NuPhotonics

Part Number: DL25-BF-XX-XX
Product State: Alpha Build

Rev. 0.4 – November 2023

25G DFB Laser Butterfly Package

Description

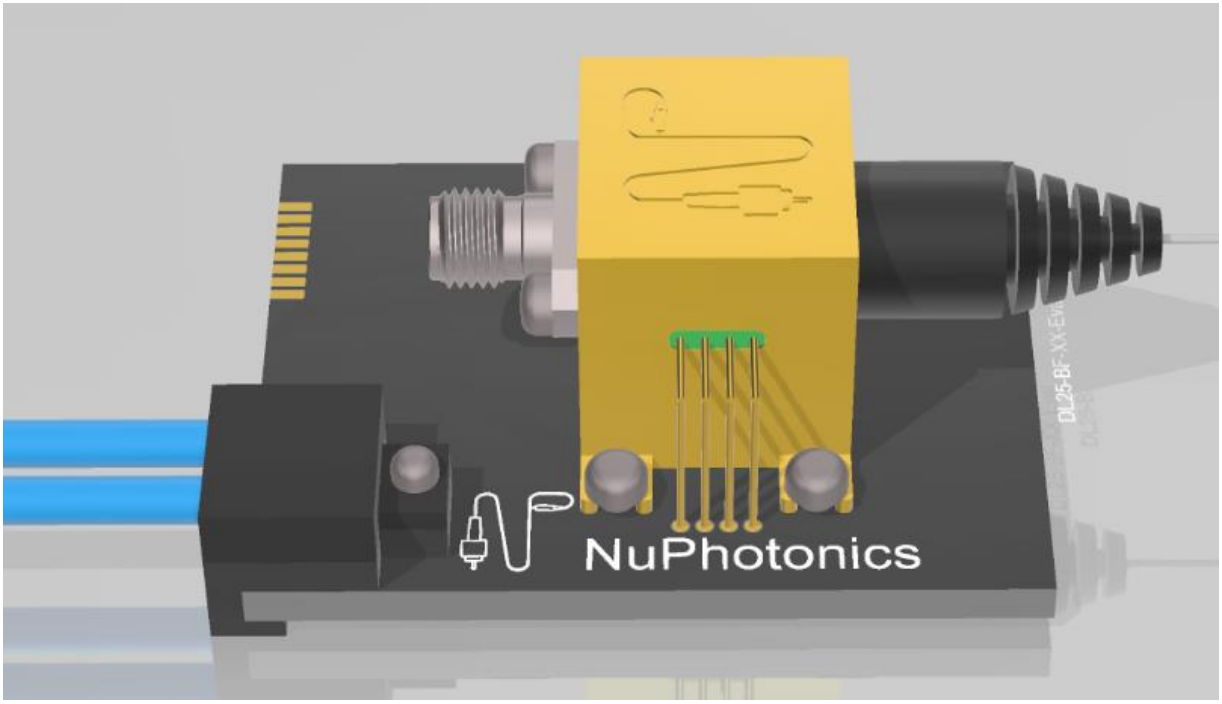
A 25 Gb/s edge emitting laser diode chip surface mount package. The Multi-quantum well distributed feedback (DFB) laser is directly modulated (DML) with a RF signal. This package when combined with a High-Speed Photodiode offers a direct drop-in replacement for Coaxial-Cables. This gives the user ability to transmit high speed singles with low loss in comparison to an electrical RF signal over long distances. This device has a good 50 Ω ohm match across the bandwidth. This device has a built in TEC to cool the laser to achieve optimal SFDR as well as built in thermistor to monitor temperature. There are 3 build configurations for heat disputation. The user can choose whether they want to utilize heat sink, liquid-cooling, or NuPhotonics proprietary surface mount liquid-cooling for the most user comprehensive packaging method. Field replaceable RF connector allows the user to replace the connector with ease if there is damage or excessive wear.

