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Pockels Cell & Pockels Cell Driver (EO Q-switch, Electro-optic Q-switch)

1. IMPACT Series EO Q-switches

A Pockels cell alters the polarization state of light passing through it when an applied voltage induces birefringence changes in an electro-optic crystal such as KD*P and BBO. When used in conjunction with polarizers, these cells can function as optical switches, or laser Q-switches. Frequently, Q-switches are employed in laser cavities for the purpose of shortening the output pulse, resulting in a light beam with enhanced peak intensity. In order to provide the device best suited to your purpose, we offer the industry standard QX series, economical IMPACT cells, BBO-based LightGate, and large-aperture TX Pockels cell lines. High-speed electronic drivers properly matched to the cell produce the best results for short pulse applications.

From the world leader in nonlinear materials and electro-optic devices comes the ideal Pockels cell for OEM applications, the IMPACT. Once again, we set the industry standard - and at an exceptional price.

The IMPACT employs the finest strain-free, highly deuterated KD*P available. Ceramic apertures ensure robust performance in demanding applications. Ultra-high-damage threshold Sol Gel and dielectric AR coatings are offered for a variety of laser wavelengths. The standard pin-type connectors (superior for high-voltage applications) provide quick connections and simplified design and assembly. Conventional threaded connectors are available as an option. The IMPACT is back-filled with dry nitrogen.



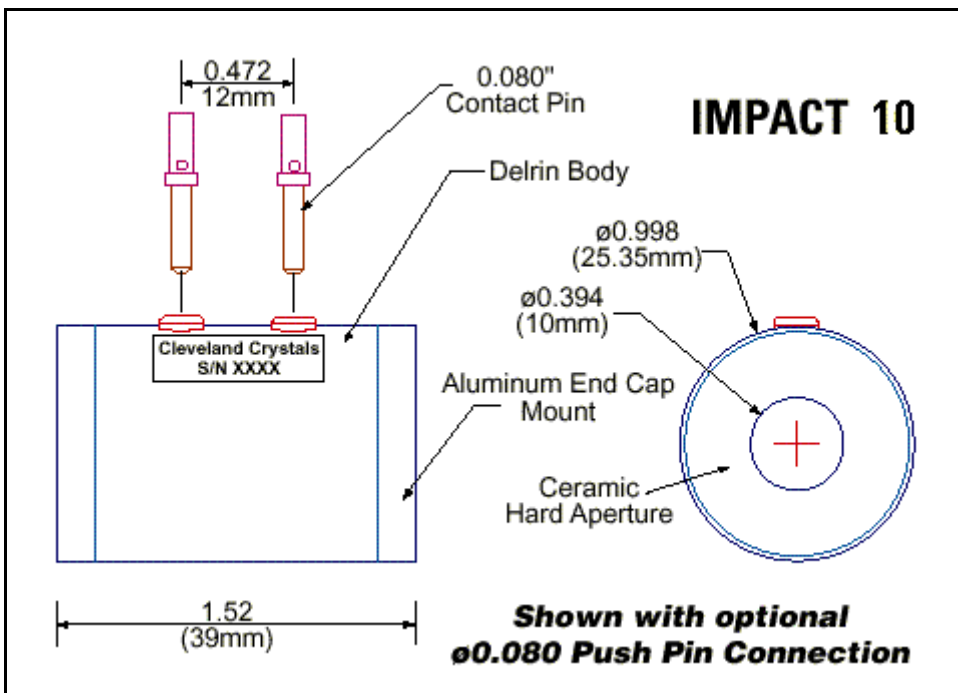
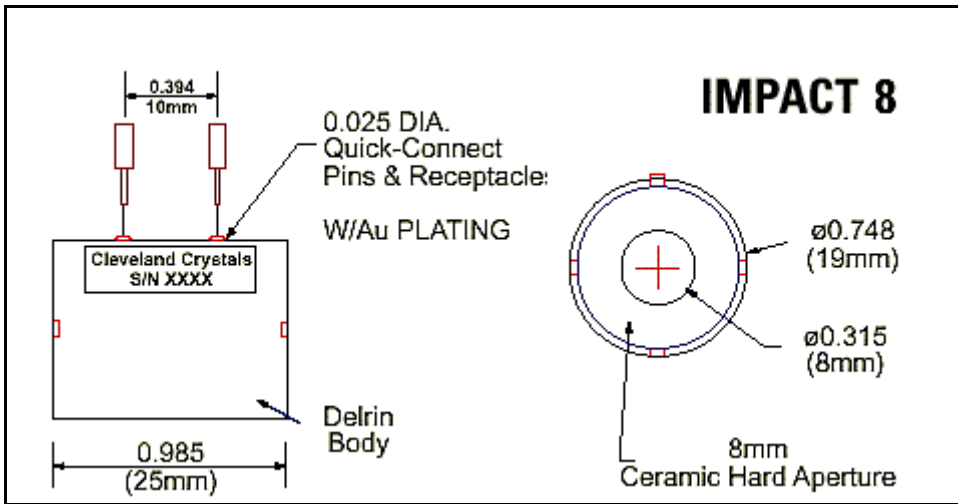
Applications:

