Fiber Coupled Tunable Laser VCSEL – 1550nm

(up to 15nm tuning range, linewidth 300MHz, 100kHz tuning speed, up to 1W output power)

DATASHEET

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The TVCS series of fiber-coupled tunable lasers combines an electrically movable MEMS mirror with a Vertical Cavity Surface Emitting Laser (VCSEL), providing a cost-effective single-mode laser source with fast wavelength tuning capability. The wavelength sweep is mode hopping-free, ensuring smooth operation. The compact design integrates an optical isolator and TEC cooler for enhanced stability. It is available with single-mode, polarization-maintaining (PM), or multimode fiber. This device is ESD-sensitive and requires mounting on a heat sink. A dedicated driver is available, offering stable laser output, 10kHz fast wavelength sweep, and digital laser modulation up to GHz.The TVCS can be driven at or beyond resonance, with resonance frequencies ranging from 250 to 320 kHz, depending on the batch.

For higher output power, up to 1W in both single-mode (SM) and polarization-maintaining (PM) configurations, we offer integration with an erbium-doped fiber amplifier (EDFA), which also provides output intensity stability through a precision feedback control loop.

Features

- 14nm Wavelength Tuning Range
- 0.6 mW CW Single Mode Output
- Isolator Integrated
- Mode Hopping Free Tuning
- 100 kHz Fast Wavelength Scan
- TEC Cooler Integrated
- SM and PM Fiber-Coupled
- 10 Gb/s Direct Modulation

Applications

- Sensor Systems
- OTC
- LIDAR
- Instrument
- Communications

Specifications

Parameter	Min	Typical	Max	Unit
Center Wavelength	1525		1575	nm
Wavelength Tuning Rang	±4		±8	nm
Tuning Speed	0		200	kHz
Spectral Width (-3dB FWHM, CW)			300	MHz
Side-Mode Suppression Ratio (SMSR)	30	40		dB
Polarization Extinction Ratio (PM Fiber)	20		25	dB
Relative Intensity Noise (RIN)			-128	dB/Hz
Output Optical Power *	0.4	0.7	1000	mW
Electrical Return Loss (S22)		-5		dB
RF Input Impedance		50		Ω
Laser Threshold Current		7		mA
Laser Operation Current		18	25	mA
Laser Revere Voltage		3		V
Wavelength Tuning Current		100		μA
Wavelength Tuning Voltage			13	V
TEC Voltage		0.35	1.5	V
TEC Current		0.05	0.55	A
TEC Operating temperature	5		35	°C
Thermistor Resistance		10		kΩ
Operating Temperature	-25		65	°C
Storage Temperature	-45		85	°C
Fiber Cover		0.9mm Tube		
Fiber Length		1		m

* Higher power is achieved with an integrated optical amplifier

CAUTION: Device is highly sensitive to electrostatic discharge. Solder temperature <350°C <10 seconds

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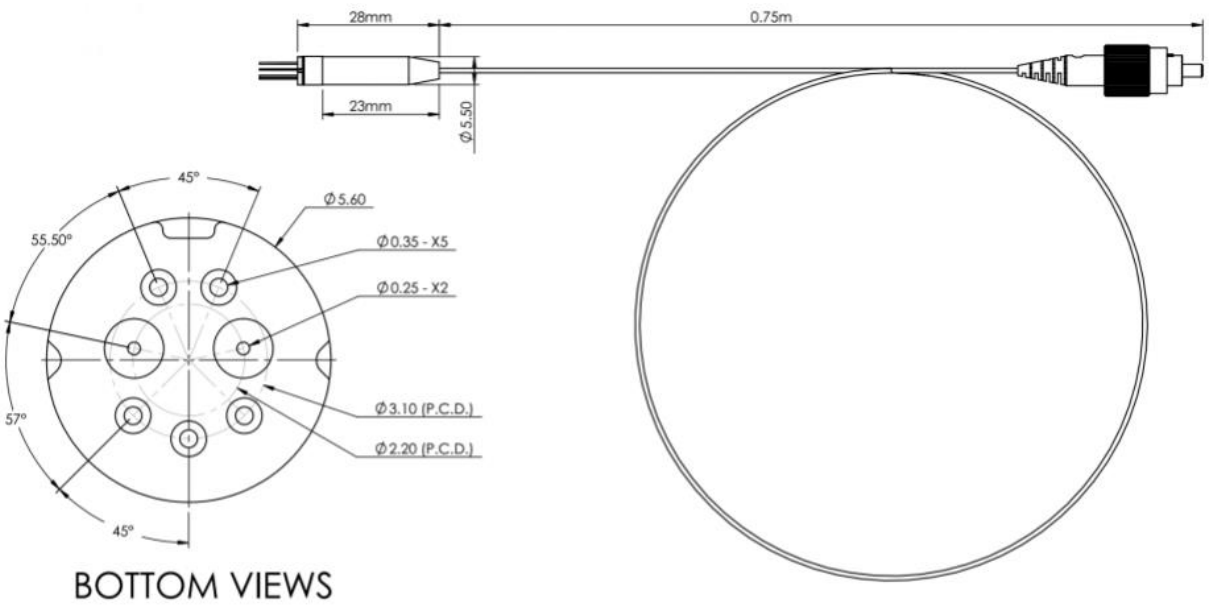
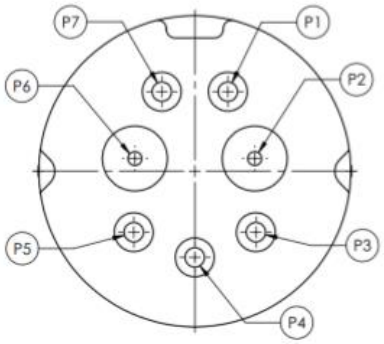
Mechanical Dimensions (mm)