Features

- Hermetic Butterfly Package
- Single mode Pigtail cable – FC/APC connector
- 27 GHz RF Connector
- 1310 nm
- High output power
- High SFDR
- Bandwidth TBD
- Built-in TEC
- Built in Thermistor
- Various heat-dissipation methods

Applications

- 5G
- Datacenters
- RF over Fiber (RFoF)



Laser Electro-Optical Characteristics (T_{op} 23 ± 3°c, unless otherwise specified)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Peak Wavelength	λ	1304.5 1545	1310 1550	1317.5 1557	nm	
Threshold Current	I_{th}		6	8	mA	T=25 C
Front Power	P_o	6	9		mW	$I_f = I_{th}$ + 20 mA
Slope Efficiency	η	0.2	0.3		W/A	$I_f = I_{th}$ + 20 mA
Series Resistance	R			10	Ohms	P_o = 8 mW
Forward Voltage	V_f		1.1	1.5	V	$I_f = I_{th}$ + 20 mA
Spectral Wavelength Width (RMS)	Δλ		0.3	0.5	Nm	P_O = 5mW at -20 dB
Frequency Bandwidth						

Laser Absolute Maximum Ratings (25G DFB Laser)

Parameter	Symbol	Condition	Min.	Max.	Unit
Voltage	V			1.8	V
Forward Current	I_F			80	mA
Storage Temperature	T_{stg}		-25	90	°C
Storage Humidity	H_{stg}			85	% r.H.
Operating Temperature	T_{op}		15	35	°C
Soldering Temperature	T_{st}	60 sec		200	°C
ESD Susceptibility		HBM	100		V

Operating at maximum operating specs for prolong periods of time will damage the device.

Thermoelectric Cooler (TEC) Specifications

Parameter	Symbol	Value	Unit	Test Condition
Max Current	I_{Max}	6	A	
Max Temperature difference	ΔT_{Max}	62	°C	
Max Voltage	V_{Max}	0.85	V	Qc = 0W
Maximum Heat Absorption	$Q_c$max	2.94	W	ΔT = 0 °C

Pin Configuration

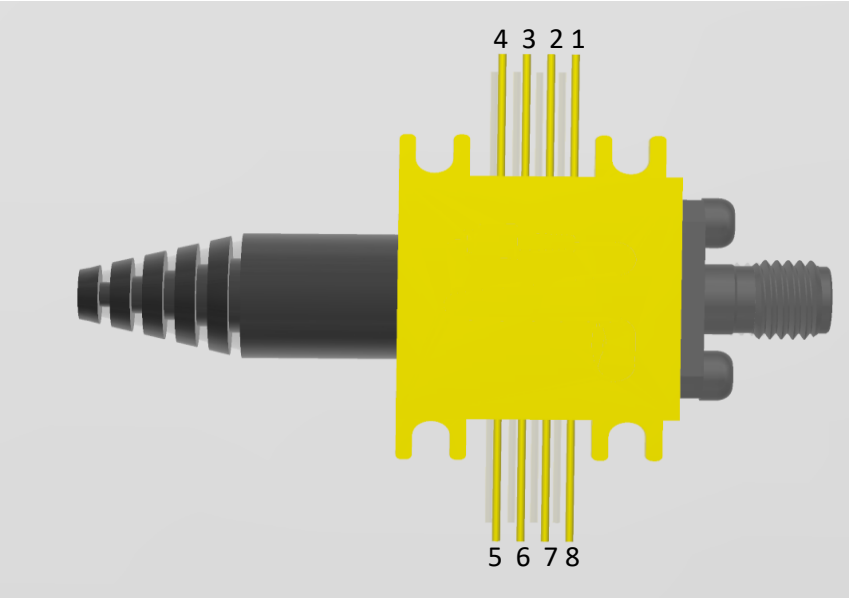


Fig 1. A: Top-Down view.