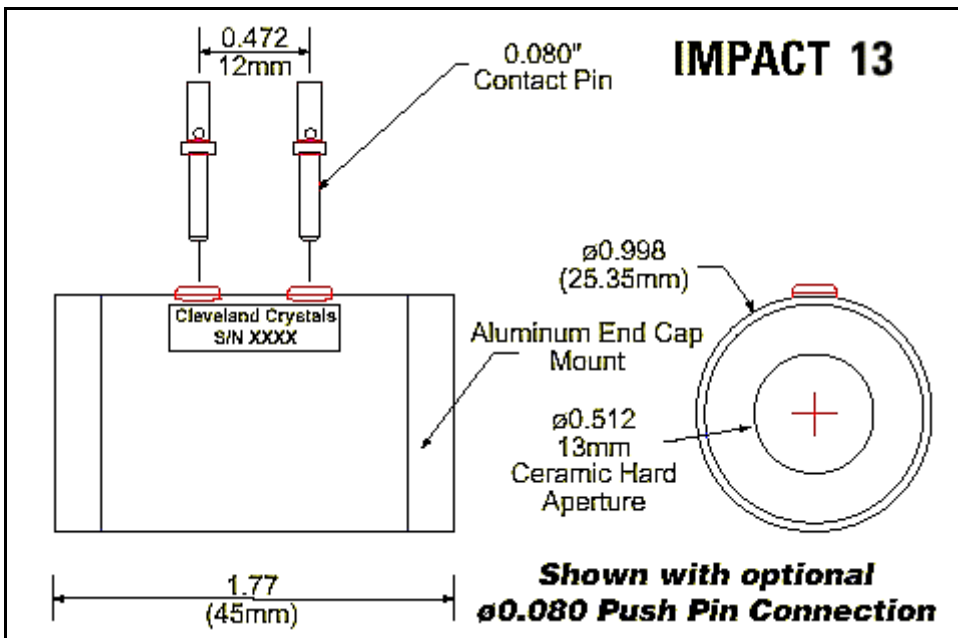
- OEM laser systems
- Medical/cosmetic lasers
- Versatile R&D laser platforms
- Military & aerospace laser systems

FEATURES	BENEFITS
CCI Quality - economically priced	Exceptional value
Finest strain-free KD*P	High contrast ratio High damage threshold Low 1/2 wave voltage
Space efficient	Ideal for compact lasers
Ceramic apertures	Clean and highly damage-resistant
High contrast ratio	Exceptional hold-off
Quick electrical connectors	Efficient/reliable installation
<i>Ultra-flat</i> crystals	Excellent beam propagation

Typical Specification

Electro-optical @ 1064nm			
1/4 Wave Voltage: 3.3 kV			
Transmitted Wave Front Error : <1/8 Wave			
ICR>2000:1			
VCR>1500:1			
Capacitance: 6 pF			
Sol Gel Damage Threshold @ 1064nm, 10ns pulse: 40J/cm ²			
Housing Dimensions	IMPACT 8	IMPACT 10	IMPACT 13
Aperture	8 mm	10 mm	13 mm
Length	25 mm	39 mm	45 mm
Diameter	19 mm	25.35 mm	25.35 mm





2. QX Series EO Q-switches

The QX series sets the standard for KD*P electro-optic Q-switches. These devices provide reliable, stable performance for a diverse range of laser applications.

We offer a unique rebuild program that extends the QX lifetime. All rebuilt units are upgraded with the latest product improvements and are returned with a new one-year warranty.

The standard configuration employs a broad band, high damage threshold Sol Gel AR coating for improved durability and performance. The QX series is also available with index matching fluid and a choice of end caps. All units are tested for optic and electric function and are supplied with a QA inspection report.

Features

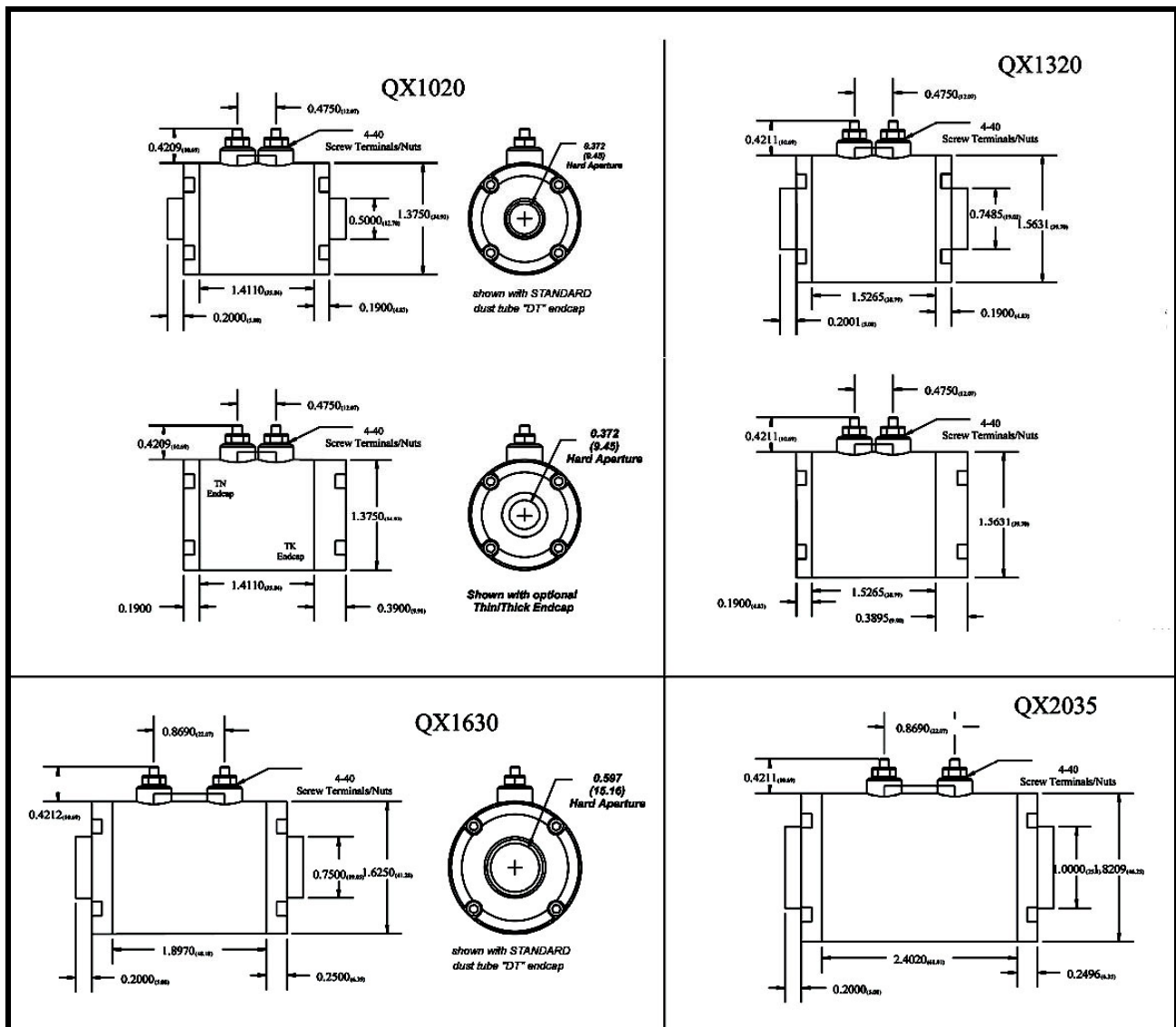
- Industry-proven performance
- Dry or fluid-filled
- Highest (99.9% KD*P) deuteration levels in industry
- Adhesive/Epoxy-free assembly
- Premium UV-grade fused silica windows
- Apertures from 9.25mm diameter up to 19.5mm diameter
- Lowest absorption in industry
- High-reliability
- Economical upgrade/rebuild program
- Highest optical damage thresholds
- Accessible technical support
- Standard performance documentation
- One-year limited warranty
- Operation up to 10kHz (special order)



