COHERENT

Product Specification

CW Tunable Laser – Butterfly Package

S7500 Family

PRODUCT FEATURES

- Full C-band tuning (89/100 channels at 50 GHz spacing)
- High, adjustable output power, from 9 to 13 dBm
- Low power dissipation, typically < 2.2 W at 75°C
- High side-mode suppression ratio > 40/35 dB
- Dark tuning by reverse biasing the integrated optical amplifier
- Compact, low-profile, hermetic laser package with internal optical isolator
- Integral wavelength locker, allowing stabilization to within ±2.5 GHz over life, compatible with 50 GHz ITU grid spacing
- Polarization maintaining fiber pigtail

APPLICATIONS

- Sensor systems
- Sweep laser applications
- Test and measurement

The S7500 tunable laser product family from Coherent incorporates a monolithic Indium Phosphide (InP) chip that integrates a tunable MG-Y laser with a semiconductor optical amplifier (SOA). The MG-Y (Modulated Grating Y-branch) laser is an electronically tuned device that can address any wavelength in the C-band. Since no mechanical or thermal adjustments are necessary, the product enables very fast wavelength sweeping, especially for sensing application. The SOA facilitates flexible control of the output power and acts as a shutter when reverse biased, enabling dark tuning between channels.

The devices are packaged into a compact, low-profile hermetically sealed package, with an internal optical isolator and a wavelength locker. The locker monitors both output power and frequency of the light emitted from the chip, enabling a closed loop control that guarantees stability of the frequency and output power over life, to within the requirements of 50 GHz ITU grid spacing applications. The S7500 is provided with polarization maintaining fiber for use with an external modulator. The laser is RoHS compliant and lead-free per Directive 2011/65/EU [1].

PRODUCT SELECTION

Product code	Description
7500001 (EOL, limited availability)	Tunable laser, butterfly package, 89 channels at 50 GHz spacing from 191.70 THz to 196.10 THz, 13 dBm output power, 27.5°C chip operating temperature, SMSR 40 dB, 400 µm polarization maintaining fiber pigtail with ST test plug
7550001	Tunable laser, butterfly package, 89 channels at 50 GHz spacing from 191.70 THz to 196.10 THz, 13 dBm output power, 42.5°C chip operating temperature, SMSR 40 dB, 400 µm polarization maintaining fiber pigtail with ST test plug
7550015	Tunable laser, butterfly package, 100 channels at 50 GHz spacing from 191.15 THz to 196.10 THz, 13 dBm output power, 42.5°C chip operating temperature, SMSR 35 dB, 400 µm polarization maintaining fiber pigtail with ST test plug

I. Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of the data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect device reliability.

Parameter	Conditions	Symbol	Min	Typ	Max	Unit	Notes
Storage temperature		T_S	-40		85	°C	
Relative humidity	Non-condensing	RH	0		85	%	
Laser diode reverse voltage	All sections				3	V	
Laser gain current		I_g			160	mA	
Reflector currents		I_{rl}, I_{rr}			50	mA	
Phase current		I_{pc}			10	mA	
SOA current		I_{SOA}			240	mA	
Photodiode bias voltage		$V_{PD,ref}$, $V_{PD,\lambda}$	-5		0	V	
Photodiode reverse current		$I_{PD,ref}$, $I_{PD,\lambda}$			2	mA	
TEC current		I_{TEC}			1.2	A	
TEC voltage		V_{TEC}			3.5	V	

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

II. Electrical & Thermal Characteristics

Parameter	Conditions	Symbol	Min	Typ	Max	Unit	Notes
Operating case temperature		T_{OP}	-5		75	°C	
Laser chip temperature	Product code 7500xxx	T_L	25		30	°C	
	Product code 7550xxx		40		45		
Laser gain current		I_g		98	100	mA	
Reflector currents (left, right)		I_{rl} , I_{rr}			33	mA	
Phase current		I_{pc}			7.5	mA	
SOA current		I_{SOA}		90	167	mA	
Photodiode bias voltage		$V_{PD,ref}$, $V_{PD,\lambda}$	-3		0	V	
Thermistor resistance	Laser chip temperature set to 25°C	R_{th}		10		kΩ	
Thermistor sensitivity index	Laser chip temperature set to 25°C	β		3930		K	
TEC current	Steady state	I_{TEC}		<0.75	0.85	A	
TEC voltage	Steady state	V_{TEC}		<2.5	2.8	V	
Total power dissipation	Steady state	P_{tot}		<2.2	2.8	W	

