

# Quasar®

## High Power UV and Green Hybrid Fiber Lasers for Fast Precision Micromachining

**mks** | Spectra-Physics®

The breakthrough performance of the Quasar series leads the industry with unprecedented highest UV average power and energy at high rep rate for fast micromachining. Quasar features novel TimeShift™ technology for programmable pulse profiles for the ultimate in process speed, flexibility, and control.

### Breakthrough Technology

Quasar combines advanced fiber laser, power amplifier and patented harmonics technologies to achieve breakthrough results. This unique design exploits fiber laser flexibility and robustness to enable TimeShift technology. Adding Spectra-Physics' exclusive power amplifier, Quasar enhances this flexibility at unprecedented high output power levels. Finally, with Spectra-Physics' patented harmonics, known for exceptional stability, Quasar continues to provide an innovative synergy of power, flexibility and control in a reliable 24/7 OEM laser for the most demanding applications.

### Breakthrough Performance

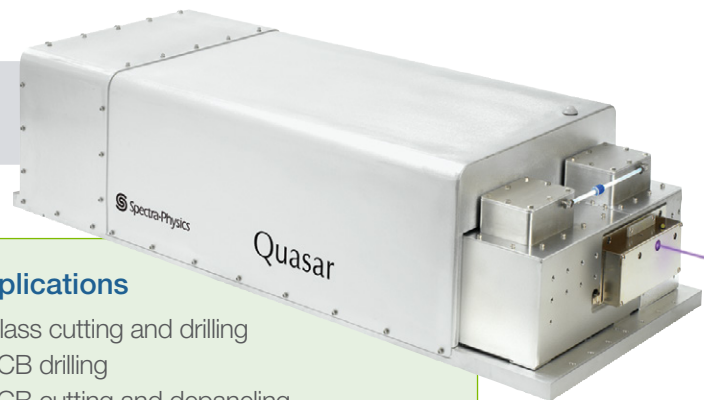
The Quasar 355-60 produces >60 W of UV output power at 200 kHz and 300 kHz, and >300 µJ pulse energy, complimenting Spectra-Physics' breakthrough Quasar 355-45 laser. The Quasar 355-60 operates over a wide repetition rate range from 0–3.5 MHz, with

### The Quasar Advantage

- >60 W UV (300 µJ) or >45 W UV (225 µJ)
- >95 W Green (475 µJ) or >75 W Green (375 µJ)
- TimeShift Technology
  - Constant pulse width over wide range of PRF
  - Variable pulse width
  - Pulse shaping
  - Pulse splitting and Burst mode operation
- High PRF from 0–3.5 MHz for fast processing
- Robust and reliable for OEM tools
- Datalog for critical performance monitoring and diagnostics

### Applications

- Glass cutting and drilling
- PCB drilling
- PCB cutting and dpaneling
- HDI (high density interconnects)
- Si crystallization
- Si wafer dicing
- Low K dielectric grooving
- Ceramic processing
- LED processing
- Solar cell processing
- ITO patterning
- Photolithography
- CFRP cutting and drilling
- Thin film planar battery cutting
- Drilling and scribing MDM polymers

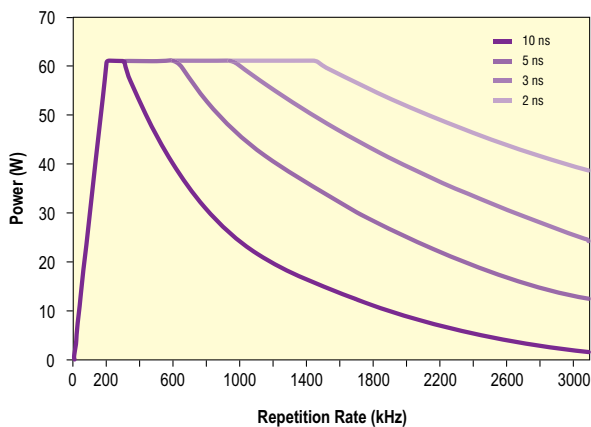


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pulse widths from <2 ns to >100 ns. The newest Quasar 355-60 Turbo, optimized for high repetition rate performance, produces >38 W of UV output power at specification point 3 MHz 2 ns. The Quasar 355-60 Turbo is an excellent match for high speed polygon scanning systems. The Quasar 532-95 nm produces >95 W of green output power, with similar pulse width and PRF range as the Quasar 355-60, complementing Spectra-Physics' breakthrough Quasar 532-75 laser.

