

Enabling Optical Components and PICs for Emerging Applications

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Freedom Photonics Introduction

- F R E E D O M PHOTONICS
- Employee-owned Limited Liability Company based in Santa Barbara, California
 - ISO 9001:2015 certified
- Manufacturer of unique and innovative photonic components, modules and subsystems
 - 780nm to 1700nm wavelength range
- Application areas
 - Specialty communication systems (digital, analog, free-space optical)
 - Optical sensing and instrumentation
 - Industrial



Freedom Photonics Introduction







Freedom Photonics Introduction



- Team 45 people
 - 13 Ph.D. in photonics and related disciplines
- Divided across departments
 - Lasers and Photonic Integrated Circuits
 - Photodiodes
 - High-power lasers
 - Subsystems
 - FSO
- Full design and manufacturing
 - Device, optical, mechanical, electronics
 - Test, burn-in, packaging systems, qual





Freedom Photonics Products



- Fast tunable lasers from 1260nm to 1700nm
 - Swept tunable laser sources (introduced in 2019)
- High power lasers
 - DFBs, 1280nm and 1550nm, >400mW
 - Single spatial mode, >1W
- High-performance photodetectors
 - Up to 100 mA photocurrent, up to 115GHz, powers up to 27 dBm
- Private label products
 - Custom PIC solutions (780 1900nm)
 - Advanced micro-optic solutions















Current Product and Application Highlights

Customer Inspired



Fast Tunable Laser Sources

Application Areas



- Optical coherence tomography
- Gas sensing
- Instrumentation
- Fiber sensing
- Communications









Emissions Quantification Data								
Segment ID	Segment Rank	Emissions Rate (SCFH)	Emissions range (confidence)	Segment Length (ft)	Emissions Factor (SCFH/ft)	Estimated # of leaks	# Leaks/ft	Emissions Rate / Leak
-4	1	7.0	4 - 16 SCFH (90%)	1579	0.0044	5	0.0032	1.14
1	2	5.1	2-8 SCFH (90%)	3090	0.0017	5	0.0016	1.0
3	3	2.4	1-4 SCFH (90%)	2535	0.001	4	0.0016	0.6
2	4	1.5	0.5 - 2 SCFH (60%)	2514	0.0006	1	0.0004	1.5



Figure 2. EQ report data table and map for pipeline replacement

Vernier based fast tunable lasers in 1260nm – 1360nm, 1530-1690nm wavelength range





Fast Arbitrary Wavelength Swept Source



- Vertically designed product
- Currently at 1550nm, compatible with all wavelengths available at Freedom Photonics
- Markets: OCT, fiber sensing, spectroscopy





High Power Laser Sources and Photodetectors

Customer Inspired

RF Photonic Link Applications





Radars and other EM systems



Doppler Radar, Electronic Warfare



Cable TV (CATV) Networks



1280nm and 1550nm high-power DFB lasers



- World-record performance (power and efficiency)
- Markets: electronic warfare (1550nm), silicon photonics (1280nm)









1565nm



High Power Photodetectors





600mW of power









100 GHz Module and its Performance







A Couple of Private Label Examples

4-channel Tunable WDM Transmitter



- Monolithic integration of C-band tunable lasers with external modulators – single output fiber
- Single chip with integrated drive electronics and multichannel wavelength locker in custom TOSA package
- Specialty communications application





4-channel Tunable WDM Transmitter













Collimated Beam Source for Methane LIDAR



Receiver





Transmitter



Comb-Optimized DBR Laser (COMBO-DBR)

D1: DBR + SGDBR

















Future Directions

Free-Space Optical Transmitter



MOPA (Master Oscillator Power Amplifier) Laser

- High Power
- Single Mode









High Temperature Semiconductor Diode Laser Pumps for High Energy Laser Applications





Tunable Mode-hop Free 780nm, 795nm Laser Sources for Atomic Sensing





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Thank you!

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