

10 Gb/s InP Mach Zehnder Modulator with DWDM Laser

The 10 Gb/s InP Mach Zehnder Modulator with DWDM Laser, containing the Bookham Technology Strained Layer MQW DFB laser chip and the InP Mach-Zehnder modulator chip, has been designed specifically for use in 10 Gb/s long distance optical fibre trunk systems. Thermo-electric heatpumps, a precision NTC thermistor and optical isolator are incorporated. By using the rear back facet monitors, the integrated Etalon locker allows wavelength locking to the 50 GHz ITU grid. The module is capable of >80 km transmission over Non Dispersion-Shifted Fibre (NDSF) without additional dispersion compensation. This is achieved by the negative chirp characteristic, which compensates for 1500 ps/nm dispersion. Increased transmission distances are possible using multiple spans of NDSF with dispersion compensation. Optical power control is achieved by applying a D.C. bias voltage to the internal attenuator electrode. This reduces the power into the modulator section without affecting the operating wavelength.

Features

- Voltage programmable output power control
- Long haul performance with negligible penalty
- Integral Etalon wavelength stabilisation to within ± 20 pm over life
- Differential or single 50 Ohm low voltage drive modulation input
- Integral thermo-electric cooler with precision NTC thermistor for temperature control
- Hermetically sealed butterfly style package with SMA RF connectors
- ITU Wavelengths available from 1527 nm to 1608 nm
- 50 GHz channel spacing

Applications

- Long reach SONET/SDH OC192/STM64 DWDM systems to 50 GHz channel spacing



Characteristics

Conditions unless otherwise stated: Submount temperature $30^{\circ}\text{C} \pm 5^{\circ}\text{C}$ (for locked λ)
 Monitor diode bias -5 V

Parameter	Conditions	Min	Typ	Max	Unit
Modulated Output Power (1) Modulated Output Power (2)	50% duty cycle at $T_{\text{case}} = 25^{\circ}\text{C}$	0		3.5 - 12.0	dBm
Threshold current (I_{th})				40	mA
Slope efficiency		3.7	6		$\mu\text{W}/\text{mA}$
RF input reflection coeff. (S_{11})	to 8 GHz	10			dB
Laser Forward voltage				2.8	V
Peak wavelength	ITU Grid	1527.22		1608.33	nm
Wavelength Accuracy	SOL, ITU Grid	-37		+37	pm
Sidemode suppression ratio		40			dB
Optical rise/fall time	(20% - 80%)			50	ps
Monitor photocurrent	@ locked λ	0.15			mA
Monitor dark current				100	nA
Thermistor resistance	@ locked λ	6.81		10.09	k Ω
Heatpump current	$T_{\text{case}} 0-70^{\circ}\text{C}$			1.8	A
Heatpump voltage	$T_{\text{case}} 0-70^{\circ}\text{C}$			5	V
M – Z bias voltage (left arm)	@<12 mA	-4	-2	-1.1	V
M – Z bias voltage (right arm)	@<12 mA	-5		0	V
Modulation voltage (single ended)	a.c. p-p	2.8	4	5.5	V
Extinction ratio	ac		13		dB
Attenuator voltage (0 – 15 dB)	@ <30 mA	-8		0.5	V
Dispersion penalty	1500 ps/nm			1	dB

(1) Start of life, power adjustment set for maximum output power

(2) Start of life, power adjustment set to -8.0 V

Absolute Ratings

Parameter	Conditions	Min	Typ	Max	Unit
Operating temperature		0		70	$^{\circ}\text{C}$
Storage temperature		-40		85	$^{\circ}\text{C}$
Laser forward current				275	mA
Laser reverse voltage				2	V
Monitor diode bias				15	V
TE cooler current				1.8	A
Mach-Zehnder bias voltage		-6		0.5	V
Attenuator voltage		-7.3		0.5	V
Fibre bend radius		30			mm