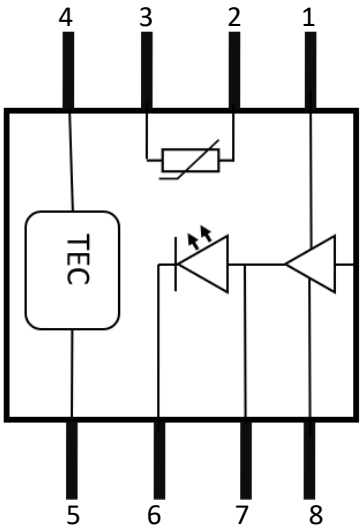


Fig 1. B: Electrical Diagram.

Pin Number	Function	DC Connector Color (Eval board)
1	Ground/GND	
2	Thermistor	
3	Thermistor	
4	TEC (-)	
5	TEC (+)	
6	Ground/GND	
7	Laser Bias	
8	Amplifier Bias	

Table 1: Module Pin out and corresponding color code for 8 pin DC connector.

Recommended Footprint Dimensions

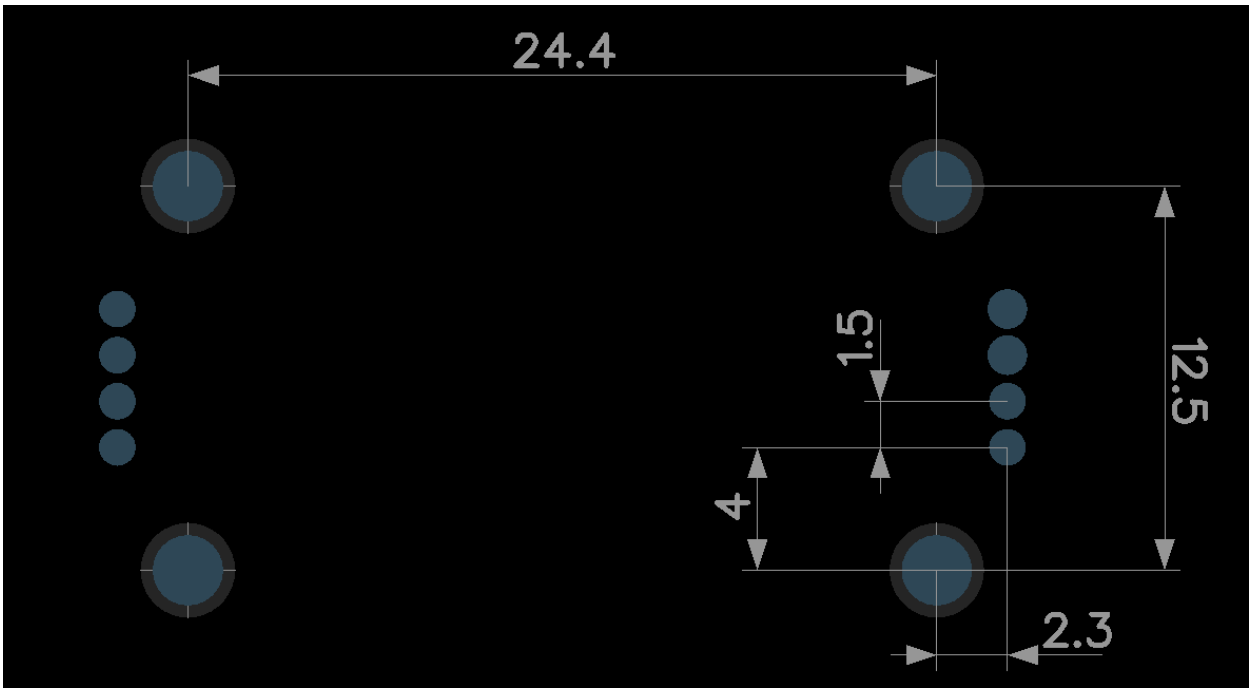
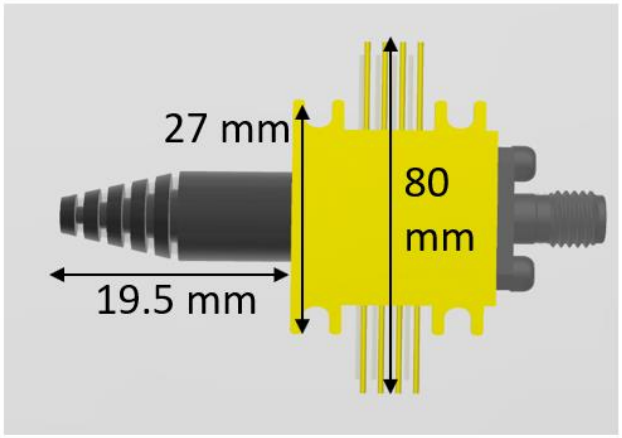


