ENGINEERED BY LASER QUANTUM & ARGES

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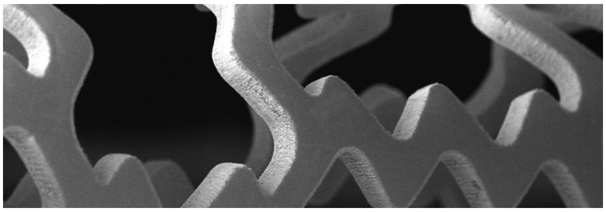
**DART PICOSECOND LASER DATASHEET**

# COMPACT PLATFORM & EXCEPTIONAL BEAM FOR DEMANDING APPLICATIONS

Our highly engineered components and subsystem solutions - paired with deep expertise in advanced photonics - make us the global technology partner of choice for advanced industrial OEMs and system integrators. Drawing on a wealth of technical and application experience from our ARGES and Laser Quantum engineering teams, we have developed Dart, a picosecond laser solution with reliable, repeatable operation to ensure precision in a multitude of applications.

## FLEXIBLE LASER PLATFORM

Dart offers a leading design for a range of precision processing and microelectronic applications with multiple power levels, wavelengths and pulse parameters available. Each laser delivers excellent beam quality with the $M^2$ close to the diffraction limit and near-perfect beam roundness.



**Diverse array of materials**

- Medical devices - copper, aluminium, steel, plastics
- Fuel injection nozzles - (stainless) steel
- E-mobility & battery manufacturing - copper, aluminium, active materials
- Semiconductors - silicon, PCBs, ceramics, wafers
- Printed & flexible circuit boards - polyimide, polyester, polyethylene, flexible copper, silver paste
- Flat panel displays - brittle materials: sapphire, glass, ITO, TO
- Solar cells - layers/coatings: mono-,

## CONFIGURED FOR OEM USERS

**Ease of integration**

- Streamline integration with single supplier for laser and scanning subsystems
- Compact footprint provides flexibility when integrating into machines
- Accurate output beam boresight aids alignment and first-time installation
- Ruggedized design for reliable pointing stability and precise positioning

**High quality cutting and drilling**

- Beam circularity, typically across 2 Rayleigh lengths, ensures clean material processing
- Reproducible beam characteristics from laser to laser ensures laser processing consistency

**Flexible, versatile processing engine**

- Range of laser characteristics to optimize for a diverse array of materials and processing speeds

**Minimal downtime**

- Design features to extend periods between servicing
- Remote monitoring to troubleshoot and anticipate preventive maintenance

# DART PICOSECOND LASER DATASHEET

| Characteristic | Specification | | | |
|---|---|---|---|---|
| Central Wavelength | 1064 nm | 532 nm | 1064 nm | 532 nm |
| Average Power | 45 W @ 1000 kHz | 25 W @ 300kHz | 10 W @ 1000 kHz | 4 W @ 300 kHz |
| Repetition Rate | Single Pulse - 15 MHz | | | |
| Average Power Stability (1σ, 8 hours) | <1% RMS | | | |
| Beam Diameter | 3.0 mm | | | |
| Beam Divergence | <1 mrad | | | |
| Beam Circularity[1] | >93% | | | |
| Beam Quality ($M^2$)[1] | <1.20 | | | |
| Boresight Accuracy | <0.5 mm (Lateral) \| <2 mrad (Angular) | | | |
| Pulse Energy (Single Pulse) | 300 µJ (100 kHz) | 120 µJ (200 kHz) | 50 µJ (100 kHz) | 20 µJ (200 kHz) |
| Pulse Energy (5x Pulse Burst, 100 kHz) | 420 µJ | 250 µJ | 90 µJ | On Request |
| Pulse Duration | typ. 8 ps | | | |
| Polarization | >100:1 Vertical or Horizontal, Depending On Mounting Orientation | | | |
| Seeder Repetition Rate | 30 MHz (33 ns Pulse Spacing) | | | |
| Environmental | | | | |
| Warm-up Time (Cold Start) | <20 min | | | |
| Warm-up Time (Warm Start) | <5 min | | | |
| Temperature Range (Operation) | 15 - 35°C | | | |
| Temperature Range (Storage) | 0 - 60°C | | | |
| Maximum Humidity | 0 - 90% Non-condensing | | | |
| Physical[2] | | | | |
| Dimensions | 570 mm x 360 mm x 180 mm | | | |
| Weight | 40 kg | | | |
| Cooling | | | | |
| Max Heat Load | <900 W typ 600 W | <900 W typ 600 W | <700 W typ 400 W | <700 W typ 400 W |
| Coolant Temperature | 25°C (+/- 0.5°C) | | | |
| Minimum Flow Rate | 5 l/min | | | |
| Power Supply Unit | | | | |
| Electrical Supply | 100 to 230 V AC \| 50 to 60 Hz \| 2.5 kW | | | |
| Dimensions | 2U 19" rack | | | |