Performa Data

Typical Specification 99% KD*P	QX1020	QX1320	QX1630	QX2035
Physical				
Hard aperture diameter	9.25 mm	12.3 mm	15.1 mm	19.5 mm
Single Pass Insertion Loss	<1.4%	<1.4%	<1.8%	<2.0%
Voltage Contrast Ratio				
(Cross polarizers)	5000:1	4000:1	3500:1	3000:1
(Parallel polarizers)	2500:1	1500:1	1800:1	1600:1
DC Quarter wave voltage @1064nm	3.2 kV	3.5 kV	3.3 kV	3.5 kV
Single Pass Distortion @ 633nm	< $\lambda/8$	< $\lambda/8$	< $\lambda/8$	< $\lambda/8$
Electrical				
Capacitance @ 1 kHz	6pF	9pF	9pF	13pF
10-90% Rise time (50 Ω line)	0.8 ns	1.1 ns	1.1 ns	1.5 ns

Note: Specifications are subject to change without notice.



EO Q-switch Driver (Pockels Cell Driver)

- Output voltage up to 5kV
- As fast as 10ns risetime
- Rugged solid-state design
- Self-contained high voltage power supply
- Compact surface mount design
- TTL/CMOS trigger

The QSDEO series Pockels cell drivers (EO Q-switch drivers) are designed for continuous pulsed applications, such as controlled Q-switching of lasers. Solid-state MOSFET technology is used, giving excellent trigger noise immunity and a smooth output waveform. This technique eliminates common problems associated with krytron, avalanche and transformer drivers. Amplitude is continuously variable by adjusting the internal high voltage power supply. Pulse amplitudes to 5kV are available. Long recovery time eliminates need for normal mode supply.

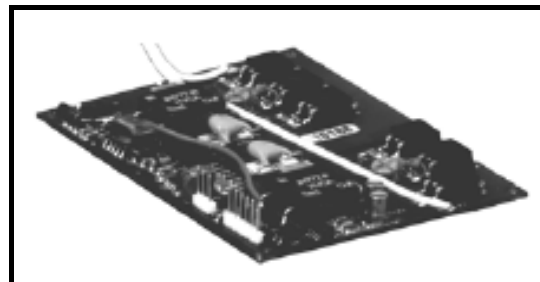
Model	Pulse frequency	Rise time	Output voltage	Input voltage
QSDEO-822	Single shot -30Hz	<10ns	1000V-3100V	15VDC
QSDEO-829	Single shot -50Hz	<10ns	500V-3500V	15VDC
QSDEO-825	Single shot -100Hz	<30ns	0V-3500V	15VDC
QSDEO-8261A	Single shot -5000Hz	<20ns(11-15ns)	1000V-5500V	15VDC



QSDEO-829, QSDEO-825



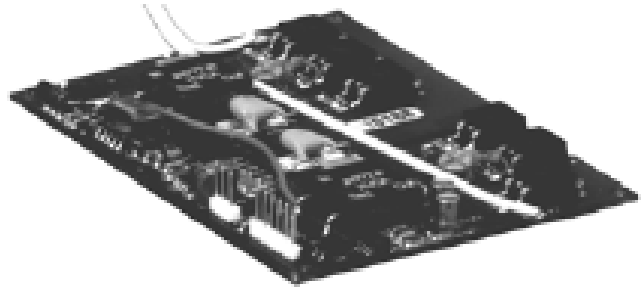
QSDEO-822



QSDEO-8261A

High Repetition Rate Rockels Cell/Shutter Driver for BBO Crystals - QSDEO8261A

- Adjustable push-pull output to 5.5kV
- $\leq 20\text{ns}$ rise time and recovery
- High PRF to 5kHz
- Rugged solid-state design
- Self-contained high voltage power supply
- Compact surface mount construction
- Opto-isolated or TTL trigger options
- Pulse width from $5\mu\text{s}$ TO DC



DESCRIPTION:

The Model QSDEO-8261A Pockels Cell/Shutter Driver is designed for high repetition rate, continuous pulsed applications. Solid-state MOSFET technology is used, giving excellent trigger noise immunity and a smooth output waveform. This technique eliminates common problems associated with krytron, avalanche, and transformer drivers. Amplitude is continuously variable by adjusting the internal high voltage power supply. The Model QSDEO-8261A is capable of operating at high pulse repetition frequencies, fast risetimes and falltimes, and output pulses up to 5.5kV. A low voltage monitor pin is provided to monitor the high voltage prior to the pulse. Internal timing is provided to refresh the output at a 5kHz rate, providing pulsewidth operation from $5\mu\text{s}$ to DC.

