



## ***BBO Pockels Cells***



*Fig 1: QS-3 Pockels cell*

The Series QS Pockels cell/Q-Switch is a product developed for high average power Lasers such as Diode-Pumped Solid State (DPSS) Lasers with powers more than 100 Watts. In this Pockels cell, BBO crystal material is used. This crystal does not suffer from problems similar to KD\*P or LiNbO<sub>3</sub> materials, offering the following features:

- ***Very low resonance operation with the AC voltage, only a few % greater than the DC switch-out voltage.***
- ***No thermal blooming or photo-refractive damage.***
- ***Typical contrast ratios of >2000:1 without high temperature degradation and high average powers more than 100 watts.***
- ***Low insertion loss of 3 ~ 2% inside the Laser cavity.***
- ***Extremely small capacitance (~2pF), giving a very fast rise-time (<220 psec) in a lumped element 50 ohm system.***
- ***Material damage threshold is more than 4 GW/cm<sup>2</sup> typical @ 1064nm for a 10ns pulse. And is limited by the AR coating.***
- ***Can operate with average High Voltage as much as 1KV without electrode migration.***
- ***Usable for pulse extraction from UV (200nm) to Mid-IR (2000nm).***
- ***Cells with larger apertures up to 6 mm are available with 8.8KV quarter-wave voltage at 1064 nm. Model QS-6-HW***

### **Model QS-series Pockels cell/Q-Switch**

The Model QS-series uses BBO crystal material, which has symmetry similar to LiNbO<sub>3</sub>. The laser beam propagates along the optic Z-axis and the electrodes are applied along the X-axes. The transverse Pockels effect is utilized, and increasing the aspect ratio or number of BBO crystal cells can decrease quarter-wave voltage. The contrast ratio is superior even at temperatures over 40°C, and the uniformity over the whole aperture is excellent. Unlike LiNbO<sub>3</sub>,

BBO is not pyro-electric, nor does it suffer for the most part from piezo-electric resonances. Also, it has an excellent resistance to thermal fracture.

Based on typical diode-pumped laser parameters, this Q-Switch Model QS-series extends simple compact Q-Switched operation of diode-pumped lasers to high average powers of 30-100W. Also, the low dispersion of the QS-series Pockels Cell eminently suits it for applications in short pulse, regenerative amplifiers. The Super Switch is ideal for Q-Switching of high power compact DPSS Lasers at sub-nanosecond speeds.

## **Model QS-Series Details**

Parameter	QS-3	QS-4	QS-6	QS-6-2	QS-6-4
Aperture (mm)	3	4	6	6	6
V <sub>1/4</sub> @1064nm (KV), (V <sub>1/2</sub> )	3.55 (7.1)	4.73 (9.47)	7.1 (14.2)	3.55 (7.1)	5.64 (2.82)
Insertion Loss @ 1064nm (Typ)	2%	2%	2%	2.5%	4%
Contrast Ratio @1064nm (Typ)	>2000:1	2000:1	2000:1	1000:1	1000:1
Wavefront Distortion @633 nm	$\lambda/10$	$\lambda/10$	$\lambda/10$	$\lambda/10$	$\lambda/8$
Spectral Range (nm)	200-2000	200-2000	20-2000	200-2000	200-2000
Typical Rise time (ps)	220	220	220	440	1000
Dimension (mm) DxL	25.4 x 40	25.4 x 40	50 x 60	50 x 60	50 x 120

Parameter	QSX-2-2	QSX-3-2	QSX-4-2	QSX-5-2	QSX-7-2
Aperture (mm)	2.7	3.25	4	5.5	7
V <sub>1/4</sub> @1064nm (KV), (V <sub>1/2</sub> )	1.6 (3.2)	2.1 (4.2)	2.65 (5.3)	2.91 (5.82)	4.4 (8.8)
Insertion Loss @ 1064nm (Typ)	2.5%	2.5%	2.5%	2.5%	2-3%
Contrast Ratio @1064nm (Typ)	>750:1	>750:1	>750:1	>750:1	>500:1
Wavefront Distortion @633 nm	$\lambda/6$	$\lambda/8$	$\lambda/8$	$\lambda/8$	$\lambda/8$
Spectral Range (nm)	200-2000	200-2000	200-2000	20-2000	200-2000
Typical Rise time (ps)	220	300	350	450	1000
Dimension (mm) DxL	25.4 x 60				

### **NOTES:**

- 1) V<sub>1/4</sub> is directly proportional to the wavelength and inversely proportional to the aspect ratio of the crystal, L/D where D is electrode distance and L is the length.
- 2) For High average power applications, the aperture plate is water cooled (-WC option). The aperture is not intended to be aperture stop for the laser beam. The peripheral beam aperture power impinging on the aperture must be << 1% and is there to absorb spurious beam reflections. For instances of power optical accidentally hitting the aperture plate, the water cooled aperture serves to mitigate the possibility of thermal runaway or thermally induced depolarization of the laser beam. The -WC Pockels cell size is 50mm diameter x 75mm long.

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