Quarterly Financial Results Briefing
1st Quarter of FY2022

QD Laser, Inc.
August 2022

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Mission

With the power of the semiconductor laser, “I can’t” becomes “I can”.

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What was once thought to be impossible is now a reality;
we have become the only company in the world
to successfully mass produce Quantum Dot LASERs.

Our laser technology will enable
dramatic improvements in our ability to process information,
support visually impaired people, prevent eye diseases,
and enhance vision, continually pushing the boundaries of
human possibility.

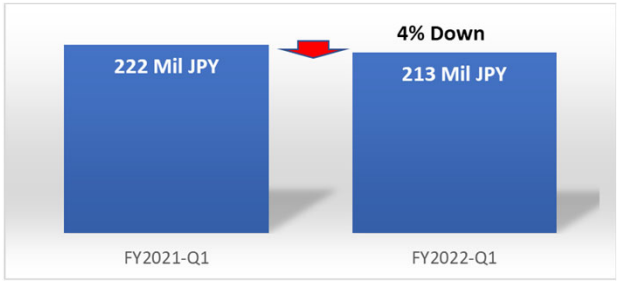
01

Financial Results for FY2022-Q1

Financial Results Highlights for FY2022-Q1 vs FY2021-Q1

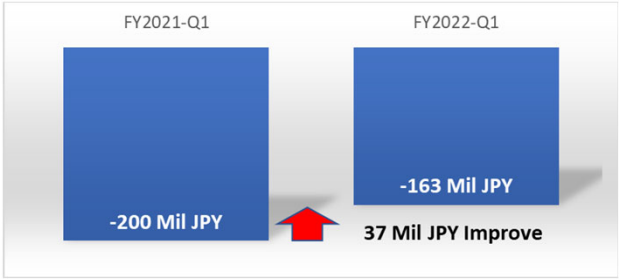
01 4% Sales Decreased

In the Laser Device (LD) business, orders for DFB lasers for precision machining and compact visible lasers for bio-inspection equipment increased, while orders for high-power lasers for sensors and NRE (Non-Recurring Engineering) decreased. Laser Eyewear (LEW) business grew 7%, but company-wide sales fell year on year.



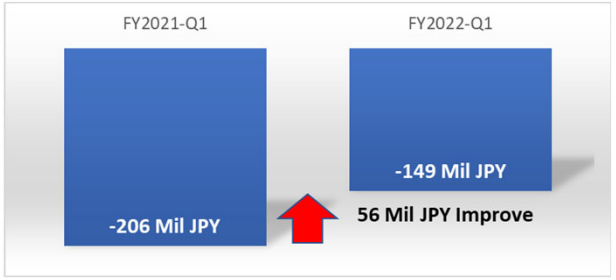
02 37 million JPY Operating Loss Improved

Operating loss improved due to improvement in gross profit margin due to changes in product mix and reduction in selling, general, and administrative expenses centered on transfer agent costs and labor costs. The LD business posted an operating profit of 7 million yen.



03 56 million JPY Quarterly Net Loss Improved

In addition to the operating loss reduction, the net loss improved due to the foreign exchange gains from the yen depreciation.



Financial Result Highlights for FY2022-Q1 vs FY2021-Q1

Sales decreased and loss improved compared to the same period of the previous year.
Sales increased in the LEW business but decreased in the LD business, resulting in an overall decrease of 4% year-on-year. LD business posted an operating profit of 7 million yen, and company-wide operating loss improved by 37 million yen year-on-year.

Performance Summary

(Million JPY)	FY2022 Q1	FY2021 Q1	YOY
Sales	**213**	222	△4% (△9)
(LD) (LEW)	**195** **17**	206 16	△5% +7%
Operating Profit or Loss (△)	**△163**	△200	+37
(LD) (LEW)	**7** **△81**	△37 △73	+44 △7
Ordinary Loss (△)	**△148**	△202	+54
Quartery Net Loss (△)	**△149**	△206	+56

Sales by Product Group

(Million JPY)	FY2022 Q1	FY2021 Q1	YOY
DFB Laser	**79**	49	+61%
Compact Visible Laser	**64**	32	+95%
High-Power Laser	**39**	56	△30%
Quantum Dot Laser	**12**	12	+5%
NRE	**0**	55	△100%
LD Total	**195**	**206**	**△5%**
LEW Total	**17**	**16**	**+7%**
Grand Total	**213**	**222**	**△4%**

Balance Sheet

Total assets decreased by 165 million yen due to a decrease in cash, deposits, and A/R, total liabilities decreased by 30 million yen due to the reduction in long-term borrowings scheduled to be repaid within one year, and the equity ratio was 89.2%.[*1] (88.9% at the end of the previous fiscal year).

Balance Sheet

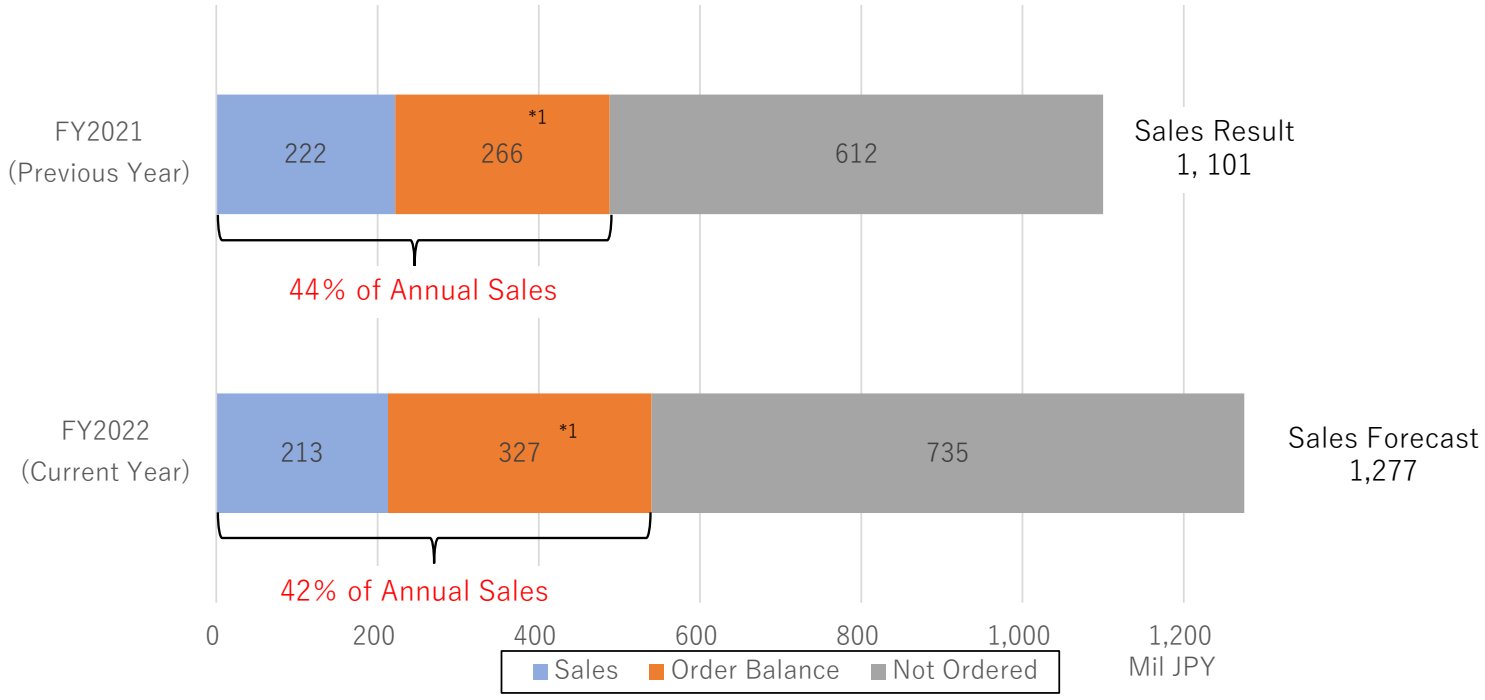
Million JPY	**End of June 2022**	End of March 2022	Increase/Decrease
Current Assets	3,576	3,729	△152
Fixed Assets	275	288	△13
Total Assets	**3,852**	**4,018**	**△165**
Current Liabilities	355	383	△28
Fixed Liabilities	48	51	△2
Total Liabilities	**403**	**434**	**△30**
Total Net Assets	**3,448**	**3,583**	**△135**
Total Liabilities and Net Assets	**3,852**	**4,018**	**△165**

*1： Calculated by deducting 12 million yen of stock acquisition rights from net assets

Order Status

As of the end of the first quarter, sales + order backlog (planned sales for the current fiscal year) is 42% of annual forecast sales (same pace as the previous year)

Sales + Order Backlog for Annual Sales Forecast



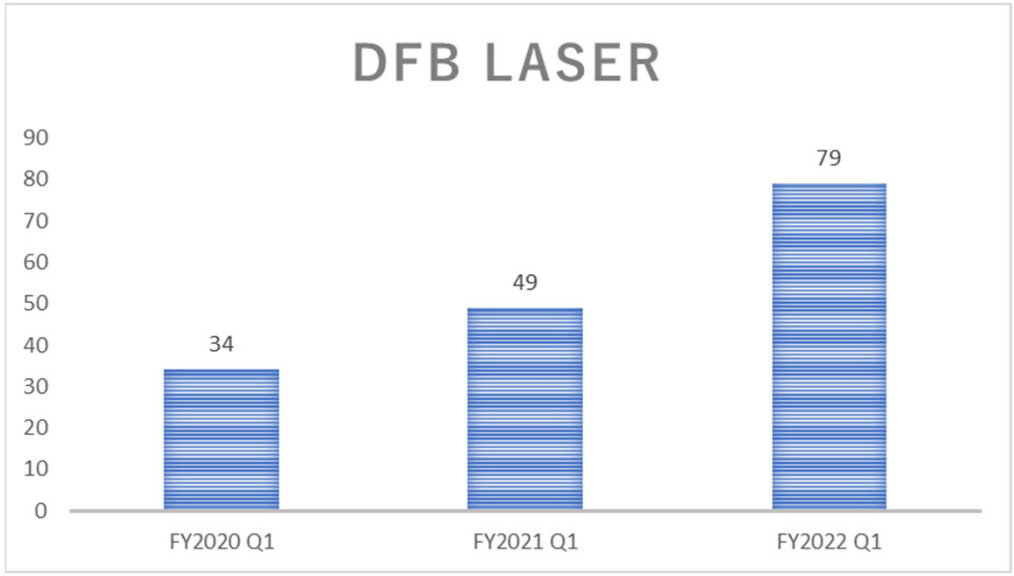
*1： Expected sales within the year

DFB Lasers for Precision Machining and Measurement：Sales in FY2022-Q1

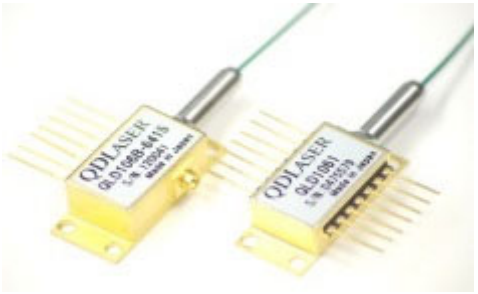
79 million JPY sales, increased by 61% YOY.

•North America: Sales increased by 1021% YOY with the mass production of new equipment for precision machining started the previous year and solid orders for existing products.
•Europe: Sales of light sources for inspection equipment in the semiconductor wafer process increased by 82% YOY.
•Europe: Sales of light sources for precision machining and geomagnetic observation increased by 331% YOY.
•JAPAN： Sales of light sources for precision machining increased by 3 million JPY YOY.
•JAPAN： Sales of light source prototypes for inspection equipment in the semiconductor wafer process increased by 3.24 million JPY YOY.

Sales of Q1 in
FY2019, 2020 and 2021



DFB lasers
Left：for 15 ps pulsed operation
Right：for 50 ps pulsed, ns pulsed, and CW operations



*1： Classified for convenience according to application, including some FP lasers, etc.

Compact Visible Lasers：Sales in FY2022-Q1

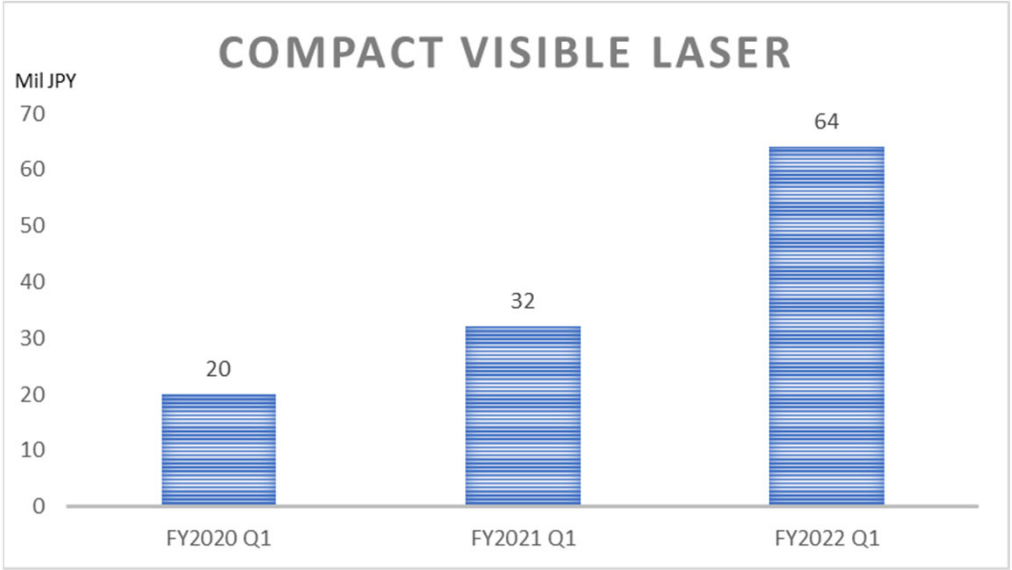
64 million JPY sales, increased by 95% YOY.