*Product dimensions may change without notice. This is sometimes required for non-standard specifications.

Electrical Connection



PIN NO.	ASSIGNMENT
P1	TEC +
P2	LD -
P3	TUNING Vt +
P4	THERMISTOR -
P5	THERMISTOR +
P6	LD + / TUNING Vt -
P7	TEC -

CAUTION: The Wavelength Tuning (PIN6) must not share a common ground with the LD Control (PIN2), as this will damage the device.

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Ordering Information

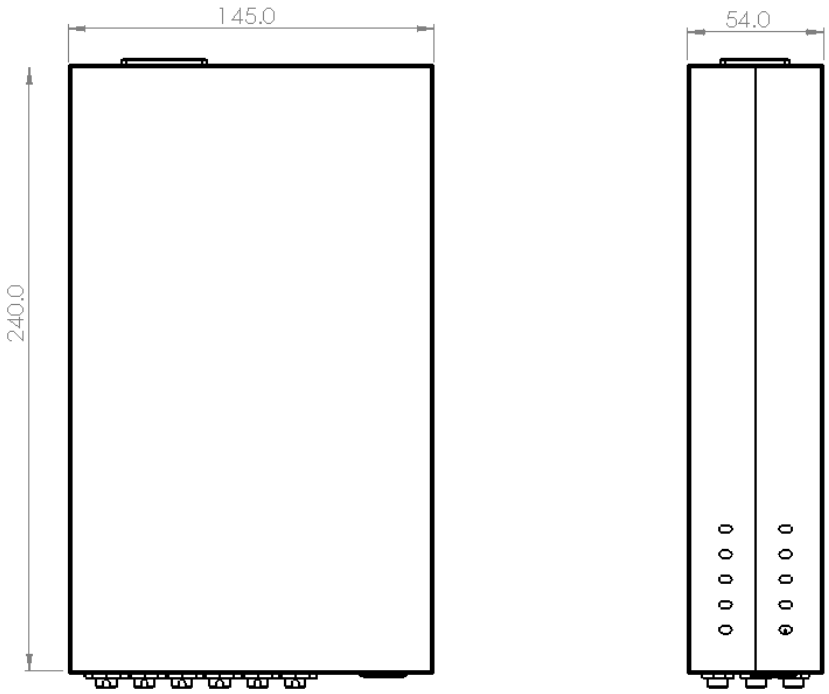
	☐☐	☐	☐	☐	☐	☐	☐	☐
Prefix	**Wavelength**	**Tuning Range**	**Optical Power [1]**	**Driver**	**Enclosure [2]**	**Fiber Type**	**Fiber Length**	**Connector**
TVSE-	1550nm = 50 1540nm = 54 1558nm = 58 1566 nm = 66 Special = 0	±4nm = 1 ±5nm = 2 ±6nm = 3 ±7nm = 4 ±8nm = 5	Standard = 1 10mW = 2 100mW = 3 500mW = 5 1W = 9 Special = 0	No = 0 Yes = 1	Non = 1 Benchtop = 2 Special = 0	SM28 = 1 PM1550 = 2 50/125 = 3 62.5/125 = 4 105/125 = 5 Hi1060 = 7 PM980 = 9 Special = 0	1m = 1 Special = 0	FC/APC = 3 FC/PC = 2 SC/PC = 4 SC/APC = 5 ST/PC = 6 LC/PC = 7 LC/APC = A LC/UPC = U Special = 0

[1]. Power >1 mW is packaged in a plug-play benchtop

[2]. The benchtop unit integrates a power supply compatible with 100-240 VAC, features an optical output connector on the front panel, and power/control interfaces on the rear panel.