Outline Drawing

Dimensions in mm

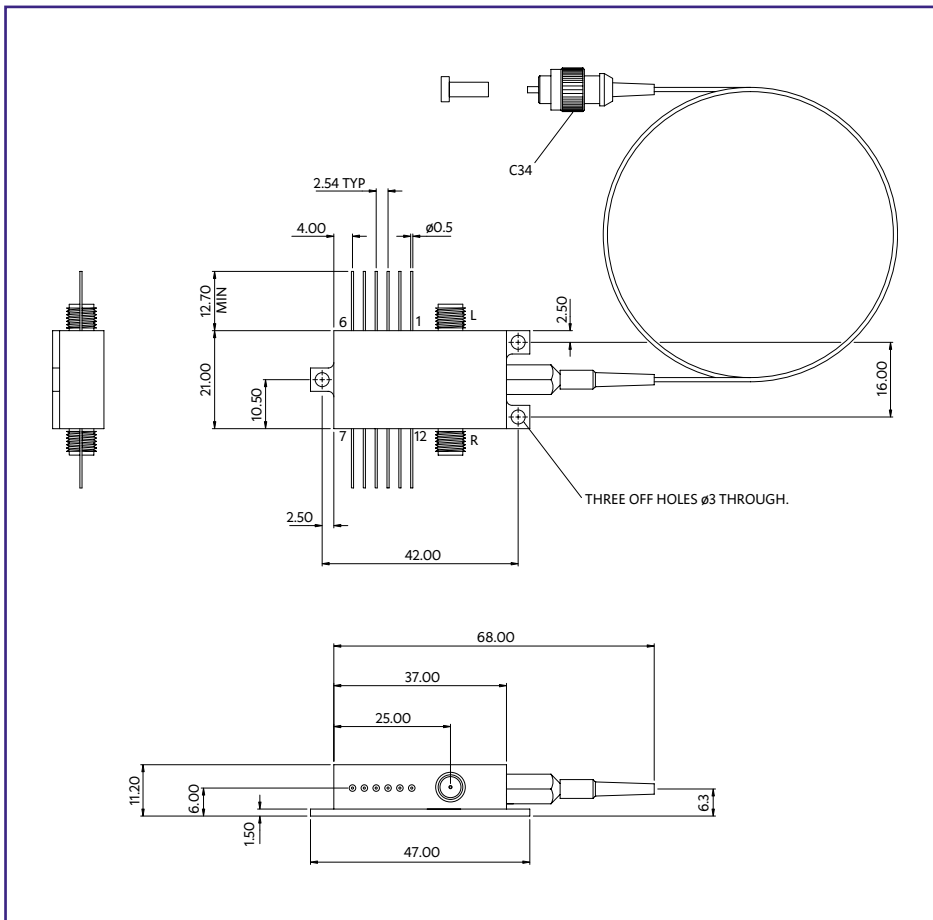


Figure 1: Outline Drawing

Instructions for Use

Pin 1 Ground

Package ground pin.

Pin 2 MZ Bias Left and Pin 11 MZ Bias Right

DC bias voltages for left and right MZ arms. These pins must be connected to a negative DC voltage (typically around -2 V) which is defined in the deliverable data. The bias voltage source must be capable of delivering up to 10 mA to each pin.

Pin 3 TEC (-) and Pin 4 TEC (+)

The package contains two peltier heatpumps connected in series. Applying a negative voltage on Pin 3 with respect to Pin 4 will cause the internal optics to be cooled relative to the case temperature. Reversing the applied voltage will cause the internal structures to be heated. The power supply for the heatpumps should be capable of sourcing up to 2 A at 5 V.

Pin 5 Thermistor

The thermistor is used in the control loop for keeping the internal temperature at a constant value. It has a nominal

resistance of 8.2 k Ω at the typical operating temperature of 30°C and is not polarity sensitive, although one side of the thermistor is connected to package ground. Operating current should be limited to less than 100 μ A to prevent self-heating errors. The exact thermistor value will be supplied with the LCM155EW variant to ensure correct operating wavelength.

Pin 6 Monitor Anode (short), Pin 7 Monitor Anode (long) and Pin 8 Monitor Cathode

The two back facet monitor diodes are used in a control loop, which maintains constant laser wavelength. Each diode has a different spectral response, which overlaps at the “locked” wavelength. The loop can control submount temperature and laser bias to maintain the two monitor diode currents at equal values. The diodes are operated with a reverse 5 V bias.

Pin 9 Laser Anode and Pin 10 Laser Cathode

The laser is operated with a forward bias current up to 275 mA at 2.8 V. Threshold current is typically 30 mA at 30°C.

Pin 12 Attenuator

A negative DC voltage in the range 0 V to -8.0 V applied to this pin will attenuate the output power by up to 15.5 dB. The supply should be capable of sinking up to 30 mA from this pin.

MZ Data Left

Single-ended data input with typical amplitude of 4.0 Vpp is applied via the SMA connector (the required value for optimum performance is supplied with the device). Input must include a DC block.

MZ Data Right

When operating the module with a differential input, data is applied to both left and right arms. Typical amplitude is 2.0 Vpp in this mode. Again, a DC block is necessary. This input should be terminated with a 50 Ω DC load if operating with a single ended input on the left arm.

