

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

1530 to 1565 nm

centre 1550 nm

INTRINSIC LINEWIDTH

Below 20 Hz

Lorentzian, typical

ACTION BANDWIDTH

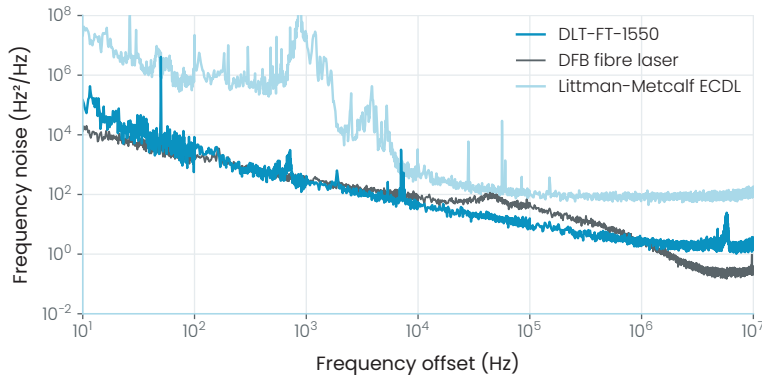
Up to 2 MHz

flat, starting at DC

PLATFORM

Silicon nitride

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-AIScN 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 below 1 kHz integrated over a 100 ms window.

+ Wafer scale production

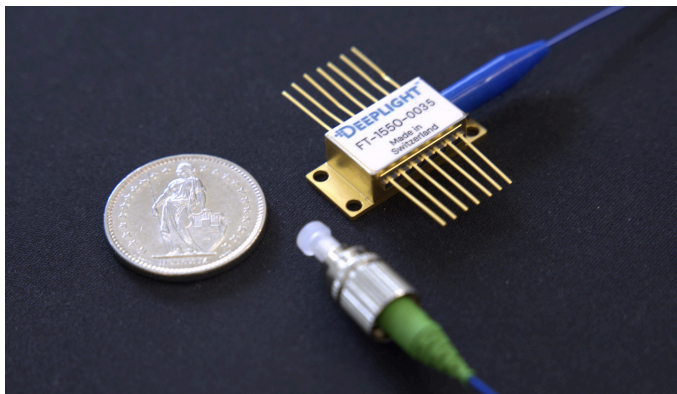
The photonic circuit is made at wafer scale, for high volume manufacture.

APPLICATIONS

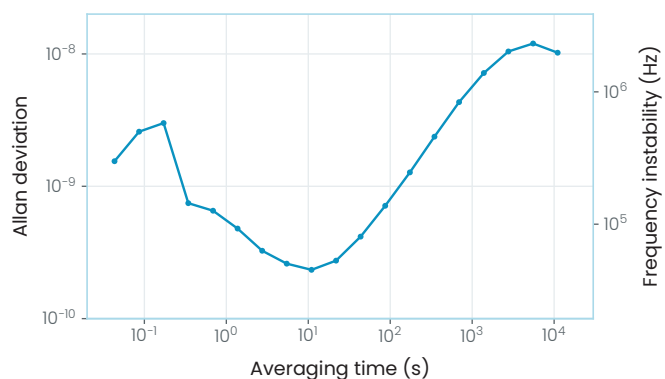
- Distributed fibre optic sensing
- Quantum: CV QKD and atomic clocks
- FMCW LiDAR
- Coherent communication
- Photonic computing
- Test and measurement, metrology

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.