•China: Sales increased by 117% YOY with the expanding mass production, including a new application (cell sorter*1) in the biomedical equipment manufacturer.
•Europe: Orders from a biomedical STED*2 microscope manufacturer resumed last fiscal year, with a forecast of 100pcs in 2022-2023. The sales of this term were 1.79 million JPY,

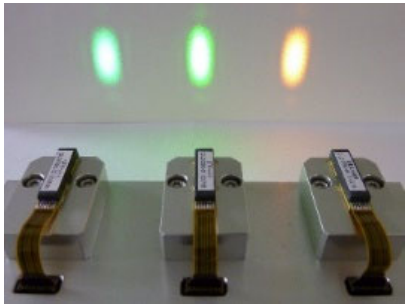
•Europe: Newly certified by one customer for microscope applications last fiscal year, with this term sales increased by 289% YOY.

•Japan： Order started for the biomedical equipment manufacturer with sales of 2.97 million JPY.

Sales of Q1 in
FY2019, 2020 and 2021



Compact visible lasers
Left: green,
Middle: yellow-green, and
Right: orange.



*1: A type of flow cytometer to separate specific cells.
*2: STED: STimulated Emission Depletion microscopy. A type of fluorescence microscope.

High-Power Lasers：Sales in FY2022-Q1

39 million JPY sales, decreased by 30% YOY.

・China: Orders of light sources for sensors and levelers decreased by 80% YOY due to the suspension of factory operations under COVID 19.

・Europe: Increased sales of light sources for sensors with 3.02 million JPY. ・North America: Increased sales of light sources for machine visions by 110% YOY.

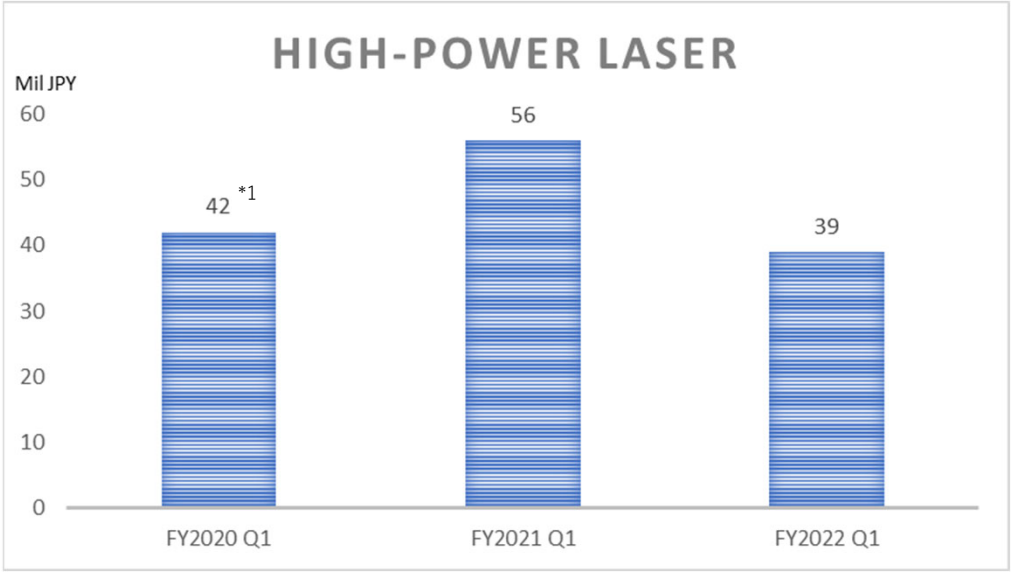
•North America: Increased sales of light sources for particle counters in semiconductor factories with 1.46 million JPY.

•Japan： Sales of light sources for sensors of wafer transfer machines in semiconductor factories increased by 301% YOY.



High-power lasers
TO package

Sales of Q1 in
FY2019, 2020 and 2021



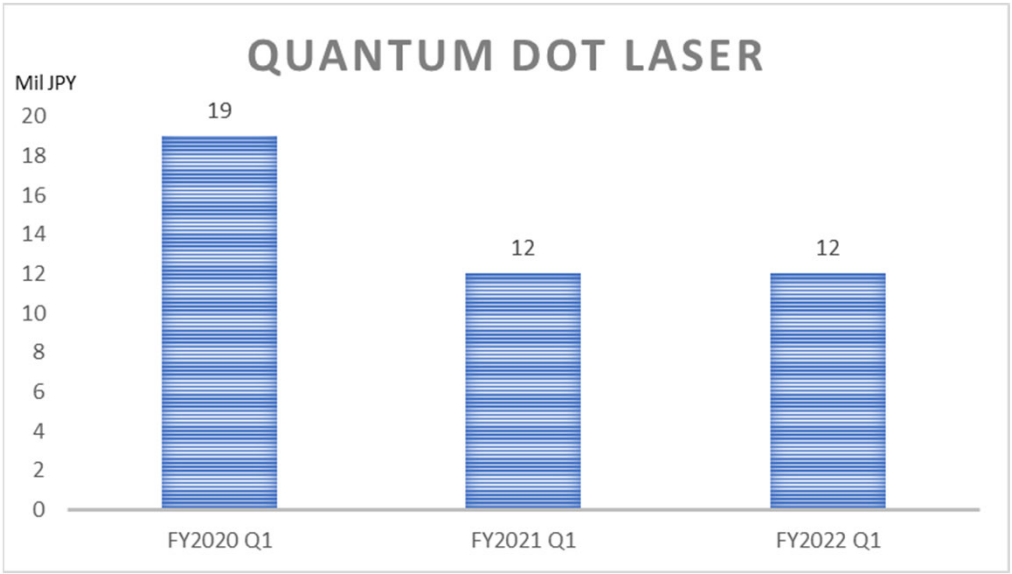
*1： 2 million yen moved from "Other" to "High power laser" due to product group rearrangement

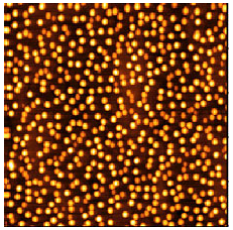
Quantum Dot Lasers[*1]：Sales in FY2021

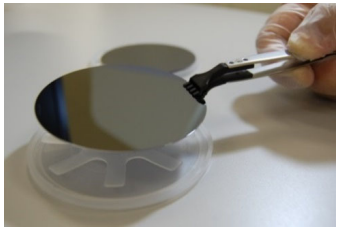
12 million JPY sales, increased by 5% YOY.

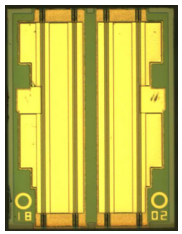
• QDLaser is working on quantum-dot lasers for silicon photonics with nine customers in Japan, the US, and Europe.
•Japan: Completed the development of highly efficient chips for the optical connector and chip-to-chip communication customer. Shipped chips as mass production. Continuing activities to reduce costs. Mass production is scheduled to start in 2023.
•North America: Shipped to customers working on LiDAR and the optical connector and chip-to-chip communication
•China： Increased sales of light sources for data communication by 238% YOY.

Sales of Q1 in
FY2019, 2020 and 2021




Quantum dot


Quantum dot wafer


Quantum dot laser chip

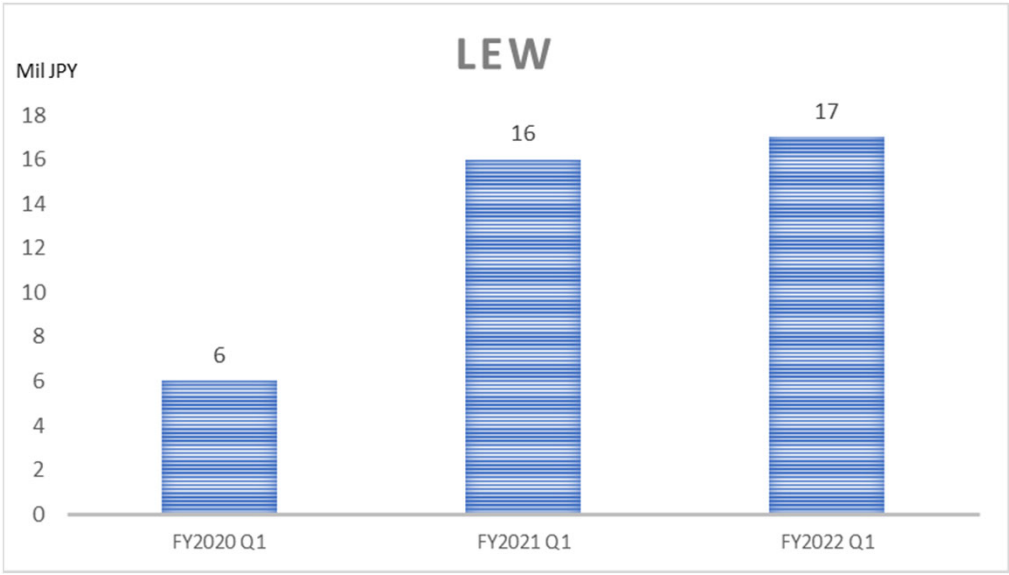
*1: Classified for convenience according to application; includes some quantum well lasers, etc.

Laser Eyewear (LEW) : Sales in FY2021 -1Q

17 million JPY sales, increased by 7% YOY.

■RETISSA Medical
・Promotion by Santen Pharmaceutical and Seed to 479 hospitals on corneal diseases.
・Started to introduce not only RETISSA Medical but Display II, ONHAND to medical institutions with high interest in retinal imaging.
■RETISSA Display II /CAM (Consumer Product)
・More than thirty low vision experienced at the MIRAIRO HOUASE Semi-Permanent Exhibition:
https://www.mirairo.co.jp/information/post-220502
https://www.youtube.com/watch?v=Dm-LFtDwYi8
・Local Municipality Subsidy with 90% benefit registered in 9 areas in Tokyo. Plan to expand to many cities nationwide.
・Rental at WAKASA-SEIKATSU antenna shop. Customer's interview entitled "Practicing to see with both eyes" on https://www.retissa.biz/.
■NRE
・Improved the resolution of flat mirrors for next-generation eyewear and delivered their parts.
・Developed fundus imaging equipment and delivered laser retinal projection parts.
■ New three products
・ONHNAD: Received an order of 100 units from a contracted distributor.
・RNV(Super Capture): Coordinating business cooperation with a digital camera manufacturer.
・MEOCHECK: Concluded a general sales agent contract (750 units sold for one year until the next term). Received an order for ten prototypes

Sales of Q1 in
FY2019, 2020 and 2021




RETISSA Display II


RD2CAM


RETISSA Medical

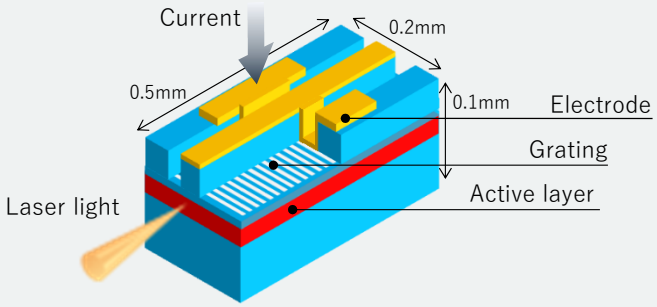
02

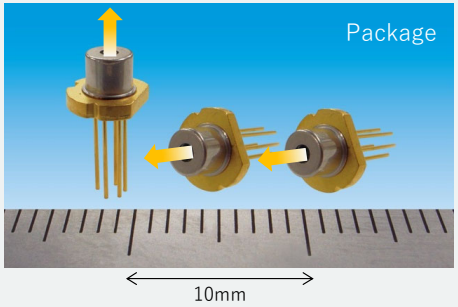
Semiconductor Laser Devices

Solid Earnings Base and High Growth Potential
under Global Laser Market Expansion

What is a Semiconductor Laser?

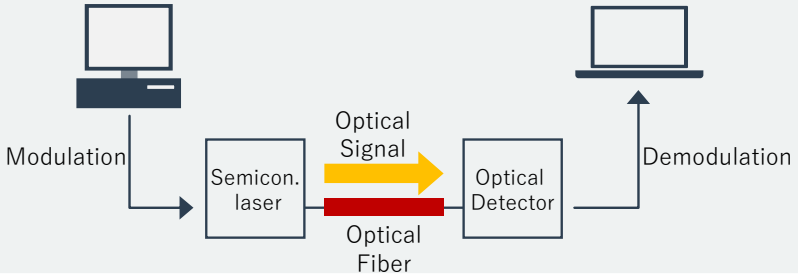
A tiny device to provide laser light by injecting an electric current through a semiconductor.



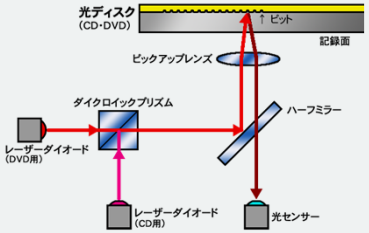


First Large-Scale Applications of Semiconductor Lasers: Optical communication and optical recording have significantly contributed to the global information and communication infrastructure.

Optical Communication@1310, 1550 nm



Optical Recording@660nm, 450nm





CD/DVD/Blu-ray

Expected Role of QD Laser, Inc.

Semiconductor Laser History and Our Position in the 3rd Phase

1st phase
Proposals of Scientific Principles and Invention of Laser (1960s)

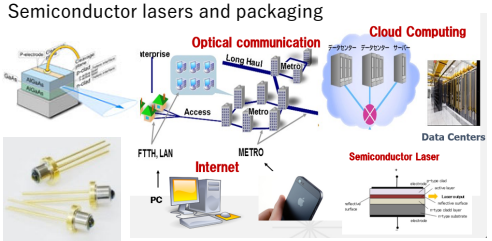
Laser

A technology used in recording, communication, processing and sensing.

Applied in various industries such as medicine, home appliances, automobiles, manufacturing and entertainment.

