

# 2.5Gb/s Buried Het Laser 360km Extended Reach With Optional Etalon Stabilization


## LC25W-B (360km)

This laser module employs the Bookham strained layer MQW Buried Heterostructure DFB laser chip, and has been designed specifically for use in Wavelength Division Multiplexed (WDM) 2.5Gb/s long distance optical fiber 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 device is available with a number of power options depending on application and link span requirements.

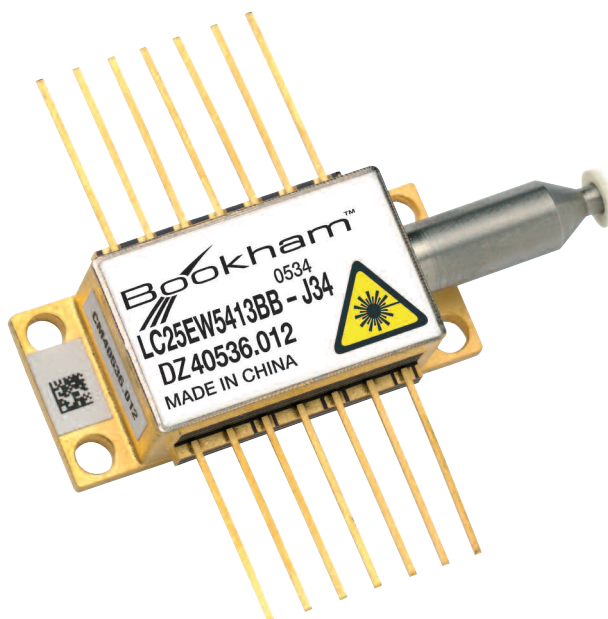
The optional internal Etalon wavelength stabilization and low chirp performance makes this product compliant with 50GHz optical channel spacing.

### Features:

- 2.5Gb/s operation
- +/-95pm wavelength stability over life without Etalon locker
- Optional Etalon wavelength stabilization provides 50GHz optical channel spacing compliance for interlay or future upgrade
- Narrow spectral line-width
- Internal TEC with precision NTC thermistor for temperature control
- Entire C & L-band ITU wavelengths available (1527nm to 1605nm)
- Code reduction with single product for reaches up to 360km
- GaInAsP SLMQW DFB single frequency laser chip
- InGaAs monitor photo-diode
- Hermetically sealed 14-pin butterfly package with optical isolator
- RoHS compliant 

### Applications:

- WDM
- On-off ramps
- Long-Haul
- DWDM on ITU Grid



## Parameters

Parameter	Conditions	Min	Typ	Max	Unit
Threshold current ( $I_{th}$ )			10	22	mA
Slope efficiency by product	2 mW	0.04		0.09	
	3 mW	0.06		0.13	
	4 mW	0.08		0.17	
	7 mW	0.143		0.43	
RF input reflection coef ( $S_{11}$ )	[1]			-10	dB
Forward voltage			1.3	1.8	V
Peak wavelength ( $\lambda_p$ )	[2]	1527		1605	nm
Dispersion penalty at 360 km	[3]			2	dB
Time averaged spectral linewidth	-20 dB		0.1	0.6	nm
Side-mode suppression		32	40		dB
Optical rise/fall time	[4]			125	ps
Monitor photo current	Unlocked	50	250	1200	$\mu$ A
	Etalon locked	40	250	360	
Monitor dark current				100	nA
Thermistor resistance		10			k $\Omega$
Heatpump current	70°C case temperature	250	600	900	mA
Heatpump voltage	70°C case temperature		1.0	2.4	V
Change of $\lambda_p$ with laser temp.	15°C to 35°C		0.09		nm/°C
Change in $\lambda$ over life and operating conditions	Unlocked [5]	-45		+145	pm
Optical Spectral Window	Locked, over life & temperature including chirp [5]	-9		+9	GHz

[1] 50  $\Omega$  measurement system, f = dc - 3GHz.

[2] Submount temperature between 20°C to 35°C start of life to achieve required  $\lambda_p$ . For the 10mW version, submount temperature is between 15°C to 35°C start of life.