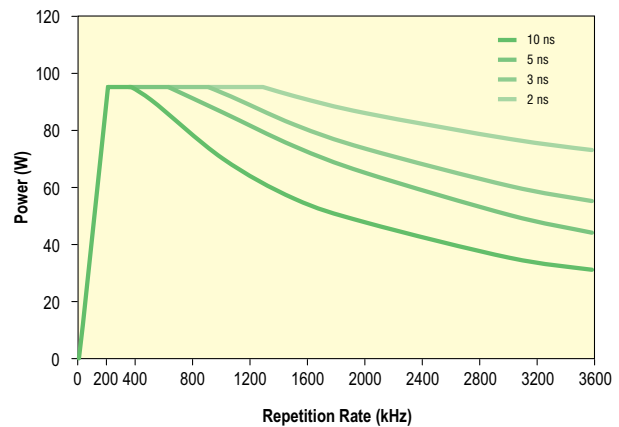
Quasar is designed, built, and tested to stringent quality standards for reliable continuous operation in demanding 24/7 manufacturing environments. The built-in ALPS (Active Laser Purification System) helps sustain that performance for long life. And finally, Quasar lasers' automatic data logging software monitors all key laser performance parameters over the life of the laser, providing a powerful service feature and product reliability tool. A customer version of this software is also available.

Quasar 355-60 Power vs  
Repetition Rate Performance<sup>1</sup>



1. Quasar 355-60 specified power is >60 W at 300 kHz 10 ns. Quasar 355-60-Turbo specified power is >38 W at 3 MHz 2 ns. Other points on graph are not a guaranteed or warranted specification.

Quasar 532-95 Power vs  
Repetition Rate Performance<sup>1</sup>



1. Quasar 532-95 specified power >95 W at 200 kHz 10 ns. Quasar 532-75 specified power >75 W at 200 kHz 10 ns. Other points on graph are not a guaranteed or warranted specification.

## TimeShift Technology – Expanding and/or Compressing (Controlling) Output in the Time Domain to Enhance Utilization

Quasar is the first laser of this class to offer TimeShift technology, which enables pulse energy programmability in the time domain. By controlling the laser pulse (width and shape) in time and repetition rate, material removal and/or modification in micromachining becomes more efficient, thereby increasing process speed and quality. Utilizing TimeShift in conjunction with high UV or green power at a higher repetition rate means Quasar can process more materials faster, and with greater quality. TimeShift enables pulse width variation, as well as pulse splitting and burst mode operation. For the Quasar 355-60 and 532-95 models, pulse widths from <2 ns to >100 ns can be created at a constant PRF or conversely, maintain constant pulse width with varying

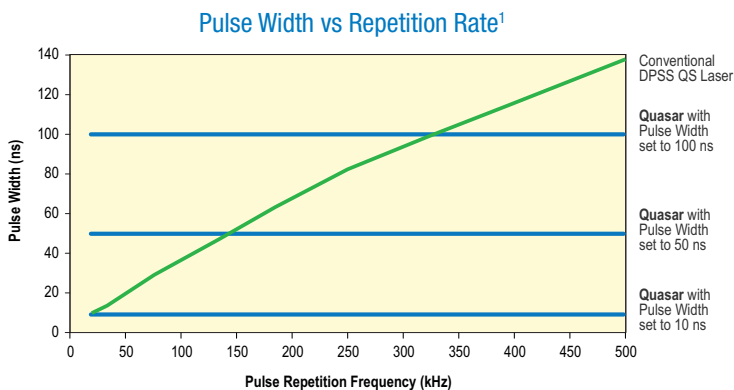
# Quasar

repetition rate from 0 to 3.5 MHz. A set of standard TimeShift waveforms is provided with each Quasar. The TimeShift GUI, which enables users to develop custom waveforms, is available at additional pricing.