2nd phase
Invention of Semiconductor Lasers, Building out Optical Communication and the Internet (1995~)

Semiconductor lasers and packaging



Semiconductor laser:

A small element with a length of about 1 mm that causes a laser to oscillate by passing a current through a semiconductor. Compared with other lasers, possesses excellent properties such as ultra-small size, high-speed modulation characteristics reaching several 10s of GHz, high power-to-light conversion efficiency (in several 10s of %), and wavelength controllability, etc.

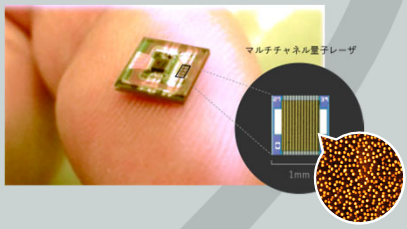
3rd phase
Accelerating the Integration of Humans and Information(2020s~)

Fields where our lasers are applied (being Developed or Commercialized)

- 5G base station
- Supercomputer
- Visual Aid
- Smart Glass
- Optical Interconnect
- Facial recognition
- Fundus photography
- Micromachining
- In-Vehicle communication
- LiDAR for autonomous cars
- Biophotonics
- Visal field testing

Nanotechnology of QD laser to generate and control laser light

Image of quantum dots taken by an atomic force microscope and a quantum dot laser equipped on fingertip-sized silicon chip as 100Gbps optical transceiver



Quantum Dot Laser:
A semiconductor laser adopting a quantum dot structure which has a semiconductor nano-sized microcrystal in its active layer.
Compared with existing semiconductor lasers, these lasers are superior in temperature stability, temperature resistance, and low noise.

New Era for Semiconductor Lasers

We are developing products for all applications shown below and have launched a part of them.

■ **Optical interconnect ⇒ enhancing the computing and data processing power**





■ **Display ⇒AR/VR/XR**

Smart Glasses

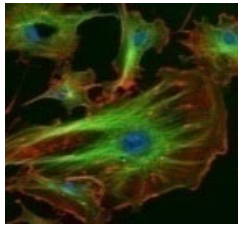


Head-up display



■ **Sensor ⇒ Precise detection of human and material (shape, position, velocity)**

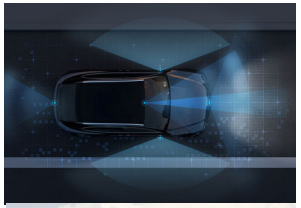
Biomedical



Face recognition



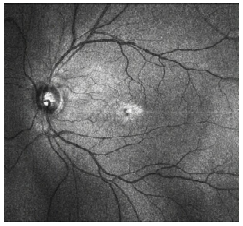
LiDAR（Automotive, Robotics, Drone）



Motion recognition

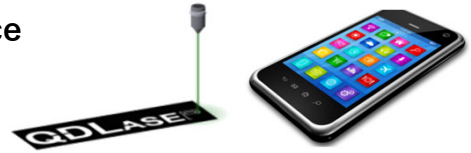


Fundus, Sight, Field of view





■ **Micromachining**
⇒Highly functional/high precision device manufacturing

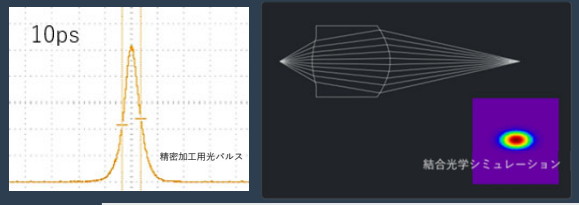


Our Core Technologies and Competitive Advantages

Material Creation, Design, and Control
Cutting Edge Semiconductor Laser Technology with Several Unique Features

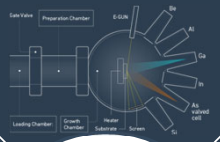
Laser Design

A technology to design lasers suitable for each use.
World's fastest (10ps)*3 semiconductor laser
for precision material processing
utilizing optical communication technology,



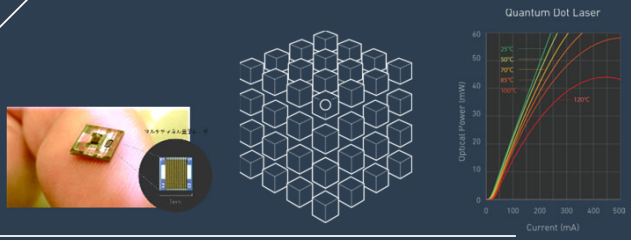
Semiconductor Crystal Growth

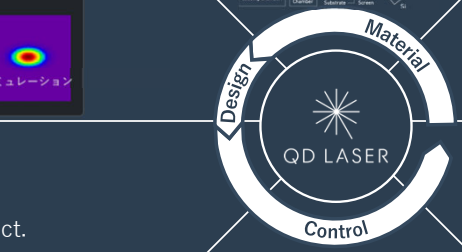
Technology to grow
each atomic layer of semiconductor crystals
on a semiconductor substrate



Quantum Dot

Succeeded in the mass production of
quantum dot lasers with world's highest operating temperature *1
and developed world's smallest silicon-based optical transceiver *2





Small Module

A technology to make DFB lasers ultra compact.
Our yellow/orange laser modules led us
to become one of the finalists at the Prism Awards 2014.



VISIRIUM Technology

A technology to project
images directly on the retina
through ultra small laser projectors.
World's First Commercialization*4



Diffraction Grating

Technology to form periodic refractive index change inside the laser
enabling arbitrary wavelength control.
World's first*5 commercialization of yellow/orange semiconductor laser



*1: "Extremely high temperature (220° C) continuous-wave operation of 1300-nm-range quantum-dot lasers", Published in 2011 Conference on Lasers and Electro-Optics Europe and 12th European

*2: Developed the world's smallest 5mm square ultra-high-speed, low-power-consumption optical transceiver – Achieved the world's best, 25Gbps / ch transmission speed –

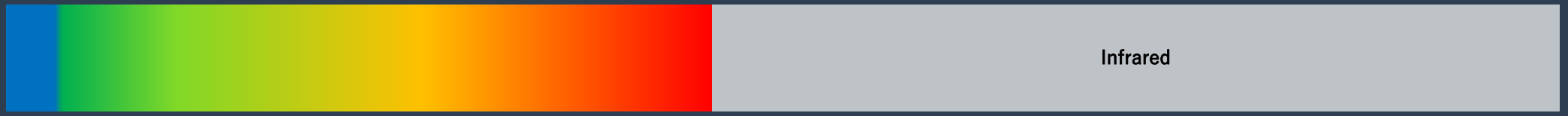
*3: 2017 PRISM Award in Industrial Lasers - QD Laser (2nd Feb 2017)

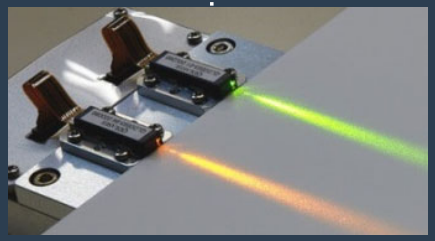
*4: Prism Awards honour photonic innovations at Photonics West 2019

*5: Japan/U.S. PATENT JP5362301/US8896911

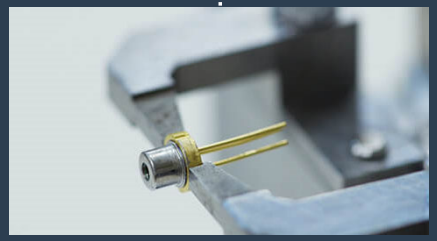
Variations on semiconductor lasers developed and sold by QD Laser

QD Laser provides a wide range of semiconductor lasers with wavelengths suitable for each application





#2 Compact Visible Laser



#4 High Power Laser

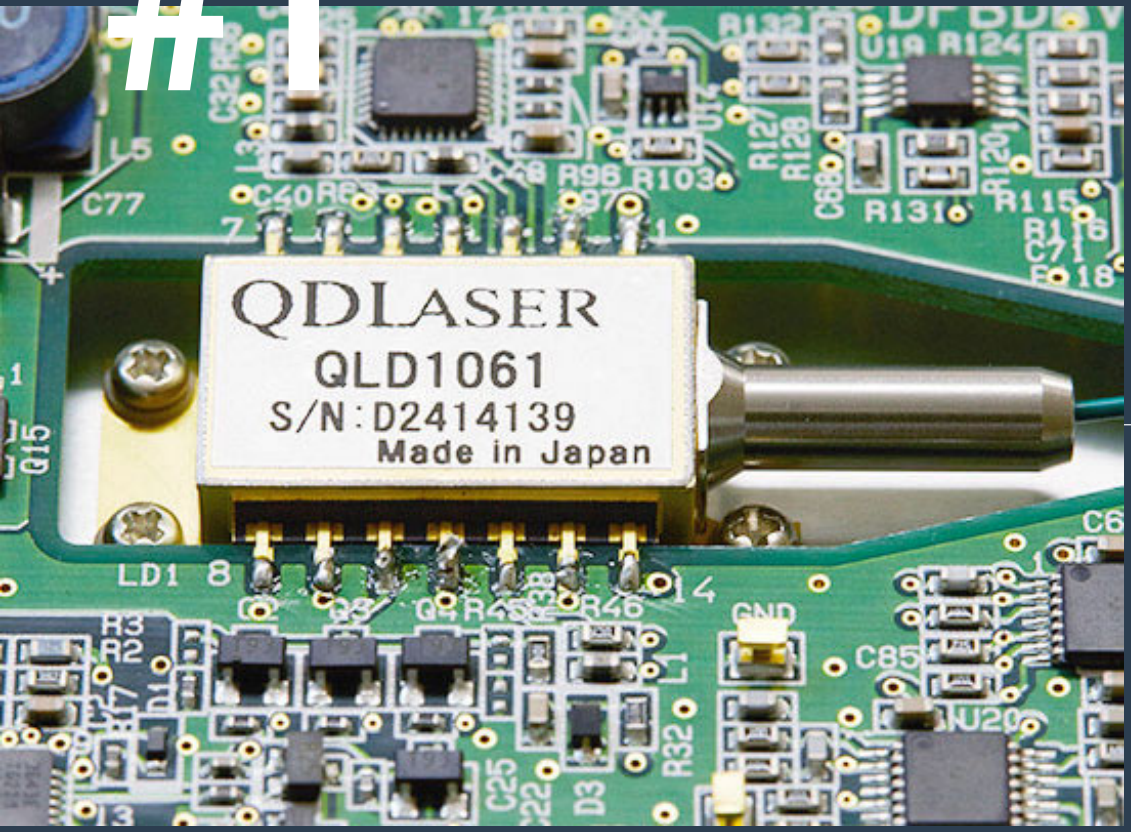


#1 DFB Laser



#3 Quantum Dot Laser

#1



DFB Laser

- Applications: Laser processing, measurement, and LiDAR.

Amplifies only the wavelength selected by the diffraction grating. **High output power, high stability, and low noise.** Provides the optimum wavelength for a wide range of applications and required performance.

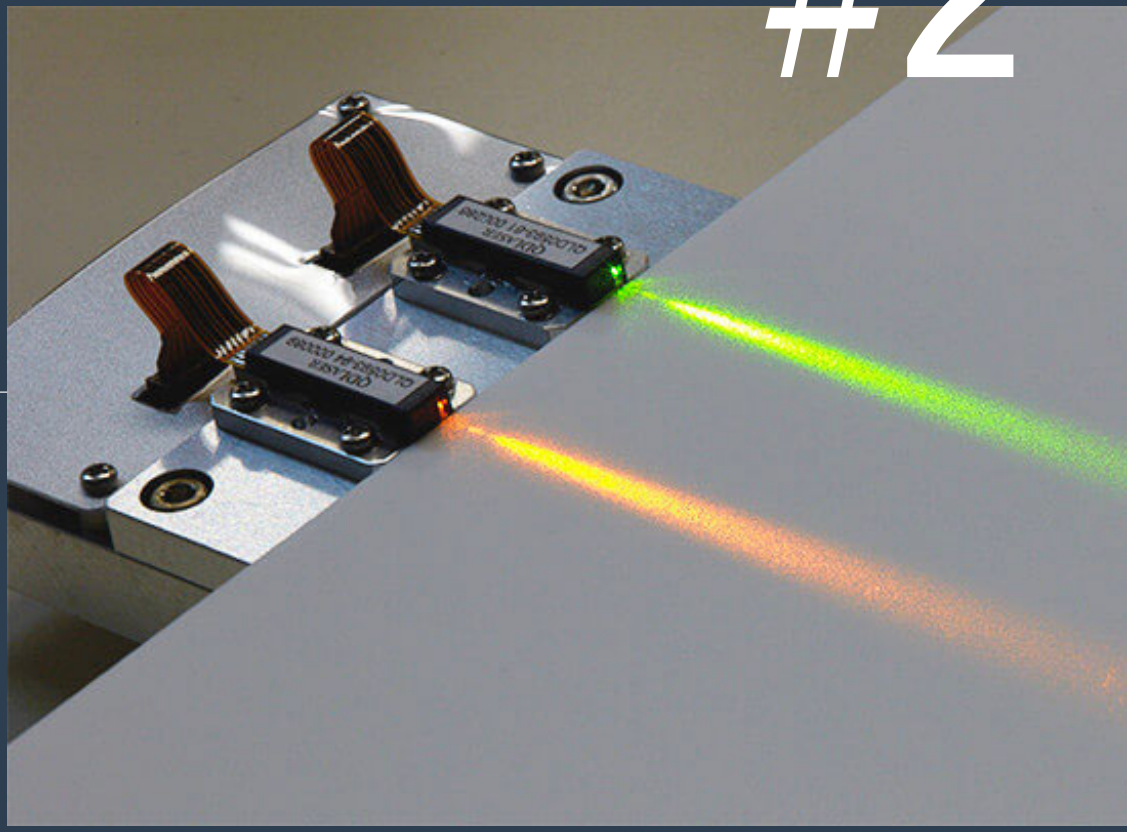
- **Wavelength lineup of**
  1030, 1053, 1064, 1080, 1120, 1180nm
- **Provided in 1nm unit**
- Non-heated processing is possible by **short-pulse operation in picoseconds.**
- **Highly stable and low noise** enables high-precision machining and measurement.
- Only a few companies worldwide can manufacture DFB lasers in this wavelength band.