III. Optical Characteristics (T_{OP} = -5 to75°C)

Parameter	Conditions	Symbol	Min	Typ	Max	Unit	Notes
Output power	For all channels, BOL	P_{max}	13			dBm	
Output power variation over life		ΔP	-0.5		0.5	dB	1
Output power adjustment range			4			dB	2
Output power when disabled					-35	dBm	3
Lowest emission frequency	75x0001 7550015	ν_{min}			191.70 191.15	THz	
Highest emission frequency		ν_{max}	196.10			THz	
Lowest emission wavelength		λ_{min}	1528.8			nm	
Highest emission wavelength	75x0001 7550015	λ_{max}			1563.9 1568.4	nm	
Channel spacing (ITU grid)				50		GHz	
Number of channels	75x0001 7550015		89 100				4
Frequency accuracy		Δν	-2.5		2.5	GHz	5
Side-mode suppression ratio	75x0001 7550015	SMSR	40 35			dB	
Optical signal-to-noise ratio		OSNR	50	55		dB	6
Linewidth		LW			5	MHz	7
Relative intensity noise		RIN			-140	dB/Hz	8
Back reflection tolerance					-14	dB	
Optical isolation			40			dB	
Polarization extinction ratio		PER	20			dB	

Notes:

1. With closed loop control on SOA current to maintain a fixed reference PD current.
2. Range over which the output power can be adjusted by changing the SOA current, down from the output power P_{max}, while maintaining all other optical specifications.
3. Output power with reverse biased SOA; used in order to block the laser output, e.g. while tuning to another channel.
4. Consecutive channels at 50 GHz spacing.
5. With closed loop control on the left reflector, right reflector, and phase current, in order to maintain a fixed ratio of the etalon and reference PD currents. See application note AN-2095 for details.

6. In a 0.1 nm wide band.
7. Intrinsic Lorentzian linewidth, measured e.g. using a phase noise spectral density measurement, disregarding low frequency phase noise originating from the drive circuitry.
8. Average value over the frequency range from 0.1 GHz to 10.0 GHz.

IV. Wavelength Locker

Parameter	Conditions	Symbol	Min	Typ	Max	Unit	Notes
Reference PD responsivity	Relative to fiber-coupled power	$I_{PD,ref}/P$	10		25	µA/mW	
Normalized locker ratio at ITU channel		R	40		75	%	1
Locker slope	@ ITU channel	dR/dv	3		7	%/GHz	2
	@ ±5 GHz offset		1.7		9.0		

Notes:

1. The normalized locker ratio R is defined as the normalized ratio of the etalon photodiode current $I_{PD,\lambda}$ to the reference photodiode current $I_{PD,ref}$ as expressed by the equation:

$$R = \frac{I_{PD,\lambda}}{I_{PD,ref}} \Big/ \left[\frac{I_{PD,\lambda}}{I_{PD,ref}}\right]_{MAX}$$

2. The locker slope is defined as the derivative of the normalized locker ratio R with respect to the emission frequency v.

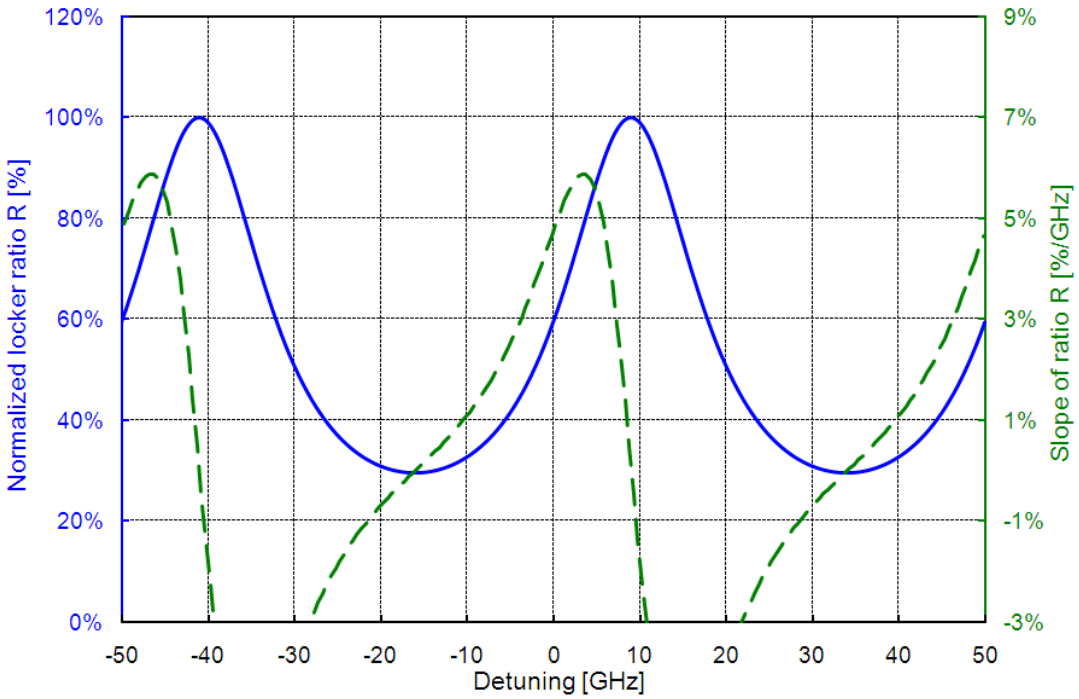


Figure 1 Typical locker response curve.