SPECIFICATIONS:

Input

Trigger Input +4V to +10V into $\geq 500\Omega$ (QSDEO8261A-1); Opto-isolated, 5V at 10mA typical via internal 470Ω (QSDEO8261A-2)

Pulsewidth $5\mu\text{s}$ to DC

Repetition Rate: Up to 5kHz (20pF load, 2.7kV)

Up to 5kHz (5pF load, 5.5kV)

Power +24VDC $\pm 0.5\text{V}$ at 20mA to 350mA depending on PRF and output voltage

Temperature 0° to $+50^\circ\text{C}$

Connections

Power/Trigger Panduit MFSS100-6 Connector

Control Monitor 0.1" pin spacing

Ext. Pot Control Panduit MFSS100-3 Connector

Output 18 ± 2 " Flying Leads

Output

Voltage 1kV to 5.5kV minimum

Load Tested with 5pF load or 20pF load

Risetime/ Recovery $\leq 20\text{ns}$ (20pF load, 2.7kV)

$\leq 20\text{ns}$ (5pF load, 5.5kV)

Pulsewidth Same as trigger pulsewidth

Voltage Control Internal multi-turn trimpot or external control voltage

When using external mode: 0V control yields 0kV output

5.5V control yields 5.5kV output

Monitor Pin to monitor HV prior to pulse

Scale same as voltage control

Size 4.20" x 3.20" x 0.71" (107x81x18mm)

Weight 3.0 oz (85grams)

Caution:

Mounting hardware must be Non-Conductive.

Nylon hardware is provided.

APPLICATIONS:

Driving E-O Q-Switches for Q-Switching Solid-State Lasers, High Voltage Pulser, E-O Shutter

MODEL NUMBER

OUTPUT SWING

1kV to 5.5kV

INPUT VOLTAGE +24V ± 0.5V
TRIGGER

QSDEO8261A-1
TTL

QSDEO8261A-2
OPTO-ISOLATED

Typical No.: **QSDEO8261A-1** = Input Voltage: +24V ± 0.5V

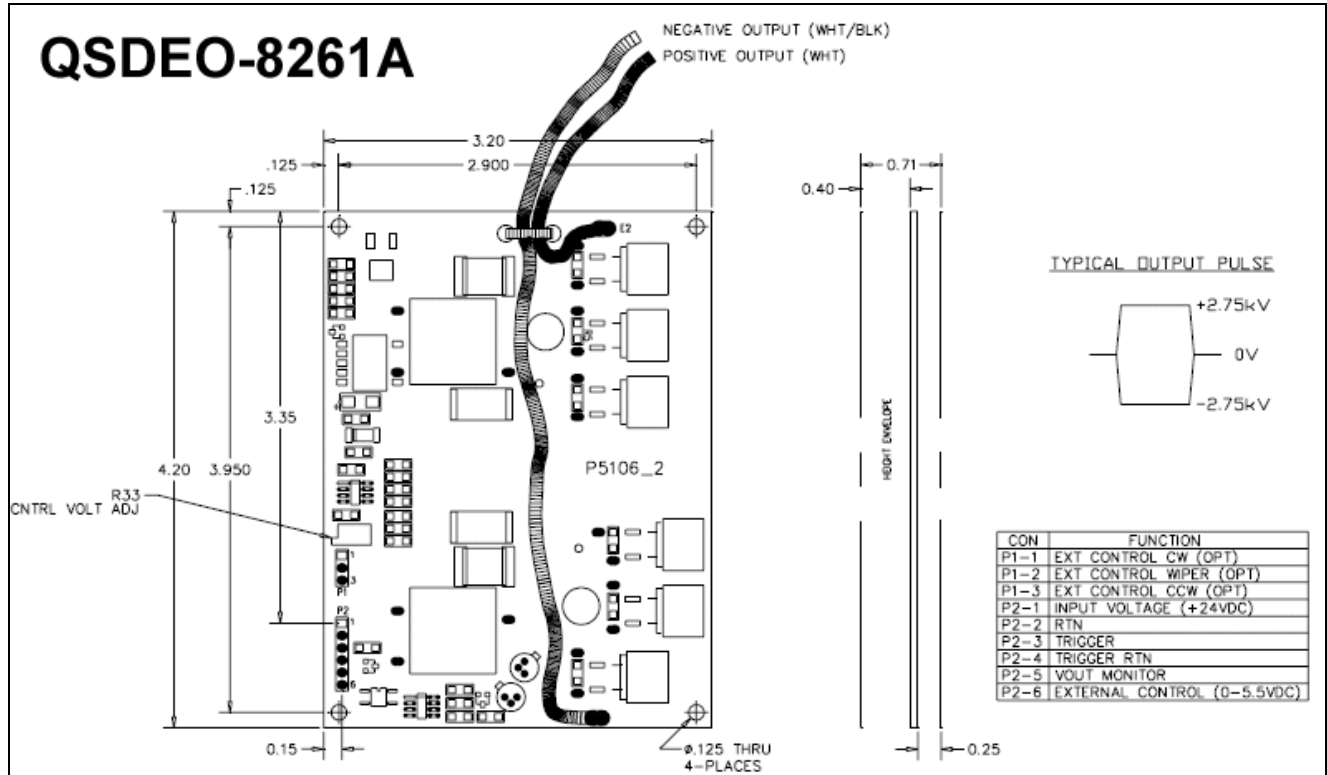
Trigger: +4V to +10V into ≥ 500Ω

Output Voltage: 1kV to 5.5kV

Voltage Control: Internal multi-turn trimpot for external voltage control

Monitor: Panduit MFSS100-6 connector to monitor HV prior to pulsing.