#2

Compact Visible Laser
Small Multi-Color Laser Light Source
- Application ：Biomedical

Green, Yellow-Green, and Orange visible laser

The patented technology * 1 realizes a small device that other companies cannot manufacture.



- Wavelength lineup of 532, 561, and 594nm.
- Used for “flow cytometer", "cell sorter" , "laser microscope", "fundus diagnostics" etc.
- Wavelength range where there is no direct emitting semiconductor lasers.
- Wavelength doubling with a nonlinear optical crystal.
- Unique semiconductor laser chip and wavelength conversion crystal package achieves miniaturization.
- Low noise and excellent pulse stability.

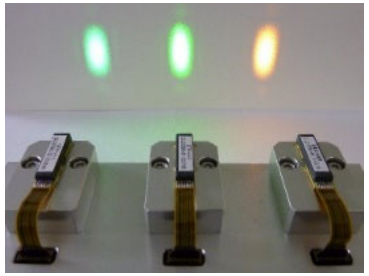
*1： Japan/U.S. PATENT JP5362301/US8896911

Launch of Palm-Sized Multi-color Compact Laser Light Source for Biomedical Equipment

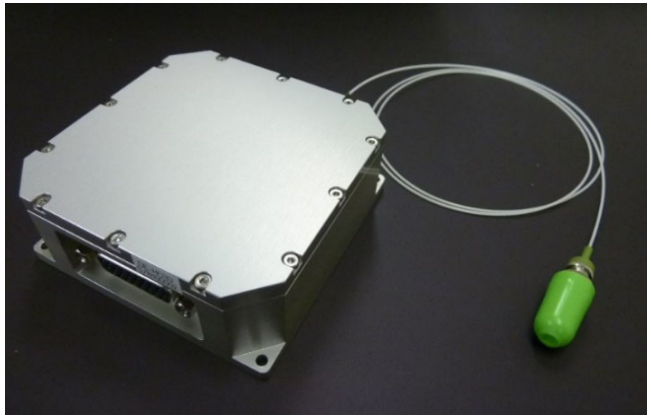
High value-added solution for biomedical equipment *1

- This light source provides manufacturers with all laser wavelengths required for any biomedical equipment in one palm-sized compact module *2 with stable output power and plug-and-play operation.
- This product enables manufacturers to miniaturize their equipment and shorten the development and production period as a new solution.
- Under testing by equipment manufactures.
- QD Laser aims for an industry share of *3 20% in light sources for biomedical equipment in five years.

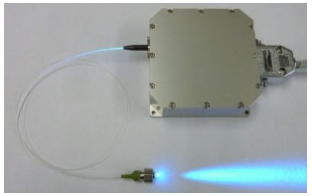
Compact Visible Lasers



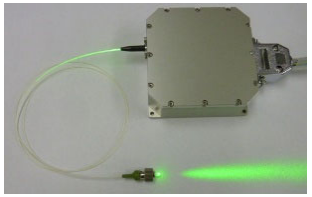
Integrated into



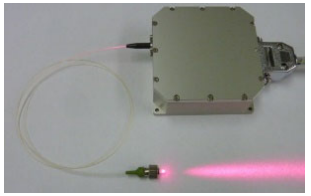
Palm-Sized Multi-color Compact Laser Light Source (80 x 80 x t30mm)



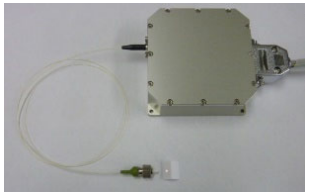
488nm



561nm



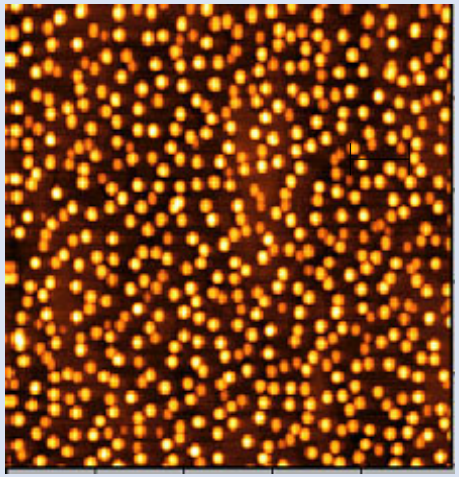
660nm



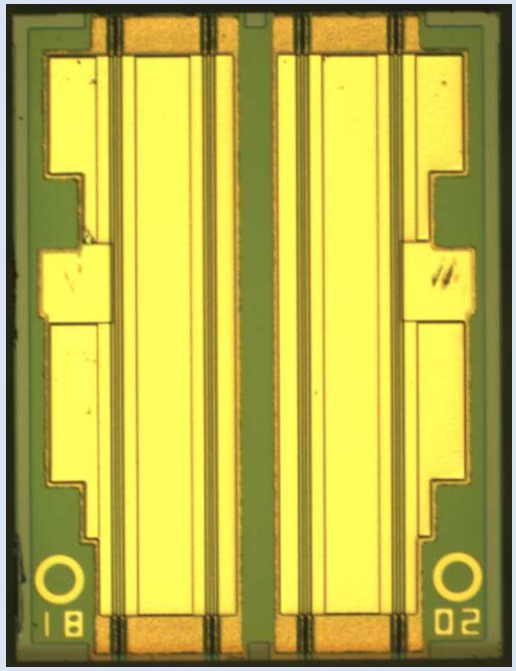
785nm

*1: Biomedical equipment is flow cytometers, ophthalmic examination equipment, fluorescence microscopes, and the like.
*2: The total volume of the driver integrated light sources is less than 50% of other company's products.
*3: Estimated annual accessible market size is 12,500 units. (8,000 out of 16,000 units for flow cytometer based on the "Global Flow Cytometer Market 2020-2024", and 4,500 units for an ophthalmic medical device)

#3



100 nm



Quantum-dot laser

- Application：Optical communication, LiDAR, and Silicon photonics.

Mass-produced by our world's only technology.

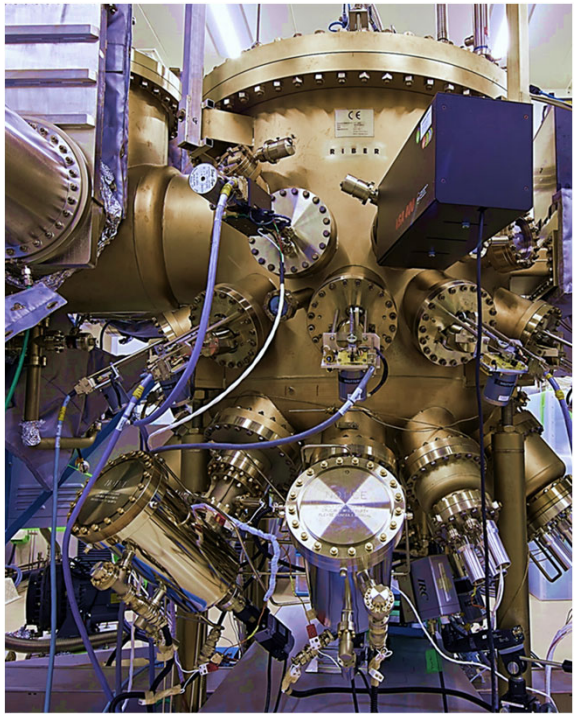
Achieved the world's highest operating temperature with excellent temperature stability at 1300nm.

- The wavelength lineup is 1200-1330nm.
- Silicon photonics (optical connector-chip communication, LiDAR) is evolved by quantum dot laser.
- Can operate even in a high temperature environment of 150-200 ° C . The operating limit temperature of a normal semiconductor laser is 80-100 ° C.
- Can be used in high-temperature environments such as servers, wireless base stations, and automobiles.
- Excellent reflected return light resistance, leading to miniaturization by eliminating isolators.

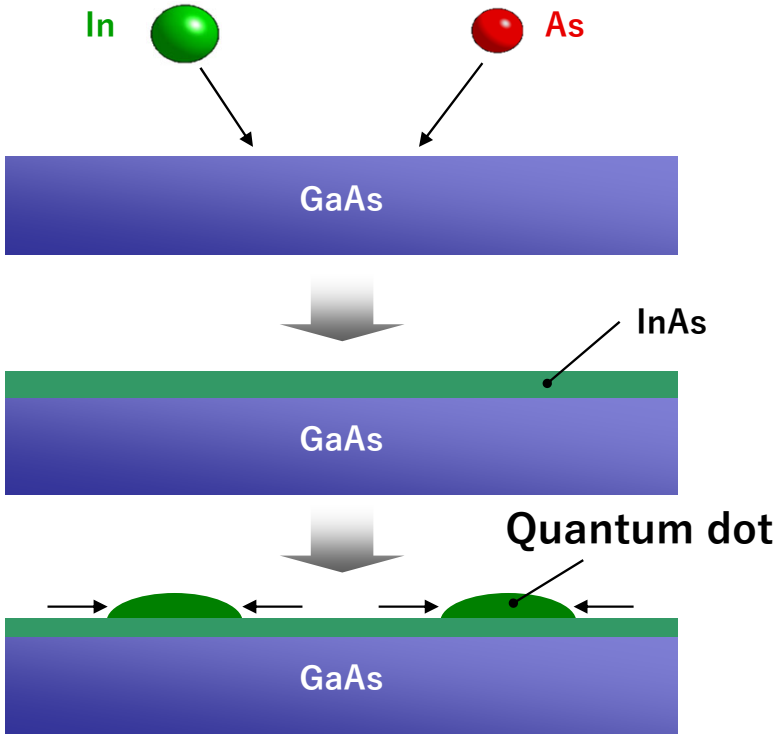
QDLaser's World Only-One Mass-Production Technology of Quantum Dot Lasers

- Introduction of mass-production MBE（Molecular Beam Epitaxy) system
- Control of temperature, indium source supply, and arsenic pressure at each second.
- Material recipe and know-hows for optimum growth conditions with several-tens-of-years experience (secret internal techniques which are intentionally not patented)

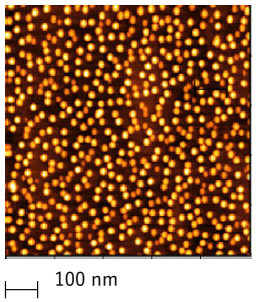
Mass production MBE system



Growth sequence of quantum dots (illustration of side view)



Atomic force microscope (top view) of quantum dots



Tangible Silicon Photonics Market as Electronic / Optical Integrated Circuit Technology Platform

Customizing quantum dot lasers for Japan/US/EU silicon photonics vendors. Starting mass production in FY2021-2023.

Development and production

2010
World's first mass production of quantum dot laser for optical communication

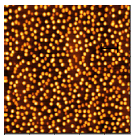
2012
Started development of quantum dot laser for silicon photonics

2017
Established mass production system of quantum dot lasers for silicon photonics (supplied to AIO core)

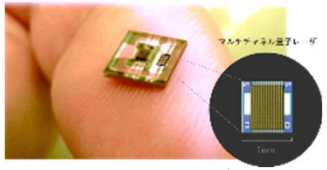
2019
Our products installed in the "Ultra-thin connector integrated active optical module (I-PEX EOM)" developed by I-PEX

2021
Working on joint development with silicon photonics vendors around the world. Starting mass production for chip-to-chip optical interconnect and Lidar during FY2021 to FY2023.

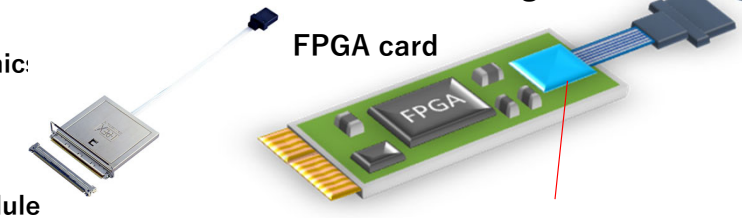
Quantum Dots



100Gbps optical transceiver with quantum dot lasers as light sources

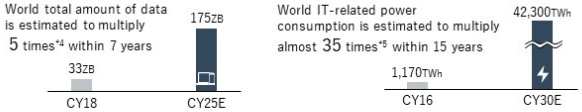


Optical Connector(EOM *1,CPO *2) : 8K-SHTV/ FA/ PCIe-Gen5/AI engine



Increased data and power consumption to be solved by Silicon Photonics

Problem
Increasing demand for global data in turn creates a global issue of increasing power consumption



Solution
Silicon photonics with quantum dot lasers mounted on silicon chips enable dramatic improvement in semiconductor performance*6

Power consumption reduction	Footprint	Processing speed
90%	1/100	100x

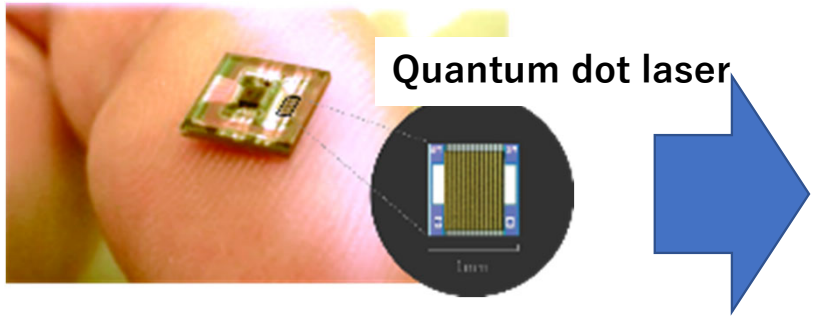
Huge information processing application that requires high-temperature operation

