DEEPLIGHT™

IN PRODUCTION - SHIPPING WORLDWIDE

Ultra-narrow linewidth, frequency agile, at chip scale

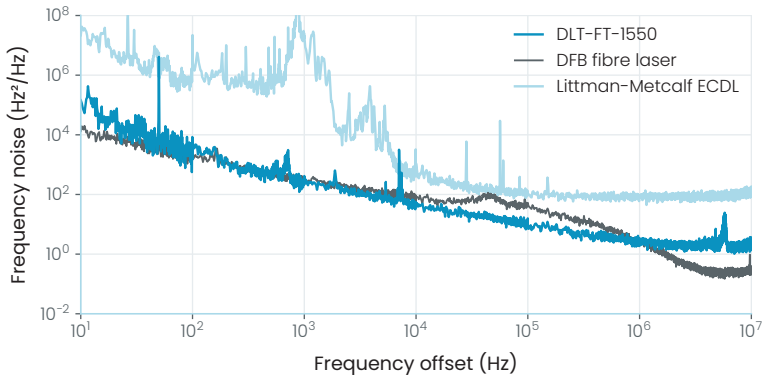
Monolithic piezoelectric actuators on the chip

DLT-FT-1550 · Ultra-narrow linewidth frequency-agile lasers, 1530 to 1565 nm

Coherent sensing asks one laser for two things at once: a linewidth narrow enough to resolve the signal, and a frequency sweep fast and linear enough to read it back. The usual answer is a benchtop assembly with a separate actuator for the sweep and a linearization stage to correct the hysteresis it leaves behind.

The DLT-FT-1550 puts both on one chip. The laser cavity is a silicon nitride photonic circuit, and the piezoelectric actuators that tune it are integrated monolithically on the same chip with industry proven MEMS technology.[1] The tuning is fast, linear and free of hysteresis, so FMCW runs without a linearization stage. You get this as a product: a hermetically sealed, industry standard 14-pin butterfly module, on its own or inside a controller ready laser head.

WAVELENGTH	INTRINSIC LINEWIDTH	ACTUATION BANDWIDTH	PLATFORM
1530 to 1565 nm	**Below 20 Hz**	**Up to 2 MHz**	**Silicon nitride**
centre 1550 nm	Lorentzian, typical	flat, starting at DC	on-chip MEMS actuators



Measured frequency noise. DLT-FT-1550 against a Littman-Metcalf ECDL and a DFB fibre laser. The Deeplight trace stays below the ECDL at every offset, and below the fibre laser from 10 kHz to 1 MHz.

KEY SPECIFICATIONS

- **Wavelength** 1530 to 1565 nm
- **Intrinsic linewidth** below 20 Hz
- **Integrated linewidth** below 1 kHz
- **Actuation bandwidth** up to 2 MHz
- **Chirp nonlinearity** below 0.5 % rms
- **Package** hermetically sealed 14-pin butterfly or laser head

Chip scale

The laser cavity and its tuning sit on one SiN-AlScN Photonic-MEMS chip, and the whole laser fits a 14-pin butterfly.

Hysteresis free

Fast, linear tuning with no correction stage in the signal path: FMCW without linearization.

Ultra-narrow linewidth

Below 20 Hz intrinsic linewidth, and ~2 kHz integrated over a 100 ms window.

Wafer scale production

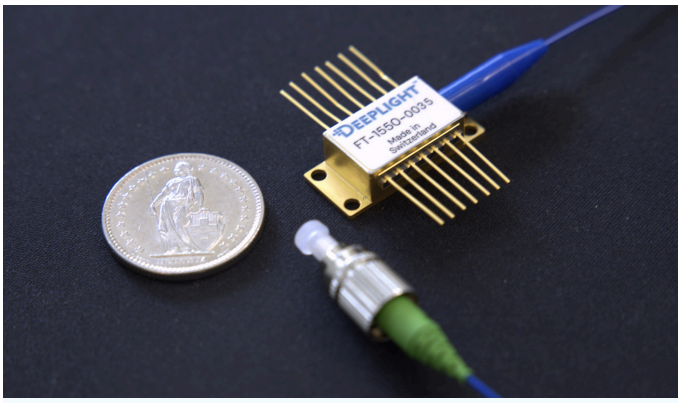
The photonic circuit is made at wafer scale, for high volume manufacture.