V. Fiber Connection

Parameter	Conditions	Symbol	Min	Typ	Max	Unit	Notes
Fiber type			Polarization maintaining single-mode fiber				1
Fiber length			0.9			m	
Mode field diameter			9.5	10.5	11.5	µm	
Fiber cladding diameter			122	125	128	µm	
Fiber polymer coating diameter			380	400	420	µm	
Polarization orientation			Parallel to slow axis of PM fiber				
Fiber bend radius			20			mm	
Fiber proof strength			200			kpsi	
			1.38			GPa	

Notes:
1. Fujikura SM15-PS-U40A-H PANDA or equivalent.

VI. Pin Descriptions

Pin	Symbol	Name/Description
1	TEC (-)	Thermo-electric cooler (-)
2	TEC (+)	Thermo-electric cooler (+)
3	Th	Laser thermistor
4		Not connected
5	GND (Th, PD)	Thermistor ground, photodiode common cathode
6	PD,λ	Etalon photodiode anode
7	PD,ref	Reference photodiode anode
8		Not connected
9	SOA	SOA anode
10	LD,gain (g)	Laser gain section anode
11	LD,phase (pc)	Laser phase section anode
12	LD,left (lr)	Laser left reflector anode
13	LD.right (rr)	Laser right reflector anode
14	GND (LD, SOA)	Laser + SOA common cathode
15		Not connected
16		Not connected
17		Not connected
18		Not connected
19		Not connected
20		Not connected
21		Not connected

VII. Mechanical Specifications

Dimensions are in millimeters.