Date Centers	5G base stations	Automatic Driving/LiDAR
80°C	105°C	105°C

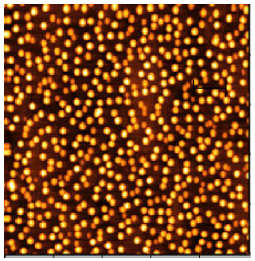
*1 EOM:Electro-Optical Module
*2 CPO:Co-Packaged Optics

I/O core with Quantum-Dot Lasers Ready for Commercialization

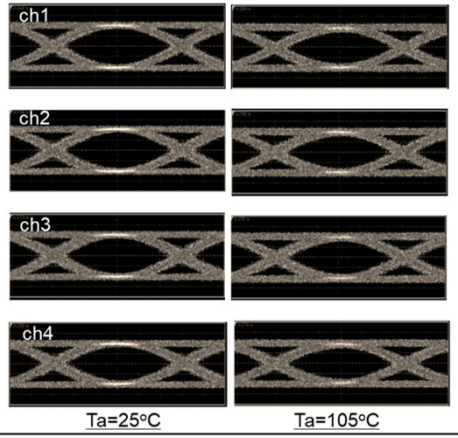
100Gb/s Silicon photonics chip named I/O core of AIO Core with QDLaser's 4-channel quantum dot lasers

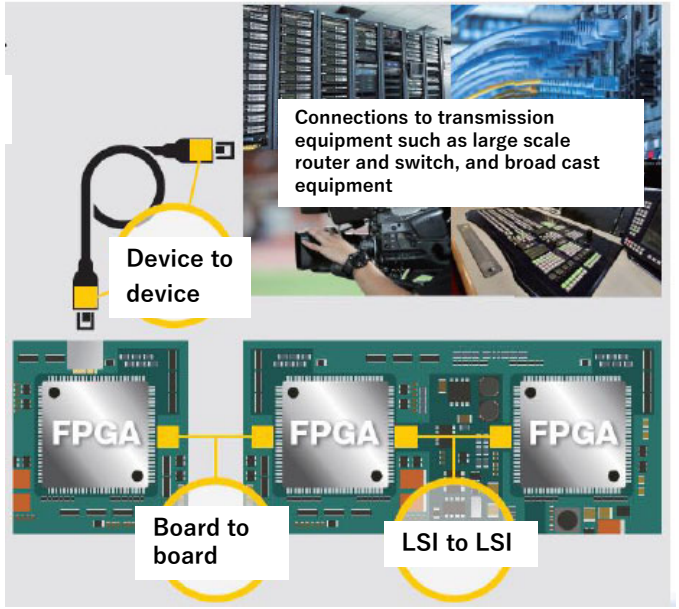


Quantum dots



Optical eye diagrams at 25Gbps

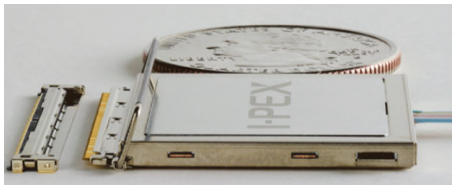




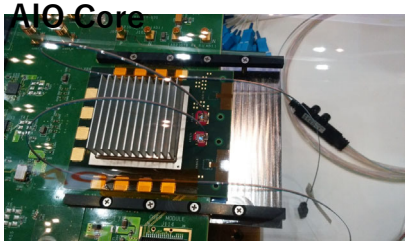
Courtesy of AIO Core Co., Ltd.
Note: Yellow squares show 100Gb/s transceiver Silicon chip

Applied modules (Sample shipment)

IPEX: LIGHTPASS ™



AIO Core



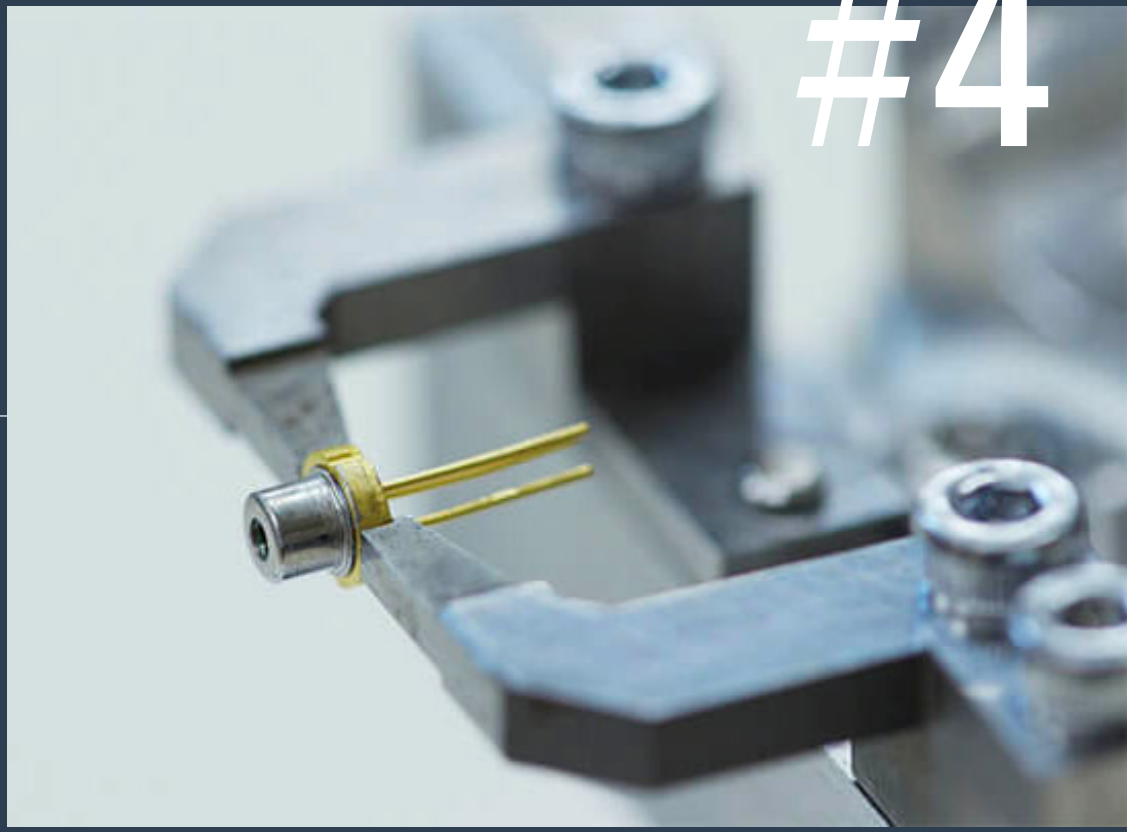
High Power FP Laser

- Applications : Particle Counter, Leveler, Machine Vision and Factory LiDAR.

Highly reliable and high-quality CW / nanosecond pulse high power laser.

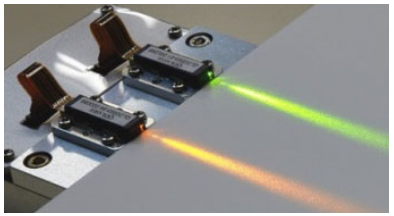
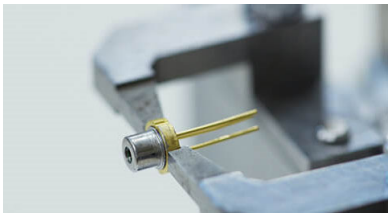
Providing services that meet customer requirements, such as usage conditions and small-quantity support.

- The wavelength lineup is 640-940nm.
- CW and high-power nanosecond pulse drive for a wide range of sensor applications.
- Hearing customer needs on pulse, optical output, reliability, wavelength, and control method to propose optimal products and solution.
- Small quantity production possible.



#4

Our Major Laser Device Products, Wavelengths, Features, and Uses

	Compact visible lasers	High power laser	DFB laser	Quantum dot laser
Produccts				
Wavelength	**532, 561,594 nm**	**640-940nm**	**1030, 1053, 1064, 1080, 1120, 1180nm** **1020-1120nm provided 1nm by 1nm**	**1200-1330nm**
Features	● Miniature size, low power consumption, stability, short pulse generation, and high-speed modulation, etc. ● World's first current injection yellow-green and orange lasers	● High power Fabry Perot laser ● Providing products and solutions according to applications. ● Supports various wavelengths, small quantities, and custom production.	● Precise control of wavelength with stable operation under continuous, nanosecond, and picosecond modes. ● High beam quality, small size, lightweight, high electricity-light conversion efficiency, and long life compared to existing solid-state lasers. ● Extensive product lineup that meets the various needs of customers.	● Quantum dots are used for the active layer (light-emitting part) of semiconductor lasers. ● Excellent temperature stability, high-temperature resistance, and low noise performance compared to existing semiconductor lasers.
Use		Measurement	Measurement Processing	Measurement Communication Silicon photonics
			Bio.	

Semiconductor Laser Devices : Our Competitive Advantages / Barriers to Entry

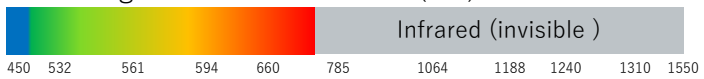
Business Model

The only fabless company in the semiconductor laser industry

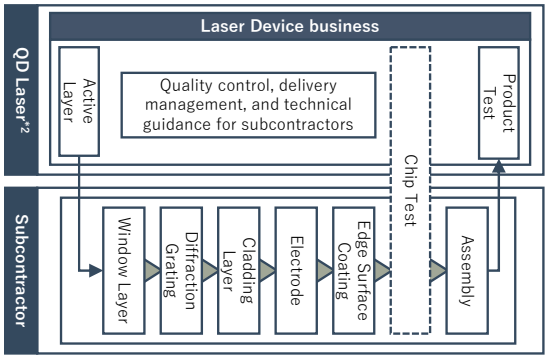
- Flexible manufacturing scale of several units to tens of millions units
- High marginal profit ratio of over 45% on average*1 (made fixed costs into variable costs)
- Mass production and diverse product offering lead to beyond breakeven point

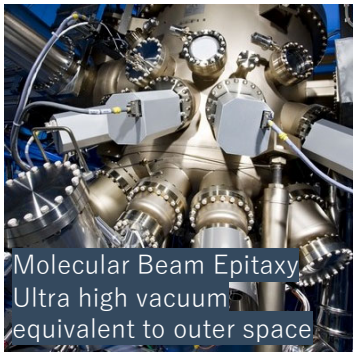
Any wavelengths of lasers

Wavelengths of lasers we offer (nm)



High level of freedom in creating new business, fields and products





Core Competence : Quantum Dot Lasers

Atomic-level precision epitaxy technology (proprietary)

- Growth control by 0.1 second
- Extracted the best recipes from over 100,000 recipes
- The only one to succeed in mass production of quantum dot lasers, thanks to over 20 years of accumulated technology

Capable of operating in harsh environments of over 100℃ and under high density packaging

- Optoelectronic integrated circuit
- In-vehicle devices

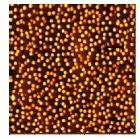
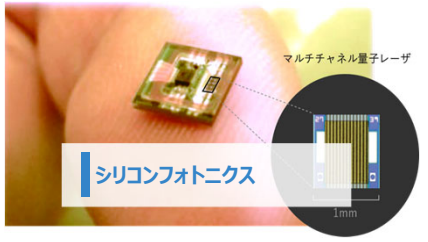


image of quantum dot by atomic force microscope

New potential market created by quantum dot lasers

- Chip-to-chip optical interconnect
- LiDAR
- Quantum cryptography





*1: Average over FY2021-Q1
*2: We only conduct device design, crystal growth process and evaluation of finished products, which are the most important aspects of semiconductor lasers, and outsource the other processes to our partner factories.

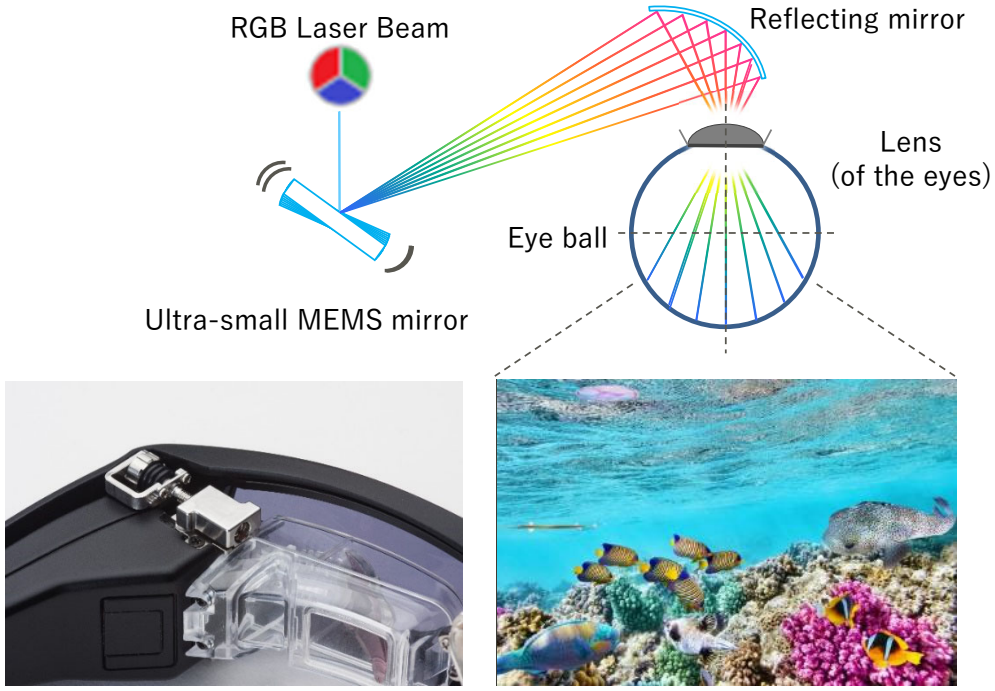
03

Laser Retinal Projection

World’s First Commercialization of Laser Retinal Projection Eyewear

VISIRIUM TECHNOLOGY®

Unique Laser Technology bringing Innovation to Vision



Direct Image Projection onto Retina

Visual experience independent of the condition of your cornea or lens

You can recognize an image clearly even with myopia, hyperopia, astigmatism, or ametropia.