When using external voltage control, R33 must be set fully CCW.



Solid-state Pockels Cell Driver - QSDEO-829

- Adjustable output to -3.5kV
- $\leq 10\text{ns}$ rise time, 4ms recovery time
- Rugged solid-state design
- Self-contained +15V power supply
- Compact surface mount construction
- Opto-isolated or TTL trigger options



DESCRIPTION:

The QSDEO-829 Series Pockels cell drivers are designed for continuous pulsed applications, such as controlled Q-switching of lasers. Solid-state MOSFET technology is used, giving excellent trigger noise immunity and a smooth output waveform. This technique eliminates common problems associated with krytron, avalanche and transformer drivers. Amplitude is continuously variable by adjusting the internal high voltage power supply. Pulse amplitudes to -3.5kV are available. Long recovery time eliminates need for normal mode supply.

SPECIFICATIONS:

Input

Trigger Input TTL/CMOS compatible, positive logic, $>2.5\text{V}$, high impedance, internally limited to $+5\text{V}$ via $1\text{k}\Omega$ load (QSDEO829-1); Opto-Isolated, active high current of 10mA (QSDEO829-2)

Pulsewidth $5\mu\text{s}$ to 1ms

Repetition Rate: Up to 50pps

Power $+15\text{VDC} \pm 0.5\text{V}$ at 20mA to 100mA depending on PRF and output voltage

Temperature 0° to $+70^\circ\text{C}$

Connections

Input 4 pin connector

Output 12" Flying Leads

Output

Voltage -500V to -3.5kV

Load Tested with 47pF

Risetime $\leq 10\text{ns}$

Recovery $4\pm 1\text{ms}$ (90% to 10%)

Pulsewidth $1\mu\text{s}$ to $300\mu\text{s}$ at 90% (4.7pF , $100\text{M}\Omega$ load)

Voltage Control Internal multi-turn trimpot
External (add -EXT to part number.)

When using external mode: 4V control yields 0V output

8.2V control yields -3.5kV output

Monitor HV monitor lead to monitor HV prior to pulse (add -HV to part number)

Size $3.73" \times 1.25" \times 0.65"$ ($95 \times 32 \times 17 \text{ mm}$)

Weight 1.8oz (51grams)

Caution:

Mounting hardware must be Non-Conductive.

Nylon hardware is provided.

APPLICATIONS:

Driving E-O Q-Switches for Q-Switching Solid-State Lasers, High Voltage Pulser, E-O Shutter

MODEL NUMBER

OUTPUT SWING

0 to -3.5kV

INPUT VOLTAGE +15V ± 0.5V
TRIGGER

QSDEO829-1
TTL

QSDEO829-2
OPTO-ISOLATED

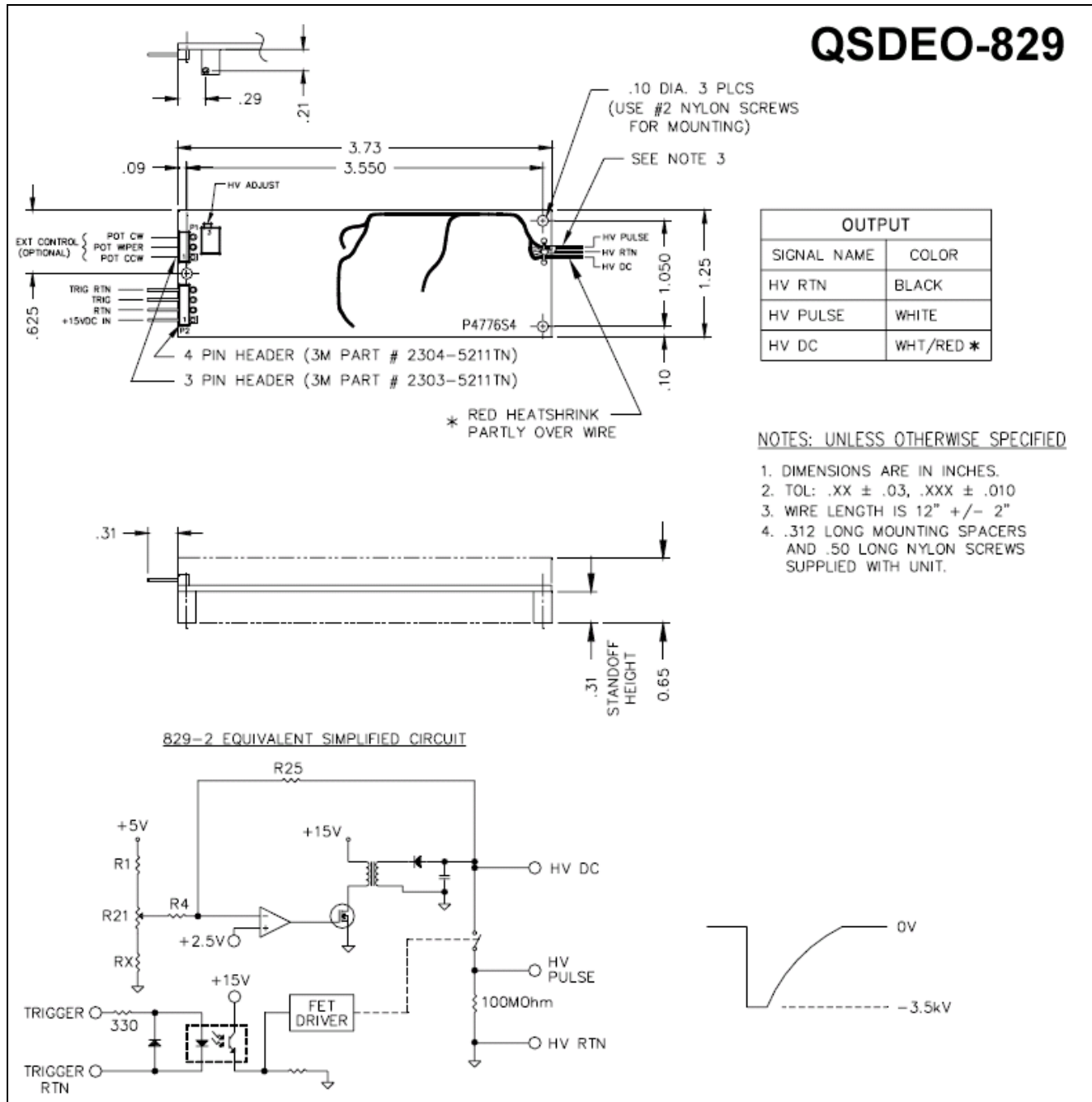
Typical No.: **QSDEO829-1-HV** = Input Voltage: +15V ± 0.5V