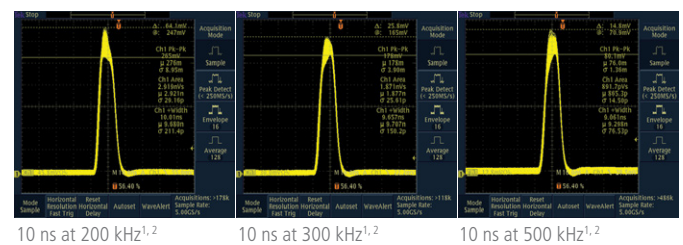
## TimeShift Technology Flexibility and Benefits

### TimeShift Constant Pulse Width vs PRF

Unlike conventional Q-switched lasers, Quasar's TimeShift technology can maintain constant pulse width over a wide range of PRF. Constant pulse width means the peak power remains more constant, allowing for more consistent process results at higher speeds.

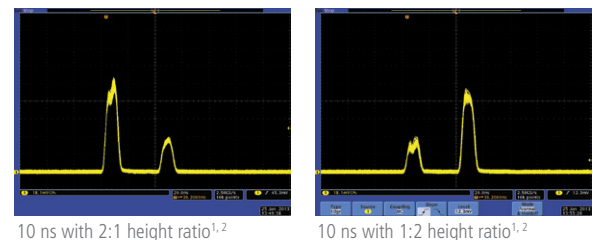
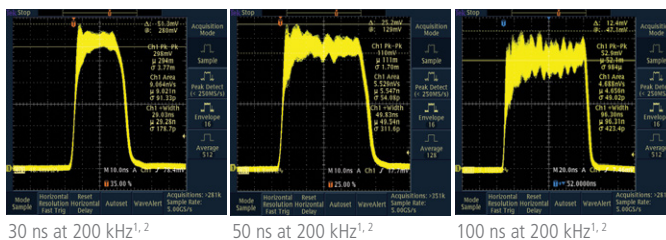


### Actual Pulse Traces of Constant Pulse Widths vs PRF



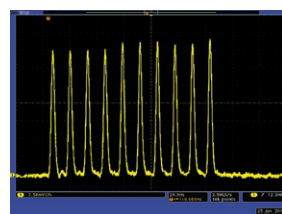
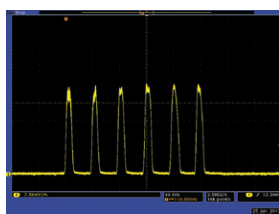
### TimeShift Variable Pulse Width and Pulse Shaping

Varying the pulse width for a given PRF can be used to optimize the material interaction. By changing the energy and intensity within a pulse (pulse shaping), the heating or cooling of the material is further optimized.



### TimeShift Pulse Splitting and Burst Mode

By splitting the pulses at a given PRF, the material is allowed to dissipate the heat or plasma such that more efficient material removal is possible. By altering the number, spacing, and relative intensity of pulses within the burst, the spatial-temporal thermal profile in the work piece can be precisely tailored, increasing process speed and/or quality.