Fig 2: Recommended Footprint dimensions. All units in (mm)

Notes:

1. Recommend M2 screws for PCB mounting.
2. Recommend 0.6 mm wide through holes for the device pins.

Device Dimensions



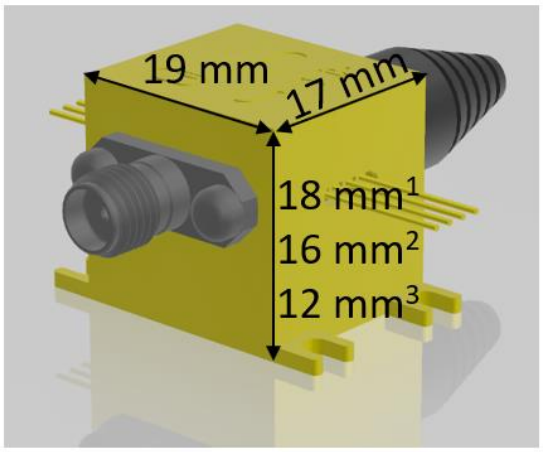


Fig 3: Device dimensions

[1] TEC package with Surface mount liquid-cooling package
[2] TEC Package External heat-sink version
[3] Standard package/ This unit does not come with TEC.

Heat Dissipation Configurations

Cooling the device < 15°C requires external heat sinking. Operating the device without external heat sink will damage the device.

Traditional heat sinking methods.

For the standard TEC build configuration, the user can use passive or active cooling to dissipate the generated heat. The user can drop in the laser into their standard build configurations. It is recommended to directly mount the device on the heat sink. This assures proper cooling and safety of the device. The user is responsible for choosing the adequate heat sink for their application.

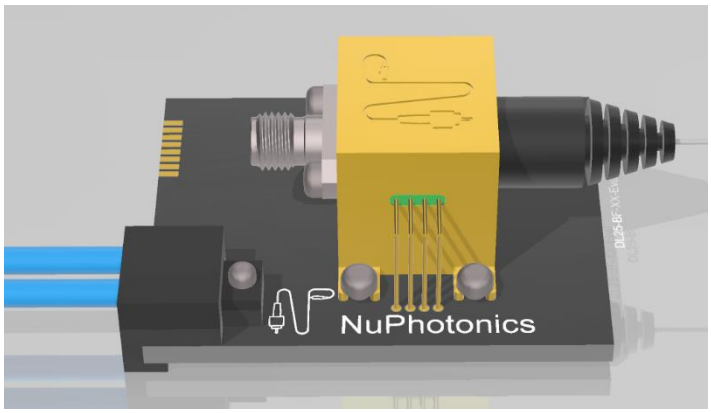


Fig 4: 25G DFB Laser mounted on Evaluation board with surface mount liquid cooling.

Liquid Cooling

NuPhotonics offers the ability to create mini-fluidic channels on FR-4 PCBs that can actively cool the device. The water channels can be routed like conducive traces. This offers the users the most comprehensive package. This is Ideal for large data centers and more. Low off gassing RTV Silicone gaskets create a watertight seal between the device body and the PCB board.