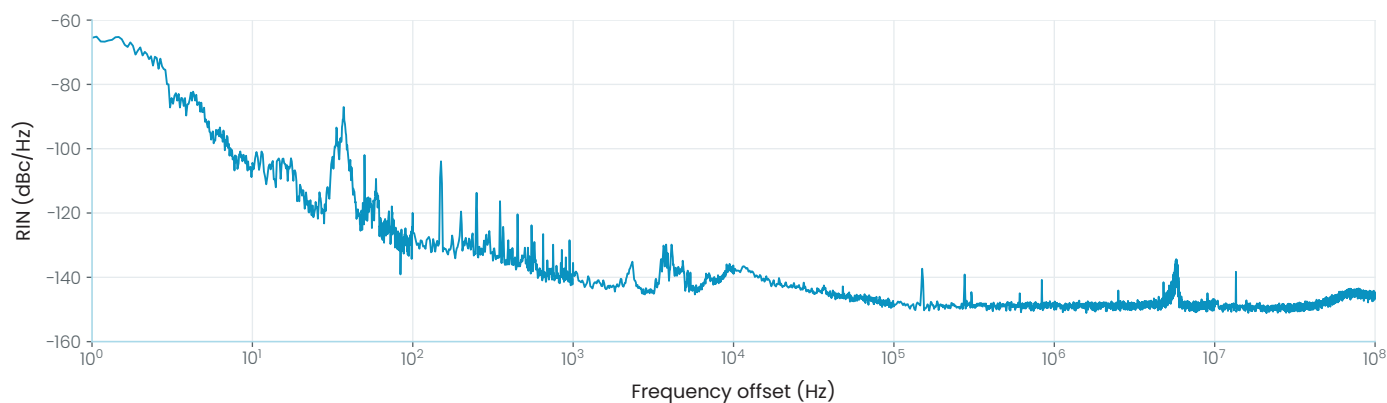
Measured performance



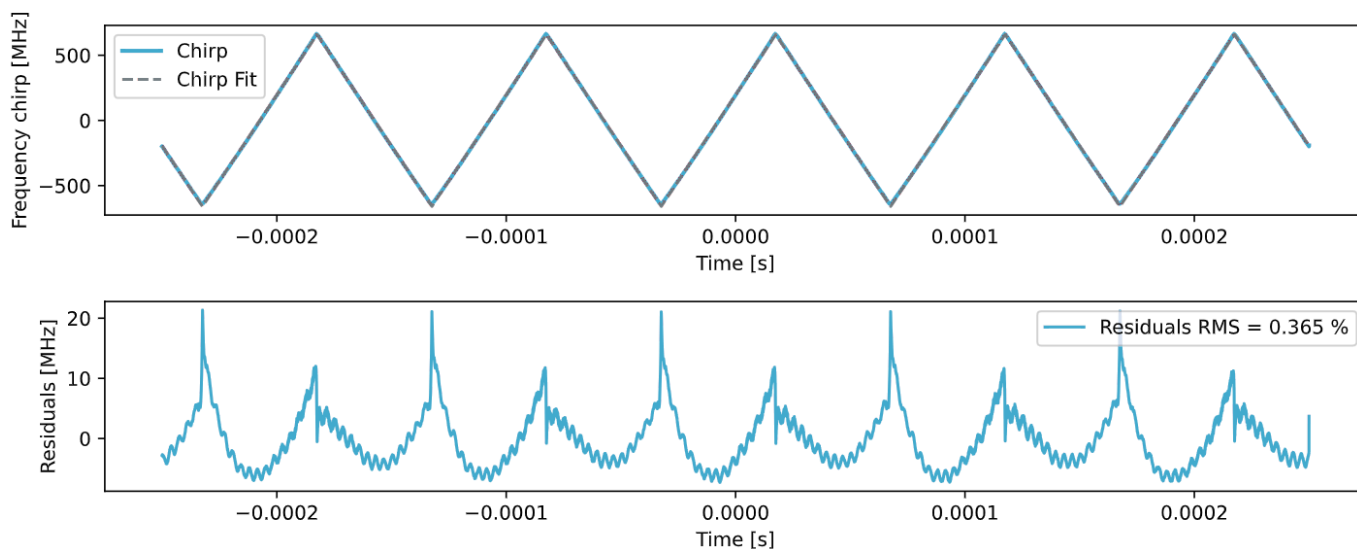
Hermetically sealed, industry standard 14-pin butterfly. The packaged laser, fibre pigtailed with PM fibre and FC/APC connector, next to a Swiss franc coin.



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.

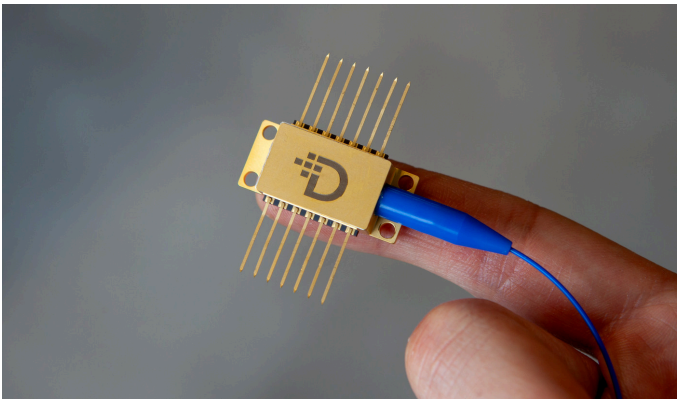
Typical performance parameters

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	1	5	10	mW	
Operation current	100	200	400	mA	
Optical side mode suppression ratio	45	50	60	dB	
Intrinsic linewidth	<10	<50	<100	Hz	Lorentzian, instantaneous
Integrated linewidth	<1	<3	<5	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.

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