[3] Standard product dispersion penalty will be compliant to the specified link length of 360km using an extinction ratio of 10dB. Fiber dispersion characteristics are derived from the following equation.

$$D(\lambda) = \frac{S_0}{4} \left( \lambda - \frac{\lambda_0^4}{\lambda^3} \right) ps / (nm.km)$$

Where  $S_0 = 0.092 ps/(nm^2.km)$  and  $\lambda = 1302nm$ .

[4] Measurements determined from 20 - 80% pk - pk.

[5] For more information on wavelength control and drift over life refer to applications 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	0	70	°C
Laser submount operating temperature <sup>[1] [2]</sup>	20	35	°C
Storage temperature	-40	85	°C
Laser current above I <sub>th</sub>		100	mA
Laser reverse voltage		1.0	V
Laser reverse current		10	μA
Monitor diode bias		-10	V
Heatpump voltage		2.4	V
Fiber bend radius	30		mm

**Notes:**

[1] Product without locker can be tuned onto the next 100 GHz ITU channel in the red shift direction (2x100 GHz tunability) by increasing the submount temperature to a maximum of 43°C.

[2] For the 10mW version, the minimum laser submount operating temperature is 15°C.

## 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 held at <35°C by internal thermoelectric cooler, mean forward current of 35 mA, and end of life limits based on 10 mA increase in I<sub>th</sub> and 25% change in laser efficiency. FIT rate data for other end of life criteria, including minimum extinction ratio requirements, are available upon request.

## Outline Drawing

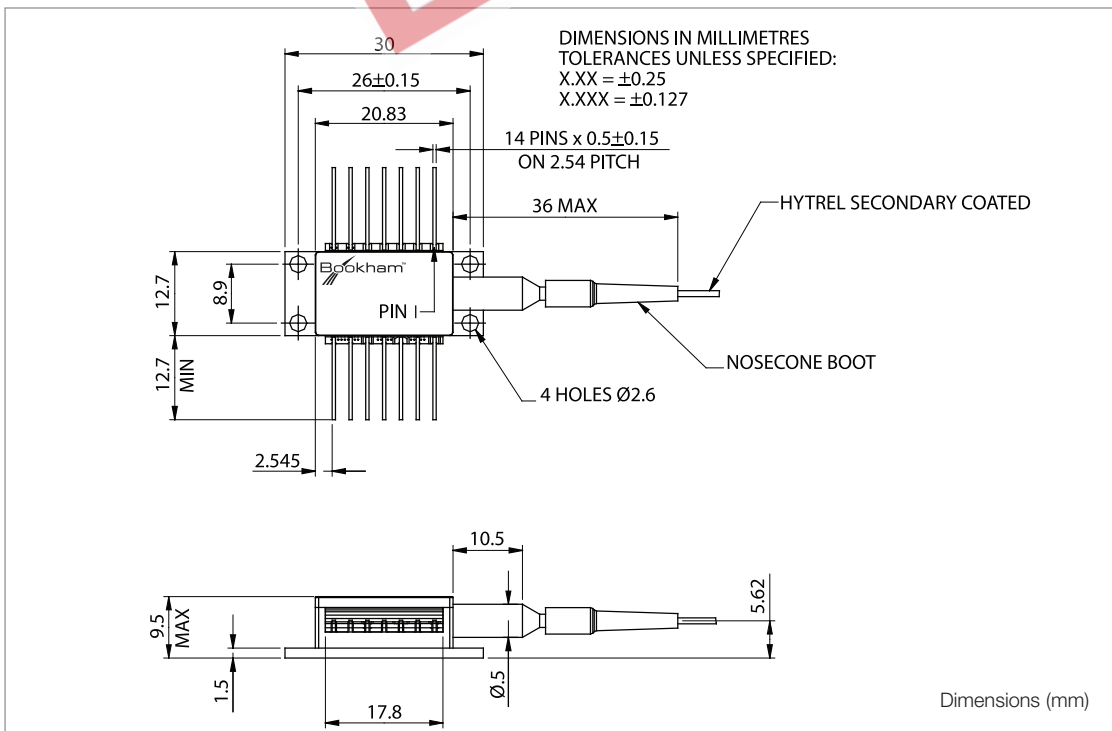


Figure 1: Outline Drawing

**Note:**

Devices can be supplied with the leads trimmed to a length of 3.81mm. Please see Ordering Information section. Fiber length: 1130mm to 1190mm.