*Notes:*
*All specifications are subject to change without notice. Latest revision 11/5/2021.*

*[1]Measured using ISO 11146 standard*

*[2]Safety shutter according to EN ISO 13849 performance level e*

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# DART PICOSECOND LASER DATASHEET

Dart offers both performance and reliability in an architecture that integrates easily into customer machines. Figure 1 is a top-level schematic of the laser and details the adjustable functions that control the laser parameters. Precision design features result in both high-quality beam characteristics and reproducibility from laser to laser.

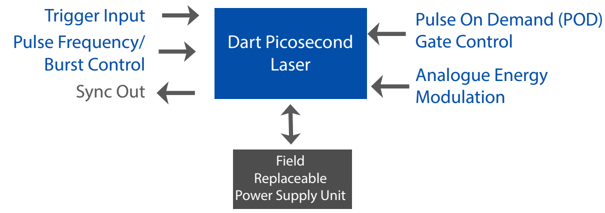


***Figure 1:*** *Schematic of the Dart laser including the adjustable functions. The system controller is an integrated part of the laser head.*

## BEAM PROFILE

**Reproducible beam circularity** is a leading feature of Dart. Figure 2 demonstrates typical beam profiles, highlighting the excellent beam roundness and the M² close to the diffraction limit. Figure 3 demonstrates how the circularity of the beam is maintained across ±2 Rayleigh lengths, typically.

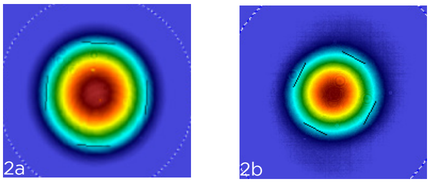


***Figure 2a:*** *Beam profile for 1064 nm, 300 kHz at the focus*
***Figure 2b:*** *Beam profile from 532 nm, 300 kHz at the focus*

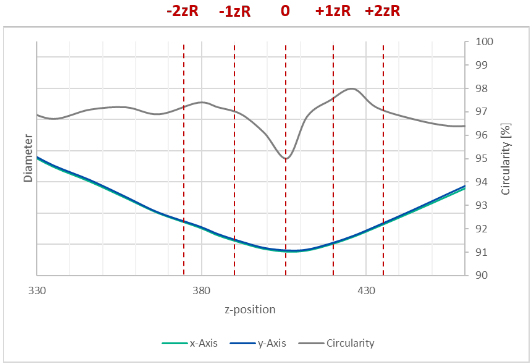


***Figure 3:*** *Typical results from 1064 nm 45 W laser showing percentage beam circularity (grey) at either side of the focus on the z-axis. The red dotted lines indicate the positions of the Rayleigh lengths out to ±2 zR. The blue and green lines show the beam diameter for both the x-and y-axis.*

## TYPICAL PERFORMANCE CHARTS

Dart typically operates in the range of 8 ps and has control electronics enabling variation of repetition rates from single pulse to 15 MHz. Power and pulse energy are important factors in ensuring high throughput and precision processing. The charts below show typical power vs. repetition frequency and pulse energy vs. repetition frequency for the 1064 nm and 532 nm picosecond Dart laser.