Trigger: TTL

Output Voltage: -500V to -3.5kV

Voltage Control: Internal multi-turn trimpot

HV Monitor: HV monitor lead provided to set HV prior to pulsing.



Solid-state Pockels Cell Driver - QSDEO-825

- Adjustable output to -3.5kV
- $\leq 30\text{ns}$ rise time, $150\mu\text{s}$ recovery time
- Rugged solid-state design
- Self-contained high voltage power supply
- Compact surface mount design
- Opto-isolated or TTL trigger options



DESCRIPTION:

The QSDEO-825 *Series* Pockels cell drivers are designed for continuous pulsed applications, such as controlled Q-switching of lasers. Solid-state MOSFET technology is used, giving excellent trigger noise immunity and a smooth output waveform. This technique eliminates common problems associated with krytron, avalanche and transformer drivers. Amplitude is continuously variable by adjusting the internal high voltage power supply. Options for triggering include an active high opto-isolator and TTL logic. Pulse amplitudes to -3.5kV are available.

SPECIFICATIONS:

Input

Trigger Input TTL/CMOS compatible, positive logic, $>2.5\text{V}$, high impedance, internally limited to $+5\text{V}$ via $1\text{k}\Omega$ load (QSDEO825-1); Opto-Isolated, active high current of 10mA (QSDEO825-2)

Pulsewidth $\geq 300\text{ns}$ to $25\mu\text{s}$

Repetition Rate: Up to 100pps , burst mode permissible

Power $+15\text{VDC} \pm 0.5\text{V}$ at 20mA to 100mA depending on PRF and output voltage

Temperature 0° to $+70^\circ\text{C}$

Connections

Input 4 pin connector

Output 12" Flying Leads

Output

Voltage 0 to -3.5kV

Load Tested with 47pF , $100\text{M}\Omega$

Risetime $\leq 30\text{ns}$

Recovery $\leq 100\mu\text{s}$

Pulsewidth $1\mu\text{s}$ to $3\mu\text{s}$ at 97%

Voltage Control Internal multi-turn trimpot
External (add -EXT to part number.)

When using external mode: 4V control yields 0V output
 8.2V control yields -3.5kV output

Monitor HV monitor lead to monitor HV prior to pulse (add -HV to part number)

Size $3.73'' \times 1.25'' \times 0.48''$ ($95 \times 32 \times 12 \text{ mm}$)

Weight 1.8oz (51grams)

Caution:

Mounting hardware must be Non-Conductive.
Nylon hardware is provided.

APPLICATIONS:

Driving E-O Q-Switches for Q-Switching Solid-State Lasers, High Voltage Pulser, E-O Shutter