## Instructions for use – LC25W\*\*\*\*B/LC25EW\*\*\*\*B

### 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.

For Etalon stabilized devices the thermistor is used for the initial set up of the submount temperature at the required wavelength value. Operating current should be less than 100  $\mu$ A to prevent self-heating errors. Once the initial submount temperature has been achieved control of the TEC current is handed over to the Etalon locking circuit to achieve fine tuning.

### 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 anodes, Pin 5 Common Monitor cathode

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

For Etalon stabilized devices the monitor diodes are arranged in the package such that they give an equal monitor current when the laser wavelength is matched to the ITU grid. A reverse bias must be applied equally across each of the monitors, this is commonly achieved by applying 5 V to Pin 5.

### 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 0.9A at 2.4V.

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

These pins must be grounded in all applications.

### Pin 10

This pin is not connected for the LC25W product and it should be grounded if possible. For the Etalon locked product this pin is used for the monitor long anode. The monitor diodes are arranged such that they give an equal monitor current when the laser wavelength is matched to the ITU grid. A reverse bias must be applied equally across each of the monitors, this is commonly achieved by applying 5V to pin 5.

### Pin 12 Laser modulation (-)

The data input (modulation current) is applied via this pin which is a nominal 25 Ohm impedance coplanar line.

### Pin 14 N/C

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

## Connections

Without Etalon		With Etalon	
Pin	Function	Pin	Function
1	Thermistor	1	Thermistor
2	Thermistor	2	Thermistor
3	Laser DC bias (-)	3	Laser DC bias (-)
4	Monitor Anode (-)	4	Monitor Short Anode (-)
5	Monitor Cathode (+)	5	Monitor Cathode (+)
6	TEC (+)	6	TEC (+)
7	TEC (-)	7	TEC (-)
8	Case Ground	8	Case Ground
9	Case Ground	9	Case Ground
10	Not Connected	10	Monitor Long Anode (-)
11	Case Ground	11	Case Ground
12	Laser Modulation (-)	12	Laser Modulation (-)
13	Case Ground	13	Case Ground
14	Not Connected	14	Not Connected

### Safety Information

Laser safety classifications:  
 IEC 60825-1:Edition 1.2 Class 1M  
 21 CFR Ch.1 (4-1-97 Edition) Class IIIb

Electrostatic discharge:  
 ESD threshold >500V  
 TA-TSY-000870 class 3.

## 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.

### Ordering Information:

LC25

[Etalon Option]	[Wavelength]	[Power Option]	[Reach]	[Connector]
W = none EW = Etalon	****	E = 2 mWpk C = 3 mWpk A = 4 mWpk B = 7 mWpk	B = 360km	J28 = SC/PC J34 = FC/PC J57 = LC J59 = MU

\*\*\*\* = Last four digits of wavelength value E.g. for  $\lambda_p = 1545.32\text{nm}$  \*\*\*\* = 4532

Product without locker can be tuned onto the next 100GHz ITU channel in the red shift direction (2x100GHz tunability) i.e. an LC25W4135CB-J28 can be tuned to service the 1542.14nm ITU channel.

Other connector types are available on request.

E.g. LC25W4532BB-J28 is a 7mW 1545.32 nm device with an SC connector for use in a 360km application.  
E.g. LC25EW4532EB-J28 is a 2mW 1545.32 nm device with an SC connector for use in a 360km application with optional Etalon stabilization.

Trimmed lead option

Devices can be supplied with the leads trimmed to a length of 3.81mm typ.

This option can be specified by adding a 'K' suffix after the reach option.

E.g. LC25W4532BAK-J28 is a 10mW 1545.32nm device with an SC connector and a lead length of 3.81mm typical, for use in a 175km application.

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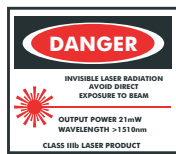
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