Marked in red on special order

Benchtop Box Mechanical Dimension



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ESD Test

ESD - Discharge to housing	IEC 61000-4-2 Performance class B contact 4kV, air 8kV	ESD test setup	3	Link test during exposure	9/9/20	10/9/20	Pass	Class A 4kV (contact) Class B 8kV (contact) Class A 15kV (air)
ESD - Discharge to electrical pins - Trx	JEDEC/EIA JESD22-A114-B HBM class 1C ± 1kV	ESD test setup	3	E/O test	9/10/20	9/10/20	Pass	

Application Notes

Fiber Core Alignment
Note that the minimum attenuation for these devices depends on excellent core-to-core alignment when the connectors are mated. This is crucial for shorter wavelengths with smaller fiber core diameters that can increase the loss of many decibels above the specification if they are not perfectly aligned. Different vendors' connectors may not mate well with each other, especially for angled APC.

Fiber Cleanliness
Fibers with smaller core diameters (<5 μm) must be kept extremely clean, contamination at fiber-fiber interfaces, combined with the high optical power density, can lead to significant optical damage. This type of damage usually requires re-polishing or replacement of the connector.

Maximum Optical Input Power
Due to their small fiber core diameters for short wavelength and high photon energies, the damage thresholds for device is substantially reduced than the common 1550nm fiber. To avoid damage to the exposed fiber end faces and internal components, the optical input power should never exceed 20 mW for wavelengths shorter 650nm. We produce a special version to increase the how handling by expanding the core side at the fiber ends.

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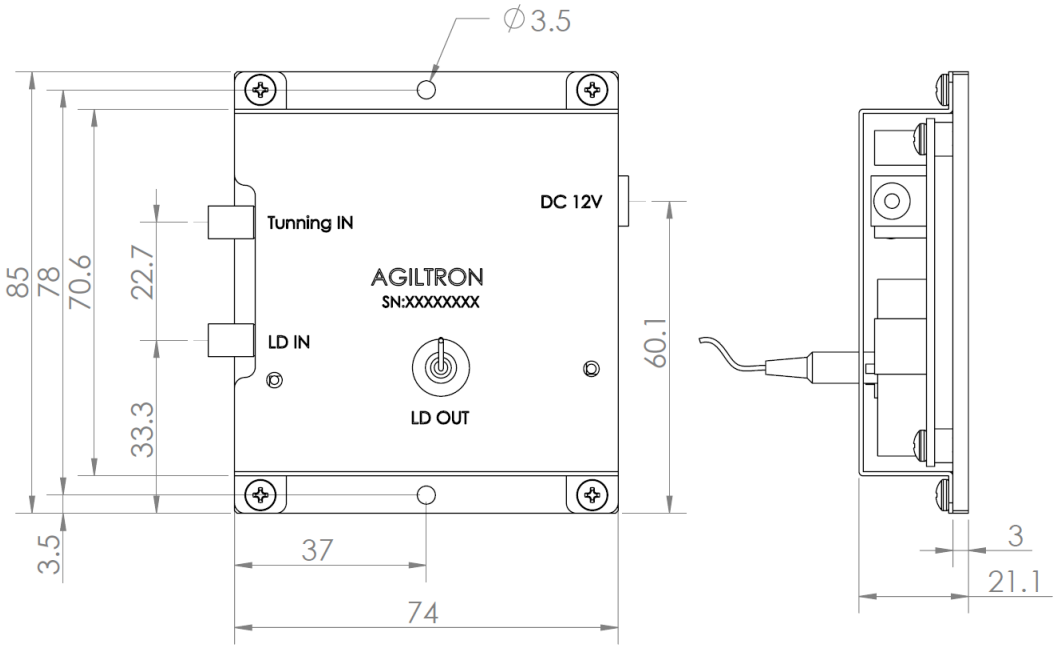
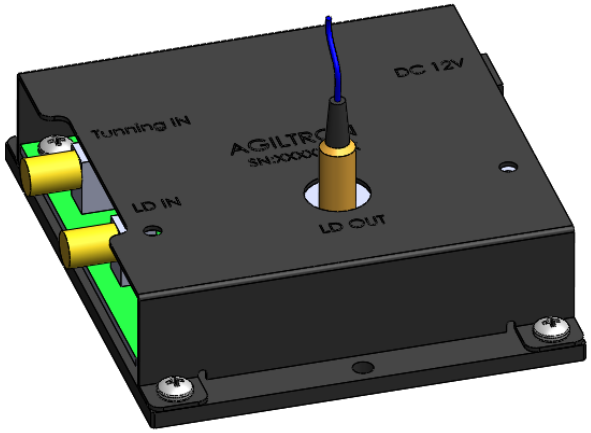
Driver Description