Free focus

The focus of both the landscape you see with the naked eye and the image projected by our glasses can be superimposed on the retina.
This is a unique feature not found in other AR glasses.

Enables vision even in the periphery of the retina*1

Since the image is in focus even over a wide area of the retina, we expect that it can also be effective for patients with retinopathy.

*1: At major airline company and National University Corporation Tsukuba University of Technology, a systematic demonstration study is currently underway.

Three Areas based on Retinal Projection Technology







Sales started

Business Development

Strengthening Alliance

World's First Laser Retinal Projection Eyewear

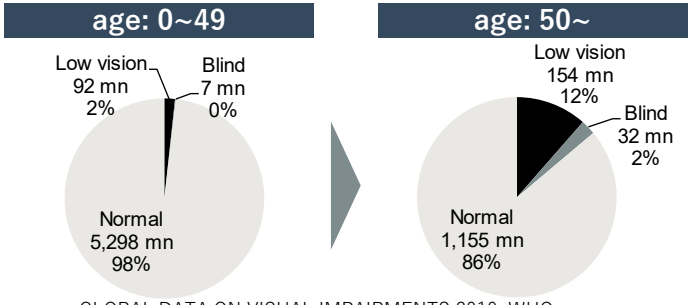
In the Low Vision Aid Space where Innovation has been Minimal, Laser Technology makes a Breakthrough

250 mn people

with Low Vision Globally*1

Currently they use magnifying glasses, video magnifiers, and telescopes daily. These tools are limited in use, have operational, issues and are not suitable for all users.

Here, we will make a breakthrough with our laser retinal projection technology.



GLOBAL DATA ON VISUAL IMPAIRMENTS 2010, WHO


WAZ SEITE 3 ESSEN

Fast Blinder kann mit Super-Brille wieder sehen

Mit 15 Jahren hat Dominic Schmitz bei einem schweren Unfall seine Sehkraft fast völlig verloren. Mit einer neuartigen Sehhilfe, die am Uniklinikum getestet wird, hat er nun ein gestochen scharfes Bild der Welt

„Papa, du bist aber alt geworden, ich kann die Falten auf deiner Stirn sehen."

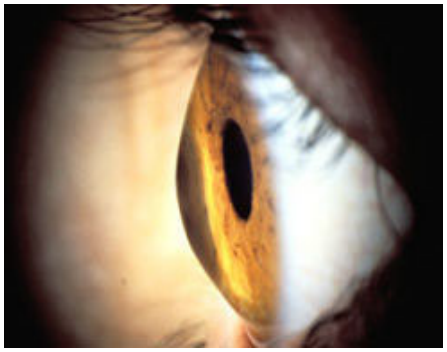
"Papa, you have grown old, I can see the wrinkles on your forehead."*2



*1: WHO Definition: Low vision is defined as the best-corrected visual acuity of less than 0.3 in the better-seeing eye. Blindness is defined as the best-corrected visual acuity of less than 0.05 in the better-seeing eye.
*2: Translated from German

Medical Regulatory Affairs: Completed Clinical Study in Japan and EU

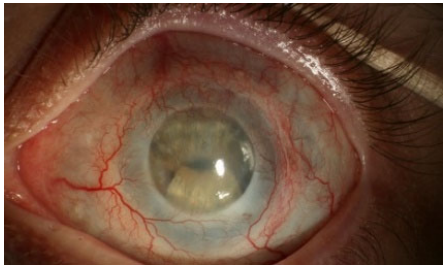
JAPAN



Irregular astigmatism

- Improved visual acuity and reading speed of 15 subjects verified.
- Domestic medical device manufacturing and marketing approval @ January 28, 2020

Europe



Corneal clouding

- Improved visual acuity on and reading speed of 20 subjects verified.
- Long-term safety confirmed after one year of home use.
- Clinical trial completed in June 2021.

RETISSA® series product development status

Medical device model sales started.
Sales increase in both consumer and medical models



Corrected vision: 0.8

- Refractive power: 0.8 corrected vision without eyeglasses in the power range of -11D[*1] (high myopia) to +6D (medium high hyperopia) [*2]

Sales strategy of this term

- New frame to improve wearing alignment and stability
- Accessory camera connected to the frame for enhanced functionality
- Proposals of use cases for companies
- Overseas sales, including US, China, and South Korea.



Controlled medical device (Controlled medical devices requiring special maintenance)[*3]

- Used to correct vision in patients whose vision is impaired by unjustified astigmatism (patients who are unable to achieve adequate vision using existing eyeglasses or contact lenses)
- Expected to (1) correct visual acuity, (2) improve reading speed, and (3) improve reading acuity

Sales strategy of this term

・ Sales collaboration with Santen Pharmaceutical and Seed. ・ Efforts to reduce the burden on purchasers: Healthcare subsidy, medical insurance, tax deduction, etc.

*1: D (Diopter) is a unit of measurement of a lens and is a reciprocal of the focal length in meters. A minus value indicates a concave lens for nearsightedness, and a plus value indicates a convex lens for farsightedness
*2: Based on the white paper "Evaluation of resolution and free-focus characteristics in retinal scanning laser eyewear - RETISSA® Display II excellent for displaying text in e-books and AR" by QD Laser
The refractive power is a theoretical value and may vary from person to person
*3: Approved as a new medical device by the Pharmaceuticals and Medical Devices Agency (PMDA) on January 28, 2020 (Approval number: 30200BZX00025000)

Low Vision Aids : Total Addressable Market (※Anterior eye disease patients only : Ametropia and corneal opacity)

JPY 900 bn (USD 8.6 bn) Market in Japan, U.S. and Europe

Plan to Expand into Other Countries like China further behind in Ophthalmic Technologies

Low Vision Market

Population of people with low vision

- Japan **1.45 million**[*1]
- Europe (EU) (our estimate) **18.77 million**[*2]
- U.S. (our Estimate) **12.00 million**[*2]

Estimated percentage of applicability (our estimate)[*3] **11%** × Product Price per Unit (our assumption)[*6] **JPY 200k (USD 1.9k)**

Total market size of advanced countries (Our estimate)
JPY 708.7bn (USD 6.7bn)

Senior Citizens Market

Population of People over 65 years old

- Japan **36.08 million**[*4]
- Europe (EU) **102.76 million**[*4]
- U.S. **52.79 million**[*4]

Estimated percentage of applicability (our estimate)[*5] **1%** × Product Price per Unit (our assumption)[*6] **JPY 100k (USD 950)**

Total market size of advanced countries (our estimate)
JPY 191.7bn (USD 1.8 bn)

JPY 900 bn (USD 8.6 bn)

*1: Japan Ophthalmologists Association "Social costs of visual impairment in Japan"
*2: Calculated by multiplying the ratio of persons with low vision sourced from WHO "Visual Impairment and Blindness 2010" by the current population in each region (Europe: Eurostat "Population on 1 January", U.S.: United States Census Bureau "Annual Estimates of the Resident Population for the United States")
*3: According to the survey by Santen Pharmaceuticals, the number of keratoconus patients in Japan is estimated to be 60,000 to 120,000; also, as the data on p.39 shows that the prevalence per 100,000 people of keratoconus is almost the same as that of corneal opacity, it is assumed that the number of corneal opacity patients in Japan is similar to that of keratoconus patients . Assuming the number of patients suffering from each of these diseases to be an intermediate value of 80,000, the total is calculated to be 160,000; then, we apply the estimated percentage of applicability of 11%, calculated by dividing 160,000 by the population of persons with low vision (1,450,000), to each country's population of low vision persons. This percentage only takes into account anterior eye diseases; therefore, if our product is also effective for patients with retinal disease, the estimated percentage of applicability is expected to increase.
*4: Assuming that all the elderly aged 65 and over use near-sighted, presbyopic or bifocal glasses, we can estimate that each country's population aged 65 and over can be the potential population of persons with gap vision (Japan: Statistics Bureau of Japan "Population Estimates May 2020", EU: Eurostat "Population on 1 January by broad age group and sex", U.S.: United States Census Bureau "Population by Age and Sex: 2019").
*5: Due to the products' similarity in characteristics to hearing aids (used by the elderly on a daily basis, wearable equipment, sold at glasses stores, etc.), the hearing aid market is used as a reference to estimate the percentage of applicability. Given that the number of hearing aids shipped in Japan in 2017 numbered 562,747 (Japan Hearing Instruments Manufacturers Association "2018 Shipment Volume of Hearing Aids"), this number divided by the number of elderly people in Japan will give us an estimate that 1.7% of the elderly purchased a hearing aid, which we then adjust conservatively to assume an estimated percentage of applicability of 1.0% which can then be applied to each country's population of gap vision persons.
*6: Expected price per unit after the mass production is realized.

Sales and Manufacturing Strategies

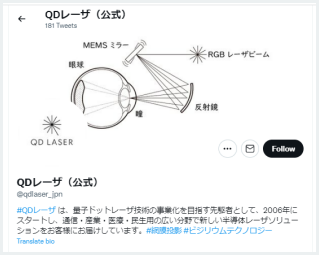
Cumulative sales record as of Marc 2022
>800 units

01 Through partnership with major manufacturers such as MinebeaMitsumi and Audio Technica, achieved fabless manufacturing for high-performance and low-cost products.

02 Through media exposure / participating in large-scale exhibitions / donations to schools for blind children / trial sessions and interviews, raise awareness



note





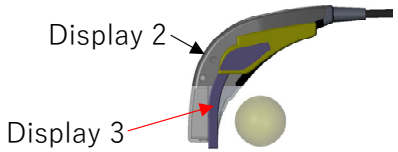
03 Develop close cooperation with major players in each field

Zoff　KAGA FEI　Santen　SONY

04 Improving usability and developing new products

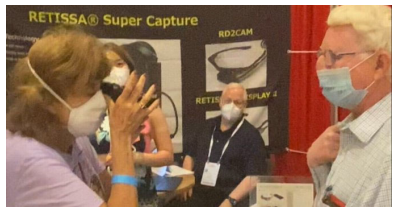
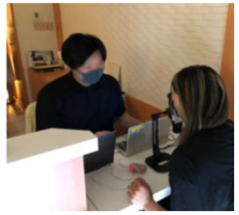
Retinal Imaging Product "RETISSA" Roadmap: Laser Eyewear

- Medical Equipment "Medical": Being promoted by Santen Pharmaceutical and Seed to 479 hospitals on corneal diseases. Eleven domestic medical institutions are now introducing the device to patients.
- Consumer Product "Display / Display2": Cumulative sales of 800 units via EC, domestic and overseas distributors. Local Municipality Subsidy with 90% benefit starting to be registered.
- Display 3: Under development to realize a compact, lightweight, and low-price eyewear with improved operability.

	Medical	Display/Display 2	Display 3
			
FY2018-2021	・Domestic manufacturing and marketing approval. ・ Introduction to low vision and corneal outpatient. ・ Treated in 11 medical institutions.	・ Free focus / high resolution (equivalent to 0.8 visual acuity) / full color ・ Launch of accessory camera RD2CAM ・ Cumulative sales of 800 units	・Jointly developed with a domestic electronics manufacturer.
FY2022	・ Continue sales activities ・ Expansion of application range through clinical research (Clouding, retinopathy) ・ Strategy in Europe	・ Subsidy, administrative budget acquisition activity (already certified by 6 municipalities) ・ Overseas expansion US in-house EC Korean subsidy acquisition activity Resume Chinese agency activities	・Development and Marketing Flat mirror (thinner and wider FOV) Built-in camera Low-cost design Compact controller BOX Eye Track
FY2023-2024	Consolidation of sales channels and know-how to comply with various regulations (Pharmaceutical Equipment Law, Consumer Product Safety Law, Welfare Equipment Law, etc.)		Commercialization 100,000 yen selling price 100,000 units sales target after launch

Retinal Imaging Product "RETISSA" Roadmap：Three New Products

- **Commercialization of three new laser retinal imaging devices for various usage scenarios**
  https://www.qdlaser.com/uploads/2021/12/20211214-1.pdf

	ONHAND	Super Capture	MEOCHECK
	Hand-held devices used by visitors in public spaces (libraries, museums, theaters, etc.)	Digital cameras viewfinders that extend the vision and behavior of low vision users	Self-measuring simple checkers to help people recognize eye diseases
	 	 	 
FY2021	Prototype ・Questioned and deliberated as a device to comply with the Reading Barrier-Free Act*1 at four congresses in the Tokyo metropolitan area.	Prototype ・Exhibited with Sony Corporation at CSUN, an accessibility exhibition in the U.S. ・Successful crowdfunding	Prototype ・Conducted eye examinations on 500 drives at cab companies in Japan under collaborative research with medical universities. ・Obtained evidence of highly sensitive detection of glaucoma, cataract, etc. (to be published)
FY2022	Product launch in August (planned) ・Introduction to administrative services like libraries, art galleries, museums, theaters, etc. ・Sales collaboration with three distributors.	Product launch in December (tentative) ・Promotion and sales collaboration with digital camera manufacturers ・Operation of EC sites in Japan and the U.S. (already established)	Product launch in September (planned) ・Sales collaboration with medical equipment distributors nationwide ・Eye check service pilot operation with Tohoku University and DX companies at transportation companies, drug chains, extensive private facilities, nursing care facilities, etc.
FY2023	Sales are expected to reach several thousand units/year.	・Assumed sales of 1,000 units/year	・Assumed sales of 1,000 units/year ・Full-scale operation of eye check service

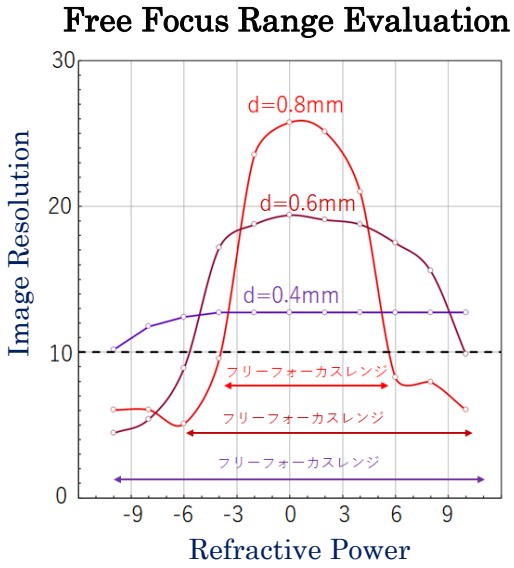
*1: Enforced June 28, 2019 "Act on Promotion of Improvement of Reading Environment for the Visually Impaired, etc." A law that allows everyone, with or without disabilities, to benefit from reading, writing and printing culture.