Package Pinout

SMA	MZ Left Data	SMA	MZ Right Data
Pin 1	Ground	Pin 12	Attenuator
2	MZ Bias Left	11	MZ Bias Right
3	TEC (-)	10	Laser Cathode
4	TEC (+)	9	Laser Anode
5	Thermistor	8	Monitor Cathodes
6	Monitor Anode (short)	7	Monitor 2 Anode (long)

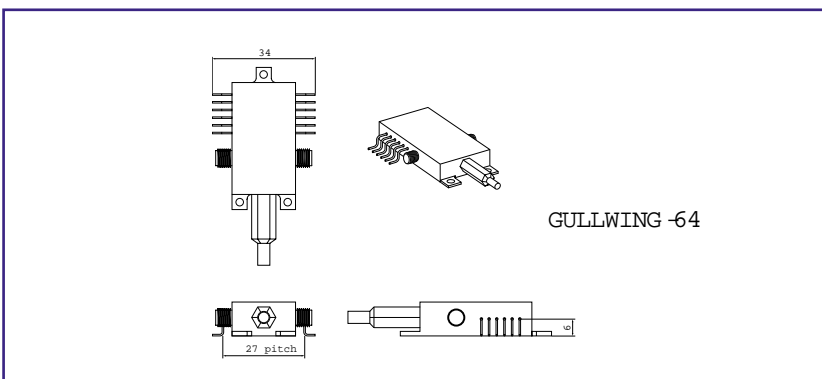


Figure 2: Gullwing-64

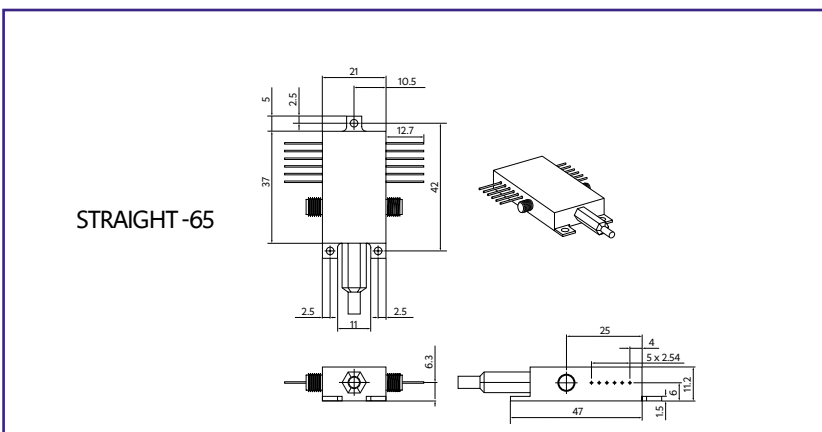


Figure 3: Straight-65

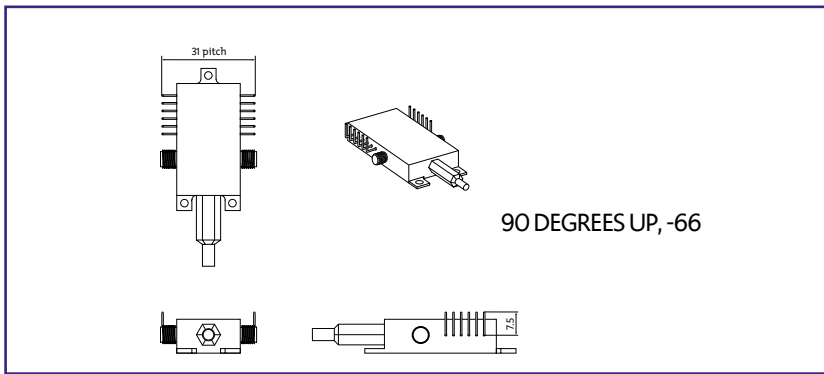


Figure 4: 90 Degrees up-66

Device Ordering Information

LCM155EW [Wavelength] - [Package] [Connector]

64 = Gullwing	C28 = SC/PC
65 = Straight Leads	C34 = FC/PC
66 = 90° Leads	C57 = LC

**** = last four digits of wavelength value. Eg. For $\lambda_p = 1557.36$ nm **** = 5736
 Eg. **LCM155EW5736-64C57** is a 1557.36 nm device with gullwing leads and an LC connector.



CLASS 1 LASER PRODUCT

REFERENCE IEC 60825-1 : Edition 1.2



This product complies with 21CFR 1040.10 and has been assessed as Class I for non-viewed sources



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