The water cavity has been optimized to achieve uniform flow across the TEC floor for optimal cooling. The liquid-cooling cavity is not symmetric , there is a designated inlet and outlet. The device internals and liquid cooling cavity are separated by the Kovar body to maintain hermeticity. It is recommended to use liquids that are specifically designed for liquid-cooling.

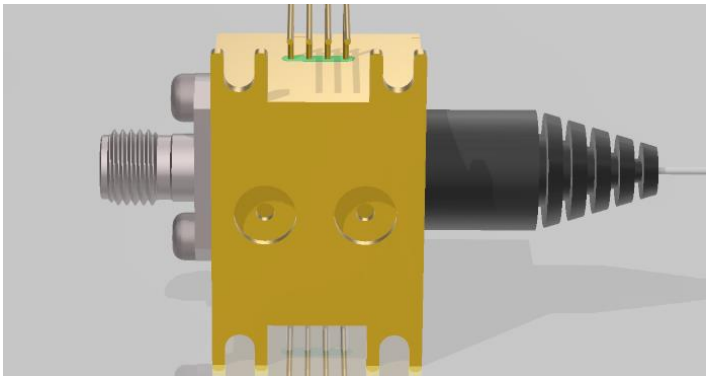


Fig 5: 25G DFB Laser bottom view. The liquid cooling inlet and outlet are shown.

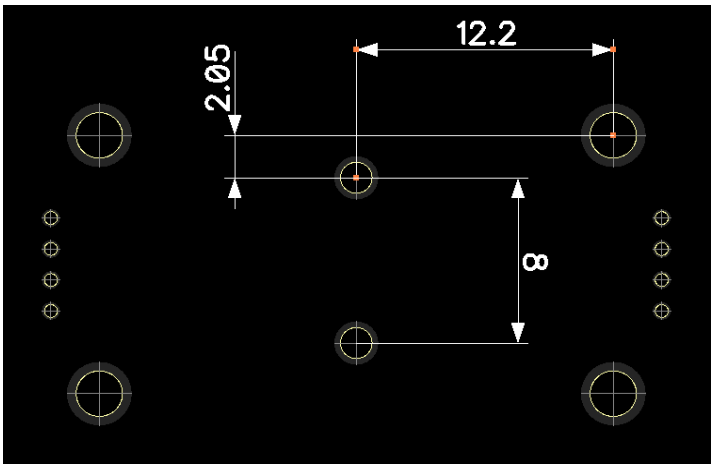
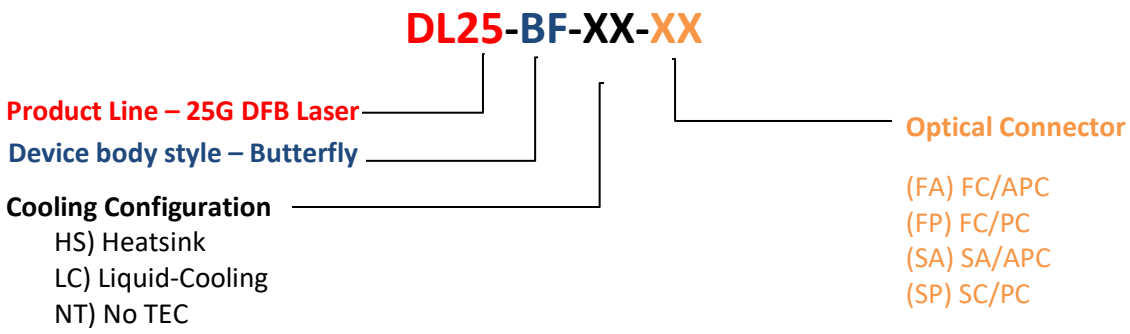


Fig 6: Liquid cooling inlet and outlet dimensions. All units in (mm)

Device Nomenclature



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