IEC (International Electrotechnical Commission) officially published an international standard that defines how to evaluate the overall image quality of scanning retinal projection devices

QD Laser Co., Ltd. is the only company to have commercialized the laser scanning retinal projection product globally. On June 20th, the IEC [Note 1] officially issued the international standard on scanning retinal projection devices. This document covers a general image quality evaluation method, including the free focus characteristics. As a result, the performance of our products to provide "clear images that do not depend on eyesight" has come to be evaluated objectively and quantitatively. With this standardization, QDLaser expects the guarantee of product quality and the elimination of inferior products in the market, accelerating the worldwide spread of our products and forming a healthy industry and market.

International Standard
IEC 62906-5-5:2022
・Laser displays – Part 5-5
・Optical measuring methods of raster-scanning retina direct projection laser displays
・https://webstore.iec.ch/publication/60142

Note 1: IEC is an abbreviation for International Electrotechnical Commission.
Note 2: Free focus means that the visibility of the image projected by the scanning retinal projection device does not depend on the refractive power of the eyeball or the focus position. The performance of free focus changes depending on the beam diameter and divergence angle of the laser incident on the eyeball.



The refractive power of the eyeball determines the resolution of the retinal projection image with the diameter of the parallel laser beam as a parameter. This international standard states that the range of refractive power of the eyeball to provide free focus is determined according to the diameter. When commercializing a scanning retinal projection device, it is required to specify the range of refractive power to provide free focus.

04

Further Growth Upside Expected

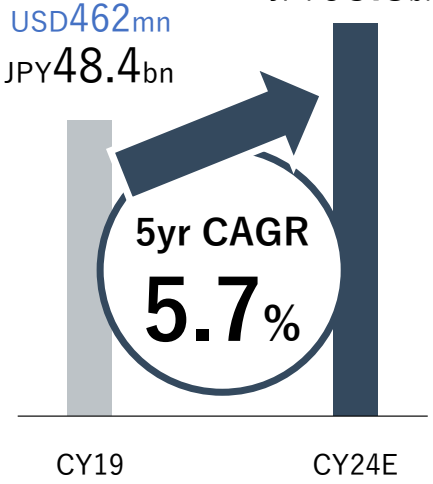
Large Growth Potential in Optometry Market

Utilizing Laser Retinal Projection Technology, Developed New Optometry Prototypes and Working with Partners to Launch in FY2022-2023

Estimated economic loss in Japan due to visual impairment*1



Fundus photography equipment market size*2



Conventional optometry equipment → New optometry equipment

Large / expensive / Requires medical staff



Medical resources are available mainly in urban areas. Given the time and the financial cost, people miss the chance to go to their optometrist and end up detecting their glaucoma late

Small / low cost / short time / self-examination possible



Enables an environment where anyone can easily examine their eyes, increasing the early detection rate of glaucoma and expecting to extend the healthy lifespan of the eye

*1: Japan Ophthalmologists Association (2009) "Economic Cost of Visual Impairment in Japan" and "Prevalence of Visual Impairment in the Adult Japanese Population by Cause and Severity and Future Projections"
Economic cost = Direct health costs + Other financial costs + monetary converted number of loss of well-being from visual impairment (measured in disability-adjusted life years (DALYs))
*2: TechNavio (2020) "Global Ophthalmic Diagnostic Devices MARKET 2020-2024" Converted at an exchange rate of JPY/USD = 110 yen
*3: The approximate measurement time of the Goldmann perimeter and Humphrey perimeter, which are typical perimeters in conventional perimeter measurement.

A new group of optometry devices that utilize laser retinal projection technology

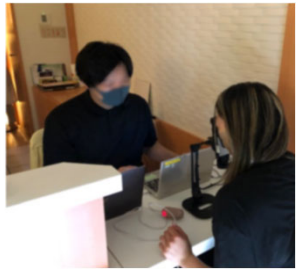
■ Eye & Brain Diseases
- Cataract (47%)
- Glaucoma (3.6%)
- Retinopathy (55%)
- Brain tumor (10 to 15 patients per 100,000)

Note:% is the average appearance rate of the entire population. The older the person, the more it increases.

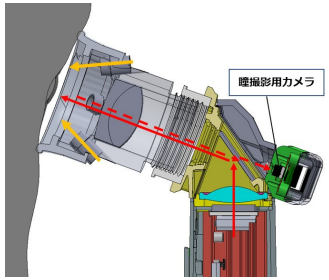
■ Cognitive Function Degradation
- Aging
- Dementia
- Fatigue, Stress
- Alcohol

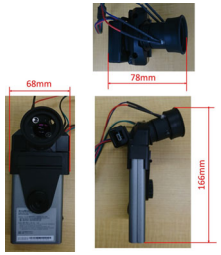
■ Cardiovascular Diseases
- Disease
- Diabetes
- Stroke
- Heart attack

1st generation: Simple perimeter to be commercialized in FY2022, screening eye diseases in 1 minute.

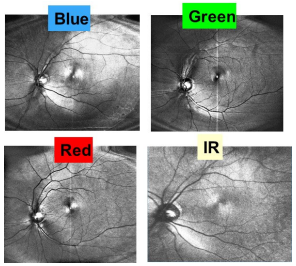

2nd generation: Eye track perimeter with a camera to measure fixation stability and dynamic response to various visual stimuli. Software medical equipment.





3rd generation: Ultra-compact fundus photography device. Hardware medical equipment.

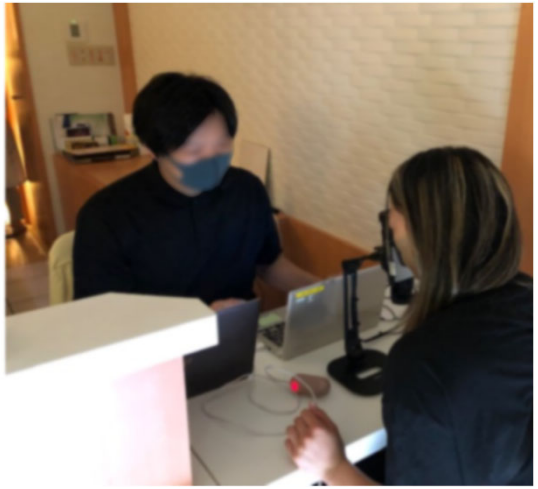




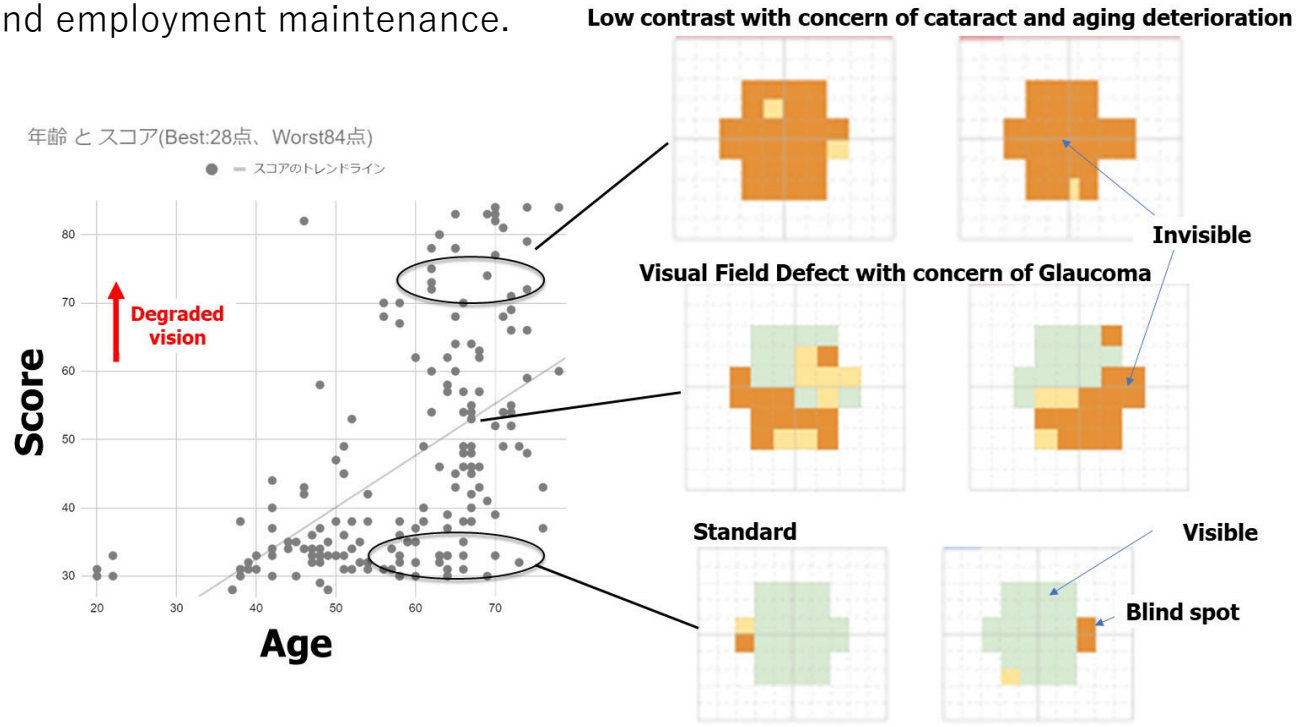
Results of the visual field test of 97 drivers of a taxi company

- We found a significant decrease in visual sensing ability with aging.
- A definitive diagnosis was made by an ophthalmologist as cataract for low contrast and glaucoma for visual field defect.
- The screening for eye diseases and the health check, including cognitive function, has become possible.
- We started studying with the taxi company about applying this device and system to health management of employees for accident prevention and employment maintenance.

Optometry diagnosis

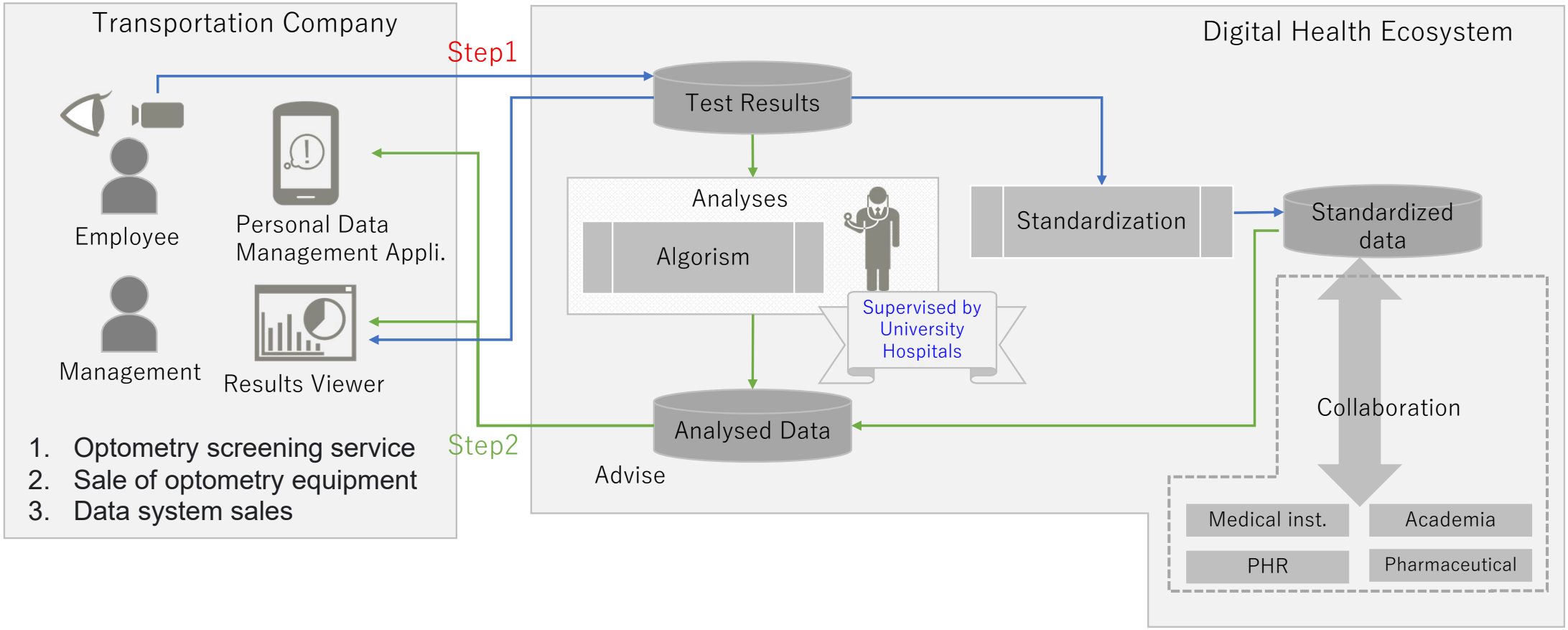


QDLaser is conducting medical research for people based on the Ministry of Health, Labor, and Welfare guidelines.



Service System Image

Starting introduction to companies with commercial drivers



Expected Growth Potential in Mid-Long Term

01 Through R&D of various laser technologies and stable profits from laser device business, strengthen business base for dramatic future growth.



02 Establish mass production and sales channels of consumer / medical eyewear
Make laser eyewear business the growth driver in the short to medium term



Target cumulative sales of 100,000 units and annual production of 50,000 units at FY2025.