1. Typically measured performance; not a guaranteed or warranted specification.

2. Vertical range on oscilloscope set so that pulse peak is 75% of window.

# Quasar Specifications<sup>1, 2, 5</sup>

	Quasar 355-60	Quasar 355-60-Turbo*	Quasar 355-45	Quasar 532-95	Quasar 532-75
Output Characteristics					
Wavelength	355 nm	355 nm	355 nm	532 nm	532 nm
Output Power	>60 W @ 200 kHz, 10 ns >60 W @ 300 kHz, 10 ns	>38 W @ 3 MHz, 2 ns	>45 W @ 200 kHz, 10 ns >45 W @ 250 kHz, 10 ns >41 W @ 300 kHz, 10 ns	>95W @ 200 kHz, 10 ns	>75 W @ 200 kHz, 10 ns
Maximum Pulse Energy at Optimization Point	>300 µJ	>12 µJ	>225 µJ	>475 µJ	>375 µJ
Repetition Rate Range	0–3.5 MHz	0–3.5 MHz	0–1.7 MHz	0–3.5 MHz	0–1.7 MHz
Optimized TimeShift™ Setting (Nominal setup for beam optimization)	300 kHz, 10 ns	3 MHz, 2 ns	300 kHz, 10 ns	200 kHz, 10 ns	200 kHz, 10 ns
Pulse-to-Pulse Energy Stability	<5%, 1σ				
Power Stability (after warm-up)	<2%, 1σ, over 8 hours				
Beam Pointing Stability	< ±25 µrad/°C				
Peak-to-Peak Power Stability (after warm-up)	±3% over 8 hours				
Polarization	≥100:1, vertical			≥100:1, horizontal	
Spatial Mode	TEM <sub>00</sub> (M² <1.3)				
Beam Divergence, full angle	<0.3 mrad			< 0.45 mrad	
Beam Asymmetry	<1.10 (> 90% circularity)				
Pulse Width, FWHM (TimeShift programmable) <sup>3</sup>	<2 ns to >100 ns	<2 ns to >100 ns	<5 ns to >100 ns	<2 ns to >100 ns	<5 ns to >100 ns
Beam Diameter (D4σ)	3.5 ±0.35 mm				
Boresight Tolerance	±0.5 mm ±5 mrad				
Operating Conditions					
Warm-up Time, typical	<20 min from warm-up mode, <60 min from cold start	<20 min from warm-up mode, <60 min from cold start	<20 min from warm-up mode, <40 min from cold start	<20 min from warm-up mode, <60 min from cold start	<20 min from warm-up mode, <40 min from cold start
Temperature Range	20–28°C				
Altitude	0–2000 m				
Humidity	10–80% non-condensing				
Storage Conditions					
Temperature Range	0–50°C				
Altitude	0–10,000 m				
Humidity	10–80% non-condensing				
Electrical and Chiller Requirements					
Heat Load (at laser head)	<1500 W				
Water Temperature (laser inlet)	20°C ±1°C				
Water Flow Rate (at laser head)	9.5 l/min				
Power Input	190–240 VAC, 2500 Watts Maximum, 50/60 Hz, single phase				
Heat Load (at power supply)	<400 W				
Power Consumption	<1900 W				
Water Temperature Stability	±0.5°C				
Physical Characteristics					
Laser Head Dimensions (L x W x H) <sup>4</sup>	39.4 x 14.7 x 9.3 in (1000 x 373 x 235 mm)				
Laser Head Weight	200 lbs (90 kg)				
Power Supply Dimensions (L x Wx H)	21.1 x 19.0 x 6.9 in (536 x 483 x 175 mm)				
Power Supply Weight	35 lbs (16 kg)				
Cable Length	5 m				
Other					
EU RoHS 2 Compliant China RoHS 2 Complaint	Yes				
User Replaceable Output Window	Yes				
Optional Safety Shutter	Yes				
Data Log (includes customer version as well)	Long and short term recording for diagnostics and equipment maintenance				

1. Due to our continuous product improvement program, specifications may change without notice.

2. Quasar 355-60 and 355-45 nm test specs are at 10 ns at 300 kHz with the diode current set to achieve 62 W for the Quasar 355-60, and 42 W for the 355-45. 355-60-Turbo test specs are at 3 MHz 2 ns with diode current set to achieve 40 W. All 532 nm test specs are at 10 ns at 200 kHz with the diode current set to achieve 97 Watts for the Quasar 532-95 and 77 Watts for the 532-75.