- TEC Cooling: Integrated thermoelectric cooler (TEC) with adjustable temperature settings (preset to 10°C).
- Laser Current Control: Constant current control, with user-settable 0-5V, SMA input with impedance>1K
- Direct Laser Modulation: The same SMA can be used to directly modulate laser at speeds up to 1 Gb/s.
- Fast Wavelength Scan: Capable of performing fast wavelength scanning at 100 kHz. 0-5V, SMA input with impedance>1K
- Constant Output Power Control: Optional external feedback tap available for maintaining stable laser output power.
- High Output Power: A cost effective optical amplifier can be integrated to increase the output power up to 100mW ($550).





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Driver Operation Manual

The TVCS driver integrates a low-noise laser driver with a modulation speed of up to 200MHz, a TEC cooler, and MEMS wavelength tuning circuitry. The TEC temperature is preset at factory to 15°C

Operation Instructions:

•**Power Up**: Connect the included 12V DC power supply (5.5 x 2.1mm connector).

•**Laser Diode Power/Modulation Control**: Apply a 0-5V control signal to the SMA connector labeled "LD IN." Ensure no negative voltage is applied.

•**Wavelength Tuning**: Apply a 0-5V control signal to the SMA connector labeled "TUNING IN." Ensure no negative voltage is applied.

•**Laser Output**: The laser output is available through the FC/APC connector labeled "LD OUT."

•**Driven at Resonance or Beyond:** The resonance is between 250 and 320KHz, depends on the batch. Driving with sinusoidal signal at resonance achieve widest tuning. One can increase the sweep rate and adjust min and max tuning voltage for optimizing the optical spectrum. Do not exceed the max / min tuning voltage. When driving beyond resonance the optical spectrum is decreased. At 1MHz sinusoidal the tuning range is about 1nm.

Benchtop

Agiltron cost-effective LDCB series benchtop control kit is designed for easy laser diode mounting and precise control. It incorporates a high-precision, low-noise auto-feedback drive electronics to ensure constant output power or a constant driving current and an integrated temperature control unit maintains optimal operating conditions. The system provides up to 1A driving current and up to 2A TEC cooling current. Each system features a front fiber output connector. The user interface includes an intuitive LCD display for independent control of output power and temperature via two front rotating knobs. The LDCB also includes a universal power supply compatible with 100 to 240 VAC. The LDCB has a built-in isolator option to prevent reflection-induced laser emissions instability. The LDCB is designed as a laser diode and TEC controller kit for customer to install laser diode.

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Caution Electrostatic Sensitivity

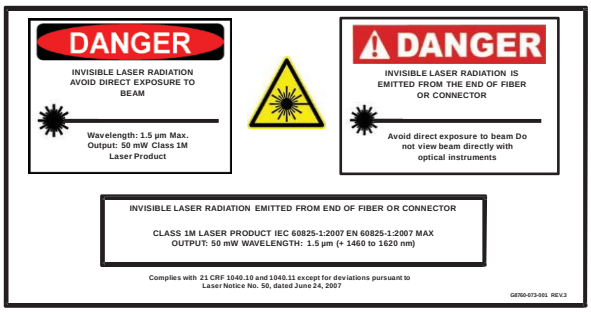
- Never touch laser diode and the module using hands
- Always use protections when handle a laser diode
- Recommend mounting the laser diode using an ionic gun and ESD finger cots

Laser Safety

This product meets the appropriate standard in Title 21 of the Code of Federal Regulations (CFR). FDA/CDRH Class 1M laser product. This device has been classified with the FDA/CDRH under accession number 0220191. All versions of this laser are Class 1M laser products, tested according to IEC 60825-1:2007 / EN 60825-1:2007. An additional warning for Class 1M laser products. For diverging beams, this warning shall state that viewing the laser output with certain optical instruments (for example eye loupes, magnifiers, and microscopes) within a distance of 100 mm may pose an eye hazard. For collimated beams, this warning shall state that viewing the laser output with certain instruments designed for use at a distance (for example telescopes and binoculars) may pose an eye hazard.

Wavelength = 1.3/1.5 µm.

Maximum power = 30 mW.



*Caution - Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.
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