APPLICATIONS

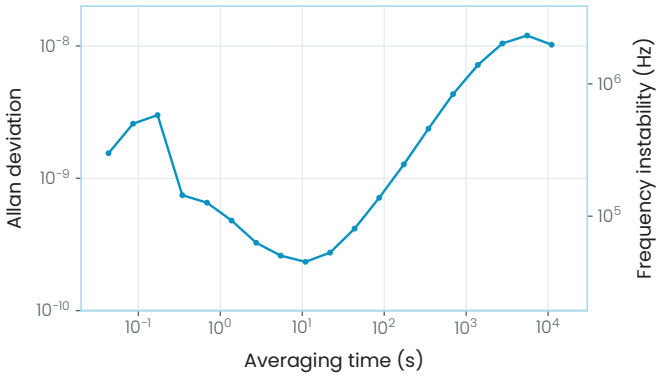
- Distributed fibre optic sensing
- Quantum: CV QKD and atomic clocks
- FMCW LiDAR
- Coherent communication
- Photonic computing
- Test and measurement, metrology

[1] G. Lihachev et al., Low-noise frequency-agile photonic integrated lasers for coherent ranging, Nature Communications 13, 3522 (2022), doi 10.1038/s41467-022-30911-6.

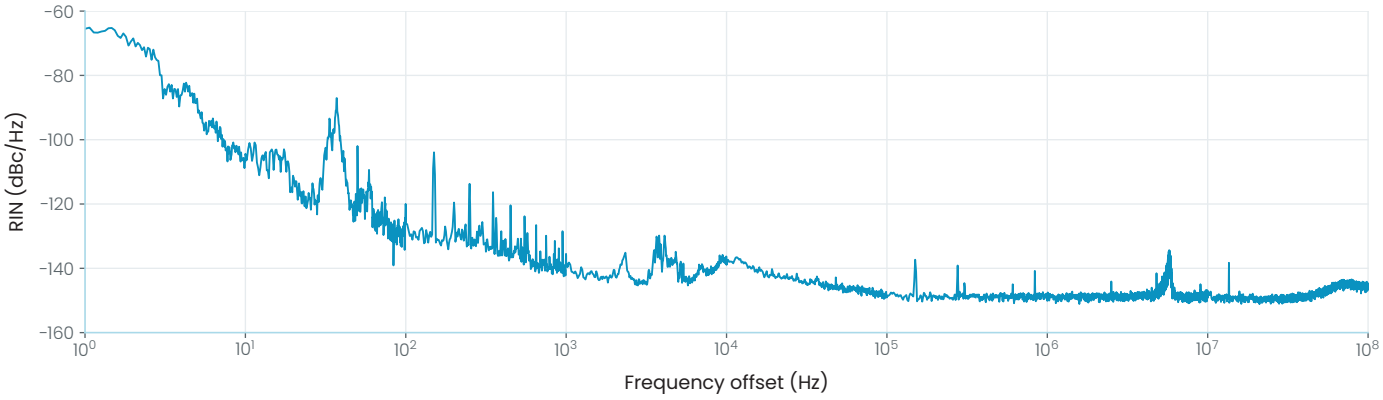
Measured performance



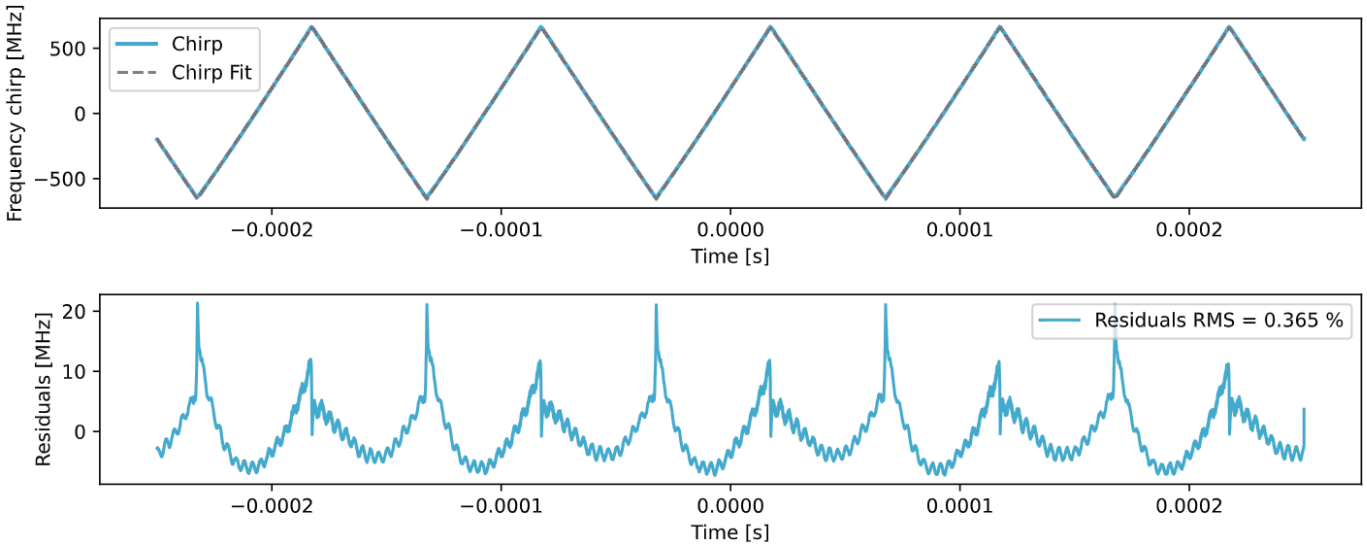
Hermetically sealed, industry standard 14-pin butterfly. The packaged laser, fibre pigtailed with PM fibre and FC/APC connector, next to a Swiss franc coin.



Frequency stability. Allan deviation with the equivalent frequency instability at 1550 nm on the right axis. The instability falls to 2.3 × 10^{-10} at 11 s, about 45 kHz, and stays below 5 × 10^{-10} from 1 to 50 s.



Relative intensity noise. Below -140 dBc/Hz beyond 10 kHz offset apart from single spurs, settling near -150 dBc/Hz above 100 kHz.



Linearization free FMCW. Triangular chirp at 10 kHz sweep rate with 50 Vpp on the piezoelectric actuator, above, over a tuning range of 1.3 GHz. The residual from a linear fit, below, is 0.365 % rms with no correction stage.

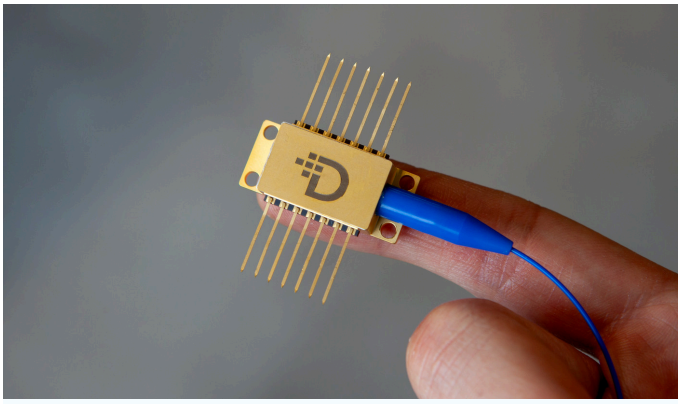
Typical performance parameters

Parameter	Min.	Typ.	Max.	Unit	Comments