MODEL NUMBER

OUTPUT SWING

0 to -3.5kV

INPUT VOLTAGE +15V ± 0.5V
TRIGGER

QSDEO825-1
TTL

QSDEO825-2
OPTO-ISOLATED

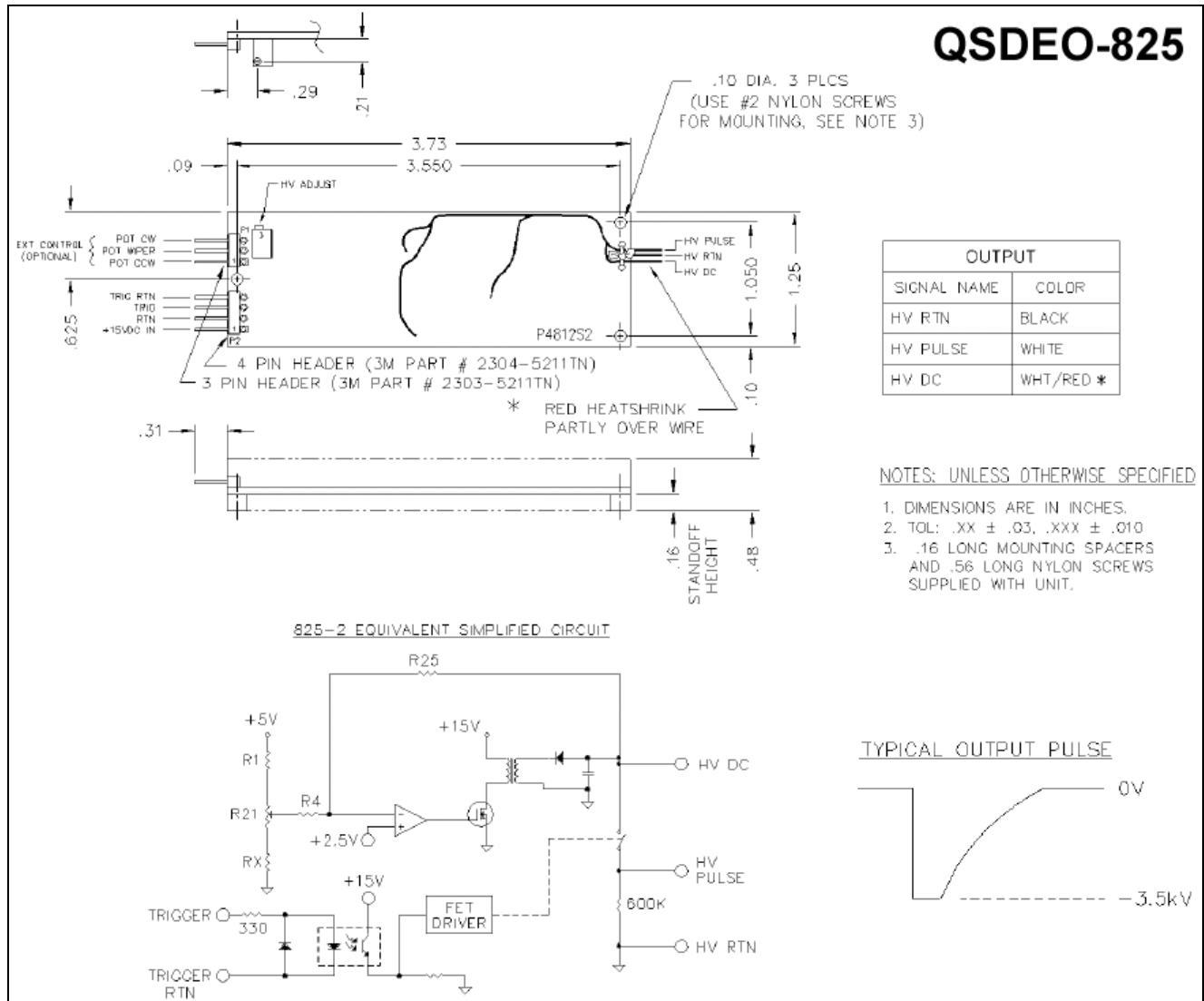
Typical No.: **QSDEO825-2-HV** = Input Voltage: +15V ± 0.5V

Trigger: Opto-isolated, active high current of 10mA

Output Voltage: 0 to -3.5kV

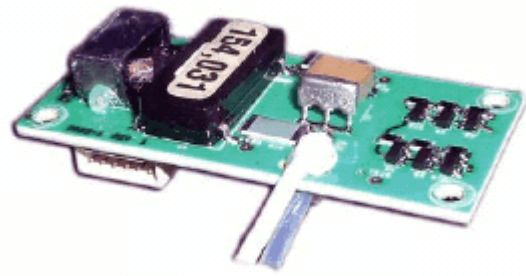
Voltage Control: Internal multi-turn trimpot

HV Monitor: HV monitor lead provided to set HV prior to pulsing.



Compact Solid-state Pockels Cell Driver - QSDEO-822

- Output voltage up to -3.1kV
- $\leq 10\text{ns}$ rise time, 3ms recovery time
- Rugged solid-state design
- Self-contained high voltage power supply
- Compact surface mount design
- TTL/CMOS trigger options



DESCRIPTION:

The QSDEO-822 Pockels cell driver is a compact rugged design for single shot or continuous pulsed applications, such as Q-switching LiNbO_3 and RTP crystals. Output voltage is fixed at the factory within the voltage ranges provided. Both commercial (-C) and industrial (-I) temperature versions are available.

SPECIFICATIONS:

Input

Trigger TTL/CMOS compatible, positive logic, 2.5V to V_{in} , high impedance

Pulsewidth $\geq 300\text{ns}$ to $25\mu\text{s}$

Repetition Rate: Single shot to 30Hz

Power +11.5VDC to +15.5V at $\leq 20\text{mA}$

Temperature 0° to $+70^\circ\text{C}$ (-C version); -40° to $+85^\circ\text{C}$ (-I version)

Connectors

Input Flying leads (18+/-1")

Output Flying Leads (3+/-1")

Output

Voltage Up to -3.1kV Factory set

Load Tested with 20pF

Risetime $\leq 10\text{ns}$, 3ns typical

Recovery $\leq 3\text{ms}$

Pulsewidth 1 μs to 3 μs at 97%

Hold time $\geq 20\mu\text{s}$ at 90%, 40 μs typical

Size 2.0"L x 0.9"W x 0.52"H (51 x 23 x 13 mm)

Weight 0.42 oz (12 grams)

Caution:

Mounting hardware must be Non-Conductive.

Nylon hardware is provided.