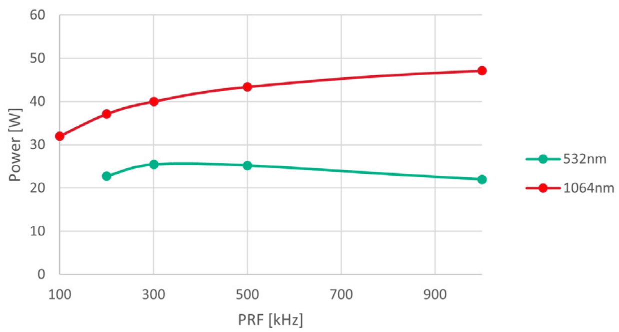


***Figure 4:*** *Power vs. repetition frequency for 1064 nm and 532 nm picosecond lasers*

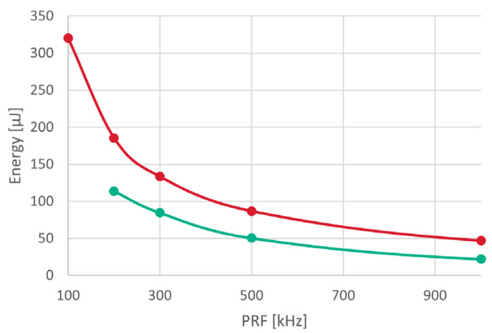


***Figure 5:*** *Pulse energy vs. repetition frequency for 1064 nm and 532 nm picosecond lasers*

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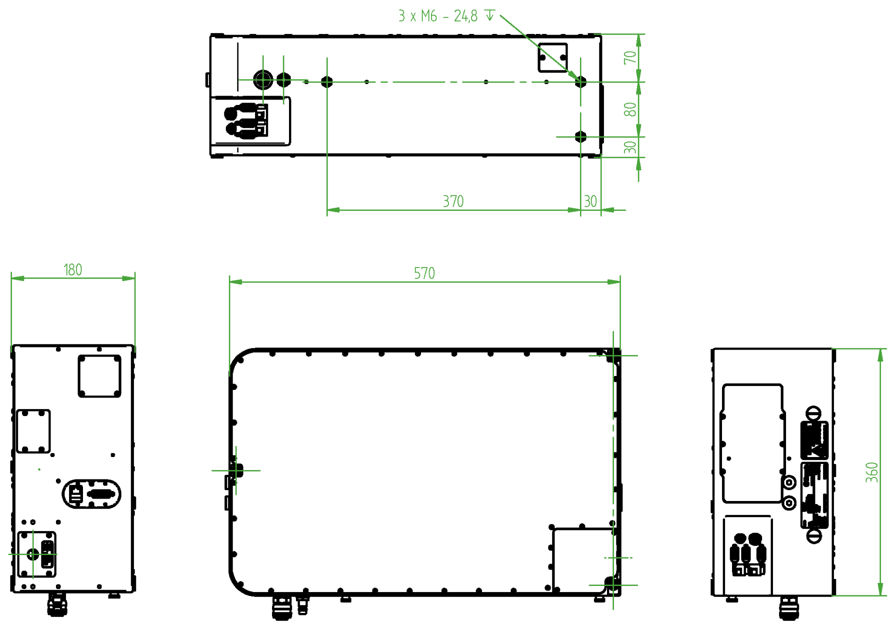
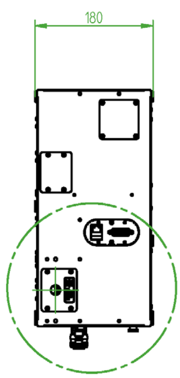
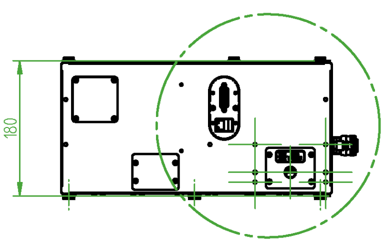



## VERTICAL MOUNTING

## HORIZONTAL MOUNTING




Polarization “horizontal”




Polarization “vertical”

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