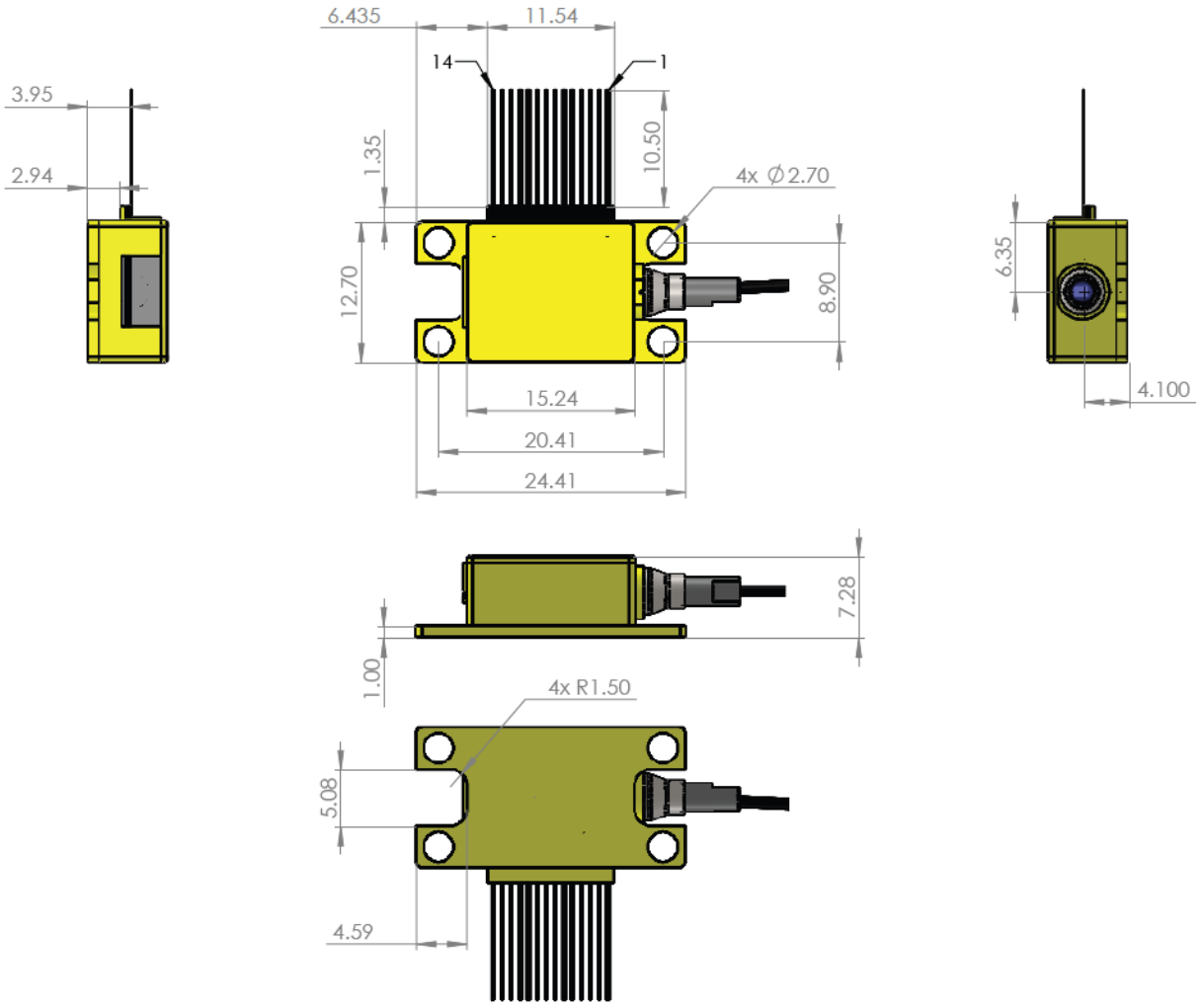


Figure 2 Mechanical drawing of the S7500 tunable laser

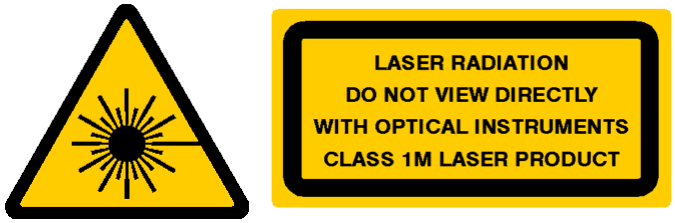
VIII. Electrostatic Discharge

S7500 tunable lasers have been tested according to TIA-455-129 (FOTP-129) “Procedures for Applying Human Body Model Electrostatic Discharge Stress to Package Optoelectronic Components” [2]. The S7500 tunable laser is classified as HBM ESDS Component Sensitivity Class 1A (per ESDA/JEDEC JS-001-2010 [3]).

CAUTION: **This device is susceptible to damage as a result of electrostatic discharge. Take proper precautions during both handling and testing. Follow guidelines such as JEDEC standard JESD625-B (January 2012) [4].**

IX. Laser Safety

The S7500 tunable laser is classified as class 1M per IEC standard 60825-1 (May 2014) [5]. This product complies with 21 CFR 1040.10 and 1040.11 [6] except for conformance with IEC 60825-1 Ed. 3., as described in Laser Notice No. 56, dated May 8, 2019 [7].



CAUTION: **Invisible Laser Radiation - Do not view directly with optical instruments (magnifiers). Viewing the laser output with certain optical instruments (e.g., eye loupes, magnifiers, and microscopes) within a distance of 100 mm may pose an eye hazard. Laser power up to 100 mW at 1.55 µm could be accessible if optical connector is open or fiber is broken. Use of controls, adjustments, and procedures other than those specified herein may result in hazardous laser radiation exposure.**

X. References

1. Directive 2011/65/EU of the European Parliament and of the Council, “on the restriction of the use of certain hazardous substances in electrical and electronic equipment”. Certain products may use one or more exemption as allowed by the Directive.
2. TIA-455-129 (FOTP-129) “Procedures for Applying Human Body Model Electrostatic Discharge Stress to Package Optoelectronic Components”
3. ESDA/JEDEC JS-001-2017 “ESDA/JEDEC Joint Standard for Electrostatic Discharge Sensitivity Test – Human Body Model (HBM) – Component Level”
4. JEDEC JESD625-B (January 2012) “Requirements for Handling Electrostatic-Discharge-Sensitive (ESDS) Devices”
5. IEC 60825-1 (May 2014) “Safety of laser products – Part 1: Equipment classification and requirements”
6. FDA/CDRH, 21 CFR 1040.10 & 1040.11 “Title 21 – Food and Drugs; Chapter I – Food and Drug Administration, Department of Health and Human Services; Subchapter J – Radiological Health; Part 1040 – Performance Standards for Light-Emitting Products; Sec. 1040.10 Laser Products & Sec. 1040.11 Specific Purpose Laser Products”
7. FDA/CDRH Laser Notice No. 56 (May 2019) “Laser Products – Conformance with IEC 60825-1 Ed. 3 and IEC 60601-2-22 Ed. 3.1 (Laser Notice No. 56) Guidance for Industry and Food and Drug Administration Staff”

XI. Revision History

Revision	Date	Description
7500001-A	2011-10-22	First release.
7500001-B	2011-12-08	Updated laser safety information.
7500001-C01	2015-11-09	Updated logo and RoHS statement.
7500001-C02	2021-10-04	Updated to II-VI template. Added 7550001 product variant.
C03	2025-02	Update to Coherent template, inclusion of version
C04	2025-07	Update package drawing, including PCN #1513250