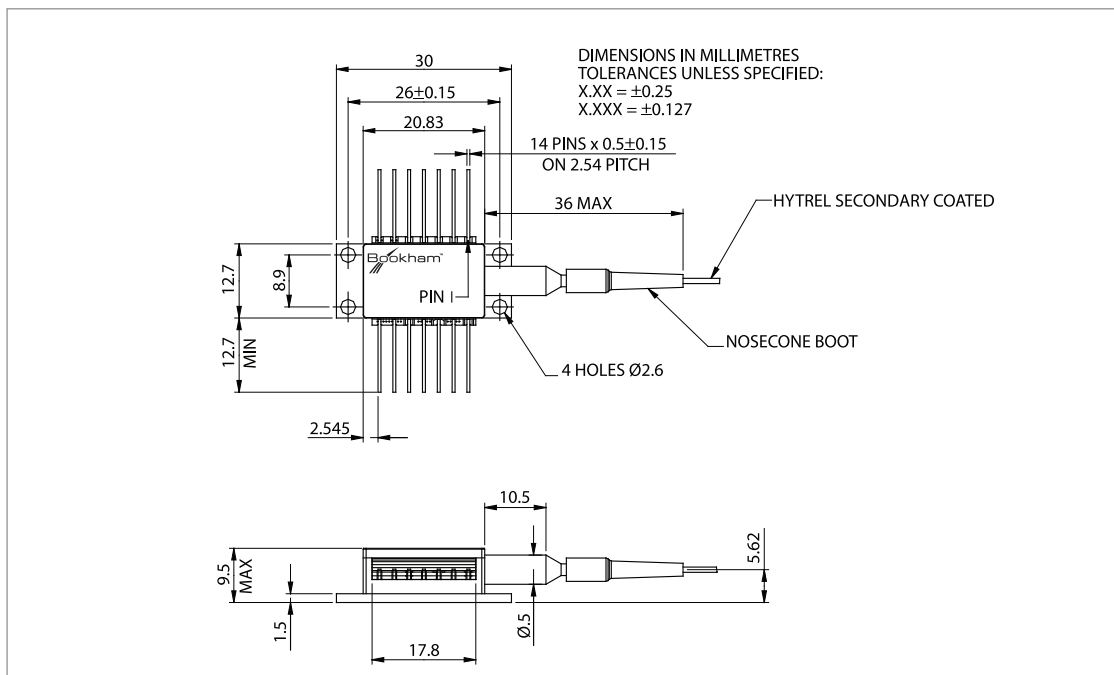


Figure 1: Outline Drawing and Pinout Information.

**Note:** Device can be supplied with the leads trimmed to a length of 3.81 mm typ.  
Please see Order Information section.

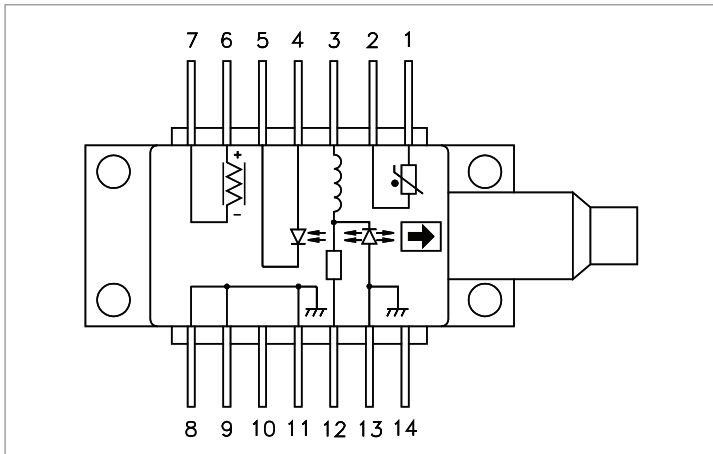


Figure 2: Schematic Diagram.

## Connections

Pin #	Function	Pin #	Function
1	Thermistor	8	Case ground
2	Thermistor	9	Case ground
3	Laser DC bias (-)	10	N/C
4	Monitor anode (-)	11	Laser case ground
5	Monitor cathode (+)	12	Laser modulation (-)
6	TEC (+)	13	Laser case ground
7	TEC (-)	14	N/C

## Instructions for use – LC25T

### Pin 1 and Pin 2 Thermistor

The thermistor is used in a control loop in conjunction with the thermo-electric cooler to maintain the laser submount temperature at the required value for wavelength. Operating current should be less than 100  $\mu$ A to prevent self-heating errors.

### Pin 3 Laser DC bias (-)

Laser bias current (negative with respect to package ground) is applied via this pin which forms one side of the bias-T connection to the laser cathode.

### Pin 4 Monitor anode, Pin 5 Monitor cathode

The back facet monitor provides a mean power reference for the laser and is normally operated with a 5 V reverse bias.

### Pin 6 TEC (+), Pin 7 TEC (-)

Applying a positive voltage on pin 6 with respect to pin 7 will cause the internal submount to be cooled relative to the case temperature. Reversing the polarity will raise the submount temperature relative to the case. The TEC supply should be capable of delivering up to 0.9 A at 2.4 V.

### Pin 8, 9, 11, 13 Case ground

These pins must be grounded in all applications.