Sales expansion in domestic and overseas markets

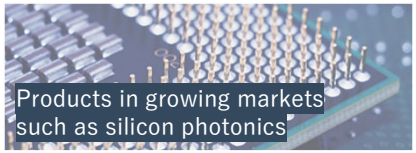
Starting low-cost mass production of RDIII later in FY 2023 to 2024

IPO

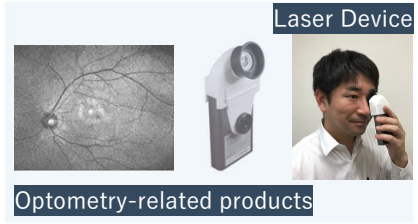
Present

Future

03 In the mid to long term, in addition to the laser eyewear business, plan to expand sales of optometers and silicon photonics.



Quantum dot lasers for silicon photonics are being developed with nine companies in Japan, the United States, and Europe. Mass production is to start in FY 2023 in order.



Trial operation of "optometry screening service" in FY2022 and full-scale delivery in FY2023.The compact optometry machine under is to be launched in FY2022.

05

ESG Initiatives

Business Development from an ESG Perspective

Social

Estimated economic cost in Japan due to visual impairment in 2030[*1]
USD105bn
JPY11tn

Global prevalence of people with low vision[*2]
250mn

Estimated number of glaucoma patients in Japan[*3]
4mn

- World's first laser retinal projection technology for low vision aids
- Through the spread of laser eyewear, provide visual support for the elderly
- Through the spread of more affordable optometers, contribute to the early detection of various eye diseases including glaucoma, etc.
- Employment support for people with low vision

Environmental

Energy savings from semiconductors with silicon photonics[*4]
90%

- Silicon photonics with quantum dot lasers improve semiconductor performance dramatically

Governance

*1: Japan Ophthalmologists Association "Economic Cost of Visual Impairment in Japan" and "Prevalence of Visual Impairment in the Adult Japanese Population by Cause and Severity and Future Projections"
Economic cost = Direct health costs + Other financial costs + monetary converted number of loss of well-being from visual impairment (measured in disability-adjusted life years (DALYs))
*2: WHO "GLOBAL DATA ON VISUAL IMPAIRMENTS 2010"
*3: Santen Pharmaceutical "Annual Report 2017"
*4: Target numbers in "Development of Technologies for Super Energy-Efficient Optical Electronics Implementation Systems" Promoted by METI, The Institute of Electronics, Information and Communication Engineers "Opt-Electronics Packaging Technology for Silicon Photonics"

With My Eyes project

#1 Photographs by low vision people.
https://www.youtube.com/watch?v=p5bIfs94Oys

#2 Let's go and see the invisible world.
https://www.youtube.com/watch?v=ZM52dax_5yc

#3　- Discovering a World of My Own –
https://www.youtube.com/watch?v=Ip6a5h6UfxA&t=37s

















QD Laser Announce Part 3 of “With My Eyes” Project supported by Sony

RETISSA Super Capture

Digital cameras viewfinders that extend the vision and behavior of low vision users

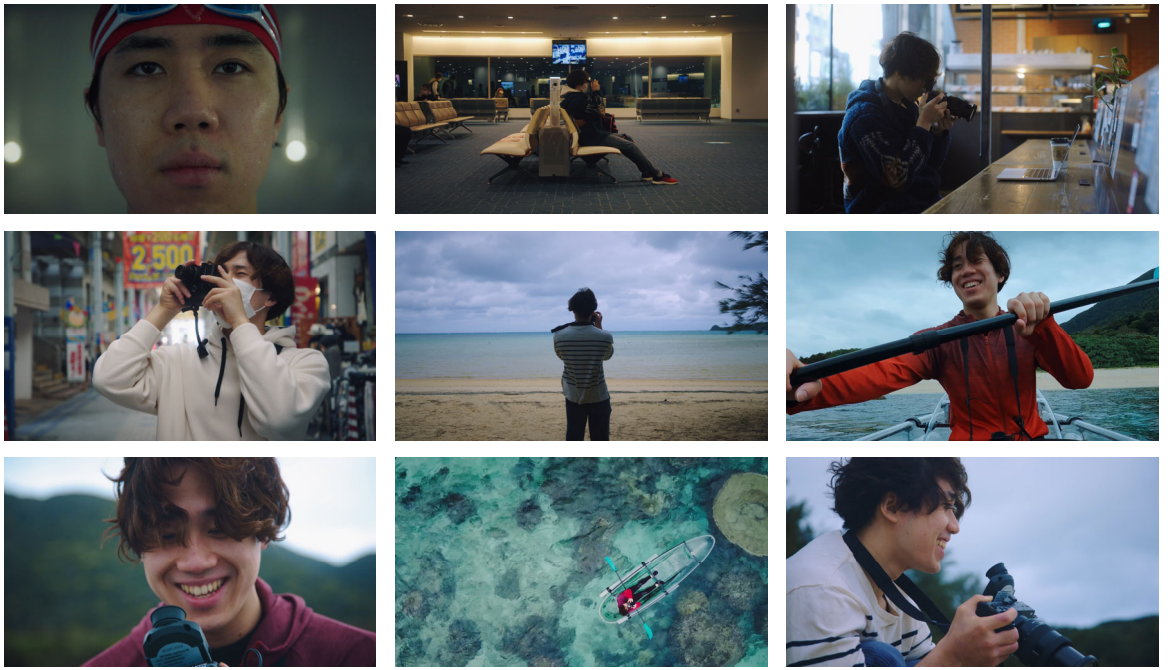




Latest documentary short in series depicts quest of Paralympic swimmer with low vision to use laser retinal imaging camera to see inside ocean
To be launched Mar. 14, 2022, on YouTube and presented at the QD Laser and Sony booths at the 37th Annual CSUN Assistive Technology Conference

QD Laser Co., Ltd. (Headquarters: Kawasaki City, Kanagawa Prefecture, hereinafter referred to as "QD Laser") is the state-of-the-art semiconductor laser technology company that plans, designs, develops, manufactures, and sells a variety of unique semiconductor lasers and related products. The company launched the project "With My Eyes," employing the original laser retinal imaging technology to change the "difficult to see" to "visible" of the 250 million low vision worldwide who have visual inconvenience even when wearing corrective glasses. This release shows off the third project carried out with the cooperation of Sony Corporation (hereinafter, Sony), featuring a newly produced documentary movie to be on air on March 14, 2022 (Monday). At the 37th Annual CSUN Assistive Technology Conference in Anaheim, USA, starting on the same day, each booth of the companies exhibits this documentary movie and the retinal imaging camera device "RETISSA SUPER CAPTURE."

■Scenes from the Movie



Company Profile

Spin-off Venture from Fujitsu

Tier 1 Medical Companies such as Nikon/Santen joined as Shareholders

Company Name	QD Laser, Inc.
Foundation	April 24, 2006
Fiscal year-ended	March 31
Representative	Mitsuru Sugawara, President and CEO
Location	Headquarter: 1-1 Minamiwatarida-cho, Kawasaki-ku, Kawasaki-shi, Kanagawa
Number of Persons*1	44
Business	Planning, design, development, production and sales of semiconductor laser and its application products
Licenses	• Class II Marketing License for Medical Devices • Registration of medical equipment manufacturer • ISO 9001 • EN ISO 13485



Science and Technology Award from the Minister of MEXT

Prime Minister's Honorary Award for Achievement in Industry-Academia-Governmental Collaboration

- Graduated from The University of Tokyo; Doctor of Engineering
- 1984: Graduated with a master's degree in Physical Engineering from the Department of Applied Physics, School of Engineering, University of Tokyo; joined Fujitsu Laboratory Ltd.
- 1995: Assumed the role of Senior Researcher at Optical Semiconductor Device Laboratory, Fujitsu Laboratory Ltd.; obtained degree in Eng. from The University of Tokyo
- 2004: Assumed the role of non-tenured professor at the Institute of Industrial Science, University of Tokyo
- 2005: Assumed the role of Deputy Head of Nanotechnology Research Center, Fujitsu Laboratory Ltd.
- 2006: Launched QD Laser Inc.; assumed the role of President and CEO

*1: As of June 30, 2022. Including 1 employee and officer, excluding 14 dispatched employees.

Laser Retinal Projection: Diseases and Applicable Rate

Parts of Eye		Major diseases	# of patients per 100k people*1	Total per eye part*1	Possible Efficacy*2		Estimated applicability %*3	Future Outlook
Anterior eye	Cornea	Corneal angiogenesis	4,000	4,104	◎	Effective on astigmatism and moderate opacity	50%	• May not be applicable in cases of severe opacity • Focused on obtaining the approvals to marketing medical devices by targeting diseases for which high efficacy can be expected. • Plan to expand the scope of application with RDII and RDIII on page 25 and the wide-angle viewfinder on page 27.
		Keratoconus	54					
		Corneal opacity	50					
	Crystalline lens	Cataract	47,800	52,900	◎	Effective on near/far-sightedness, astigmatism, opacity, etc. and as the technology does not depend on the function of the crystalline lens	40%	
		Aphakia	5,100					
		Phacocele	<50					
	Uvea	Uveitis	714	714	△	Effective on astigmatism developed as a complication	10%	
		Choroidal neovascularization	<50					
Vitreum		Vitreous opacity	NA	-	○	Effective on low to moderate opacity	20%	
Retina		Epiretinal membrane	28,900	55,614	○	Enlargement and black and white inversion features are effective on macular diseases	30%	• Adaptable to central scotoma by changing the projection position and increasing magnification • Adaptable to tunnel vision through wide-angle imaging • May not be applicable in cases with severe symptoms
		Lattice degeneration of retina	10,600					
		Hypertensive retinopathy	9,100			Some efficacy is seen in cases where anterior eye disease is also present		
		Age-related maculopathy	3,900					
		Diabetic retinopathy	3,114			AE camera feature is exceptionally effective on photophobia, night blindness, etc.		
		Retinitis pigmentosa	<50					
Optic nerve		Glaucoma	3,550	3,865	△	Image downsizing feature is effective on tunnel vision	10%	• May not be applicable in cases with severe symptoms
		Optic nerve head drusen	200					
		Optic neuritis	115					
Other		High myopia	3,000	3,000	◎	Exceptionally effective	50%	
		Color amblyopia, color blindness	2,500	2,500	○	-	20%	• Can improve by processing images taken by camera

*1: These numbers were calculated by research company Lampe & Company in a report we commissioned with reference to scholarly papers published by governments and research institutions from each country. Figures for "# of patients per 100k people" and "Total per eye part" reflect the general research conducted across several jurisdictions and are not necessarily indicative of the number of potential cases in the markets in which we currently operate.
*2: Based on our assumptions
*3: Evaluated the "expected efficacy" using a scale: ◎ = 40-50%, ○ = 20-30% and △ = 5-10%.

Terminology

Semiconductor laser	A compact device with an approximate length of 1mm that causes laser oscillation by passing an electric current to a semiconductor. In comparison with a solid-state laser or gas laser, more micro-miniature in size; higher speed modulation characteristics up to 10GHz; higher photoelectric conversion efficiency achieving several tens of percent and better controllability of wavelength, among other things. Became widely used in the 1980s as a light source for communication systems and optical recording media, such as CDs and DVDs, etc.
Quantum dot laser (QDL)	A semiconductor laser using a quantum-dot structure comprising nanocrystalline semiconductors in its active layer. QD Laser is the only firm in the world to mass-produce QDLs for optical communications and silicon photonics. In comparison to existing semiconductor lasers, it is superior in temperature stability, high-temperature endurance and low-noise properties.
DFB laser	Distributed Feedback Laser: QD Laser's DFB laser is equipped with a diffraction grating which enables laser oscillation at a single wavelength. It is suitable for applications where the light output needs to be concentrated into a narrow wavelength range, such as the seed light of a fiber laser.
Silicon photonics	A technology which integrates an optical circuit with a silicon electronic circuit that has signal processing and memory functions, thus enabling a breakthrough in the processing capacity limitation of the conventional electronic circuit system (achieving 100 times faster processing speed and lower power consumption) and high-capacity data transmission between LSI chips (10Tb/s).
VISIRIUM technology	A technology that projects images onto the retina using precise optical systems, creating different colors flexibly from the three primary laser light colors - red, green and blue.
Diffraction grating technology	A technology that freely and precisely controls the wavelength of semiconductor lasers to fit into various applications by forming periodic irregularities inside the laser.
Ultrashort pulse	A laser with a very short pulse width (duration). It is used for microfabrication and other processes as it can prevent shape distortion due to thermal effects.
Retinal projection	To project images onto the retina
Simple perimeter	A device to assess the visual field of human eyes
CE marking	A certification mark that indicates conformity with standards required to be met by products exported to the EU. The CE mark is granted when a product meets standards in all EU member states.
Flow cytometer	A device capable of measuring certain properties of cells. By irradiating a cell suspension in a tube with a laser beam, it can measure the number and size of a large volume of cells over a short period of time using fluorescence and scattered light parameters. It is used in various fields including molecular biology, pathology, immunology, plant biology and marine biology.
LiDAR	LiDAR (Light Detection and Ranging) is a technology which irradiates an object and uses a light sensor to detect the reflection to measure the distance. It is expected to be used in autonomous driving systems in the future.
Heads-up Display	A technology that projects information and images onto various surfaces, such as glass, within the field of view. It is expected one day to project necessary information for drivers onto the windshield and the like.

Caution When Handling This Document

- The materials and information provided in this presentation include forward-looking statements.
- These statements are based on expectations, forecasts and risk assumptions as of this presentation's publishing, and contain uncertainties that could lead to results that are substantially different from these statements.
- These risks and uncertainties are present in any transaction, and are applicable to general industry and market conditions as well as general domestic and international economic conditions, including fluctuations in interest rates and currency exchange rates.
- Note that QD Laser does not bear any duty to update or revise forward-looking statements provided in this document, even if new information comes to light or future events occur.