APPLICATIONS:

Driving E-O Q-Switches for Q-Switching Solid-State Lasers, High Voltage Pulser, E-O Shutter

Model Number	Output Voltage*
QSDEO-822-1	-1.00kV \pm 100V
QSDEO-822-2	-2.15kV \pm 150V
QSDEO-822-3	-2.50kV \pm 200V
QSDEO-822-4	-2.90kV \pm 200V

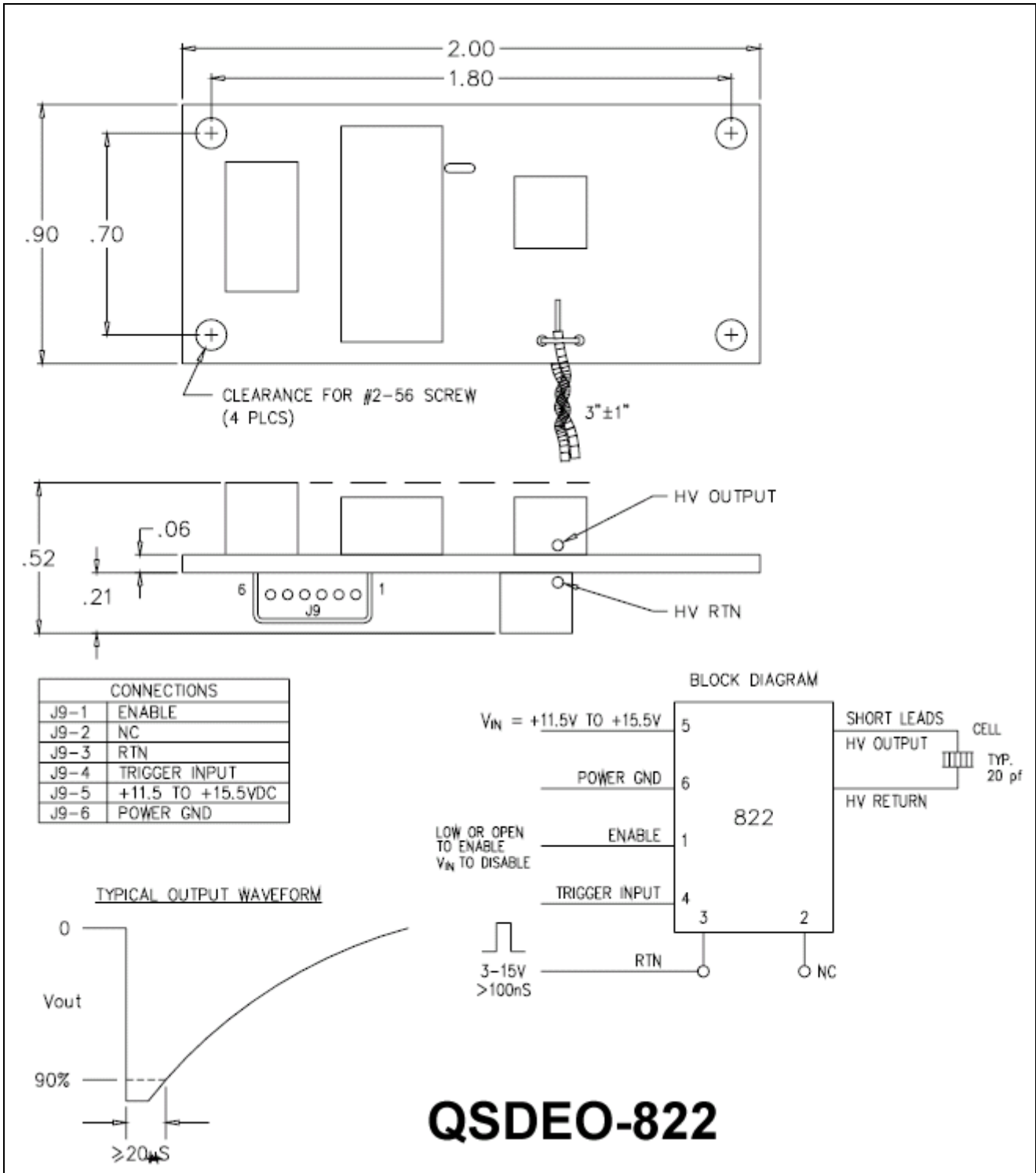
*Output voltage fixed at the factory within the range provided.

Typical No.: **QSDEO822-3-C** = Input Voltage(V_{in}): +11.5V to + 15.5VDC

Trigger: TTL/CMOS

Output Voltage: -2.5kV +/- 200V

Temperature Range: 0° to $+70^\circ\text{C}$



Pockels Cell (EO Q-switch) Questionnaire

In order for us to understand your application, please answer the following questions so that we can recommend our best product to meet your requirements:

1. What is the beam diameter or radius (1/e² value)? – Please specify if radius or diameter.
2. What is the beam profile (Gaussian, pseudo-Gaussian, top hat, etc.)?
3. What is the wavelength of operation?
4. What is the repetition rate? (What is the desired repetition rate for the Pockels cell?)
5. What is the laser peak power (extra-cavity)?
6. What is the energy-per-pulse?
7. What is the pulse width (FWHM)?
8. What is the desired pulse width? (How long do you expect the cell to be energized? What is the anticipated “on” time.)
9. Do you require quarter wave or half wave operation? (A Pockels cell is similar in function to an “electrically operated wave plate”. You can achieve $\lambda/4$ operation at 3.2KV or $\lambda/2$ operation at 6.4KV at 1064nm. However, if the cell is intended to be used at $\lambda/2$ it may need to be specially constructed or we may determine that our cell is not proper for a particular application based on answers to 8 and 9.)
10. What is your duty cycle? (we recommend <5%) (Duty cycle is the on/off time ratio. We recommend no more than 5% “on” or “electrically energized” time. Some designers want to energize the cell all of the time and switch it to ground briefly for the pulse time. This situation is not recommended and will void the customers warranty.)
11. If using a laser cavity, what is the finesse or output coupler reflectivity? (This helps us to determine intra-cavity power levels to determine cell suitability.)