### Pin 10

This pin is not connected for the LC25T product and it should be grounded if possible.

### Pin 12 Laser modulation (-)

The data input (modulation current) is applied via this pin which is a nominal 25 Ohm impedance coplanar line. For 10mW applications the end of life modulation current is 90mA maximum. For all other applications 60mA maximum modulation current should be provisioned.

### 4 Pin 14 N/C

This pin is not connected. It should be grounded if possible.

## Ordering Information

LC25T [Wavelength]	[Power Option]	[Reach]	[Connector]
****	E = 2 mWpk C = 3 mWpk A = 4 mWpk B = High power	A = 175 km - B = 360 km -	J28 = SC/PC J34 = FC/PC J57 = LC J59 = MU

Fibre Length 1130 to 1190 mm.  
Other connector types are available on request.

\*\*\*\* = Last four digits of first channel / shortest wavelength  
E.g. LC25T4532CA-J28 has the following four channels:

- 1545.32 nm
- 1546.12 nm
- 1546.92 nm
- 1547.72 nm

The high power option provides 10 mW peak power at 175 km or 7 mW peak power over 360 km.

E.g. **LC25T4532BA-J28** is a 10 mW 1545.32 to 1547.72 nm device with an SC connector for use in a 175 km application.

E.g. **LC25T4532BB-J28** is a 7 mW 1545.32 to 1547.72 nm device with an SC connector for use in a 360 km application.

### Trimmed lead option

Devices can be supplied with the leads trimmed to a length of 3.81 mm typ.  
This option can be specified by adding a 'K' suffix after the reach option.

E.g. **LC25T4532BBK-J28** is a 7 mW 1545.32 nm device with an SC connector and a lead length of 3.81mm, for use in a 360 km application.

### -20°C to 85°C Case Temperature, 2 x 100 GHz Tunable Operation

Where a maximum case temperature of +85°C is required, the LC25T can be tuned over 2 adjacent 100 GHz channels.  
With the elevated case temperature, the submount temperature tuning range becomes 25°C to 50°C.

## Revised Parameters for 85°C Case Temperature Operation

Parameter	Conditions	Min	Typ	Max	Unit
Thermistor resistance		4.07		10	kΩ
Case operating temperature		-20		85	°C
Laser submount operating temperature		25		50	°C

## Ordering Information (continued)

To order the 85°C case temperature compliant device, the wavelength 2 channels below the required wavelength must be selected.

See table below.

Lower channel		Upper channel		Wavelength Code to Order
Wavelength (nm)	ITU Channel No.	Wavelength (nm)	ITU Channel No.	
1527.22	63	1527.99	62	2566
1527.99	62	1528.77	61	2644
1528.77	61	1529.55	60	2722
1529.55	60	1530.33	59	2799
1530.33	59	1531.12	58	2877
1531.12	58	1531.90	57	2955
1531.90	57	1532.68	56	3033
1532.68	56	1533.47	55	3112
1533.47	55	1534.25	54	3190
1534.25	54	1535.04	53	3268
1535.04	53	1535.82	52	3347
1535.82	52	1536.61	51	3425
1536.61	51	1537.40	50	3504
1537.40	50	1538.19	49	3582
1538.19	49	1538.98	48	3661
1538.98	48	1539.77	47	3740
1539.77	47	1540.56	46	3819
1540.56	46	1541.35	45	3898
1541.35	45	1542.14	44	3977
1542.14	44	1542.94	43	4056
1542.94	43	1543.73	42	4135
1543.73	42	1544.53	41	4214
1544.53	41	1545.32	40	4294
1545.32	40	1546.12	39	4373
1546.12	39	1546.92	38	4453
1546.92	38	1547.72	37	4532
1547.72	37	1548.51	36	4612
1548.51	36	1549.32	35	4692
1549.32	35	1550.12	34	4772
1550.12	34	1550.92	33	4851

### Ordering Information (continued)

Lower channel		Upper channel		Wavelength Code to Order
Wavelength (nm)	ITU Channel No.	Wavelength (nm)	ITU Channel No.	
1550.92	33	1551.72	32	4932
1551.72	32	1552.52	31	5012
1552.52	31	1553.33	30	5092
1553.33	30	1554.13	29	5172
1554.13	29	1554.94	28	5252
1554.94	28	1555.75	27	5333
1555.75	27	1556.56	26	5413
1556.56	26	1557.36	25	5494
1557.36	25	1558.17	24	5575
1558.17	24	1558.98	23	5655
1558.98	23	1559.79	22	5736
1559.79	22	1560.61	21	5817
1560.61	21	1561.42	20	5898
1561.42	20	1562.23	19	5979
1562.23	19	1563.05	18	6061
1563.05	18	1563.86	17	6142

E.g. LC25T5252BB-J28 will operate at an 85°C maximum case temperature with a lower channel wavelength of 1554.13 nm and can be tuned up one channel to 1554.94 nm.

## RoHS Compliance



Bookham is fully committed to environment protection and sustainable development and has set in place a comprehensive program for removing polluting and hazardous substances from all of its products. The relevant evidence of RoHS compliance is held as part of our controlled documentation for each of our compliant products. RoHS compliance parts are available to order, please refer to the ordering information section for further details.

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