Output interface		FC/APC			PM Panda fibre
Wavelength	1530	1550	1565	nm	Optional ITU grid channels on request
Output power		10	15	mW	
Operation current	100	250	400	mA	
Optical side mode suppression ratio	45	50	60	dB	
Intrinsic linewidth	<10	<20	<50	Hz	Lorentzian, instantaneous
Integrated linewidth	~1	~2	~4	kHz	100 ms integration time
Coarse wavelength tuning	0.5	0.75	1	nm	Bandwidth below 1 kHz
Laser frequency modulation range	1.5	2	2.5	GHz	
Laser frequency actuation bandwidth		1	2	MHz	Flat actuation response, starting at DC
Actuation efficiency	15	18	20	MHz/V	
Chirp nonlinearity	<0.1	<0.3	<0.5	%	At 10 to 100 kHz sweep rates

Values are given for a typical device and may vary from device to device.

Ordering information

Product code	Form	Included with every unit
DLT-FT-1550	Hermetically sealed 14-pin butterfly, fibre pigtailed, on its own or inside a controller ready laser head	Full characterization report and operating instructions.



Chip scale. The complete laser in its 14-pin butterfly package, on a fingertip.



Laser head. The controller ready head, with its temperature and current connectors, and a butterfly module on the lid.

Photonic integrated circuits change what a laser can be.
Request a quote or discuss your integration with our photonics experts.
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