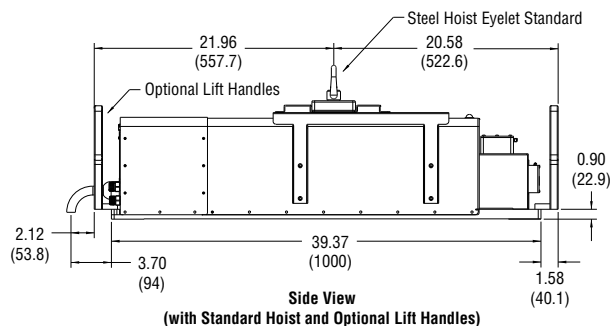
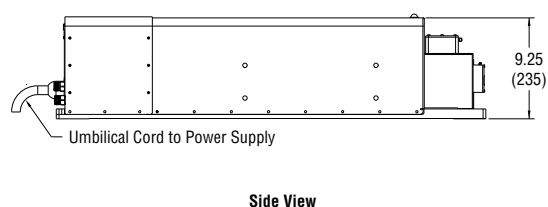
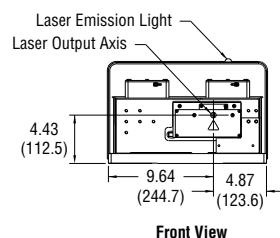
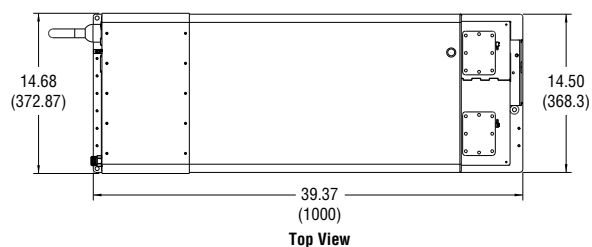
3. Quasar 355-60, 355-45, 532-95 and 532-75: nominal pulse width 10 ns. Quasar 355-60-Turbo nominal pulse width 2 ns. Alternative/programmable pulse widths using TimeShift will change power and beam parameter performance. Contact Spectra-Physics for more information.

4. Quasar 355-60, 355-60-Turbo, 355-45, 532-95 and 532-75 dimensions noted do not include the standard removable lifting hoist exoskeleton or the optionally removable lift handles.

5. Quasar is a Class IV - High Power Laser, whose beam is, by definition, a safety and fire hazard. Take precautions to prevent exposure to the direct and reflected beams. Diffuse as well as specular reflections can cause severe skin or eye damage.

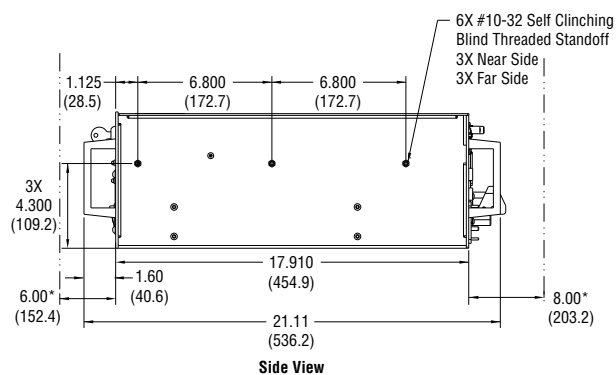
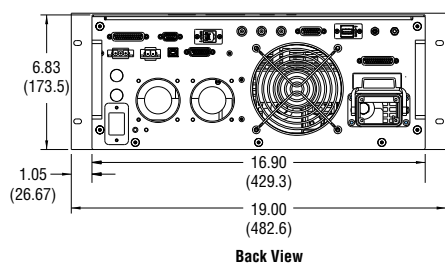
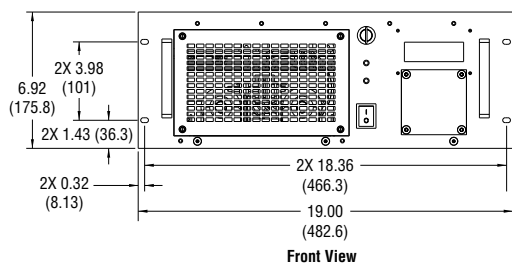
\* Quasar 355-60-Turbo sales part number is Quasar355-60-Turbo.

# Quasar



Dimensions in inch (mm)

## Quasar Laser Head Dimensions



\*Minimum envelope for cable/tubing bending radius and/or proper air flow circulation

Dimensions are in inches (mm)

## Quasar Power Supply Dimensions



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