

LIGHTGATE SERIES

BBO Pockels Cell

DATASHEET

LightGate BBO Pockels cells are the preferred alternative to KD*P Pockels cells for high-average power and high repetition rate applications.

The LightGate series BBO Pockels cell employs dual crystal geometry to minimize drive voltage (~2.9 kV quarter-wave voltage @ 1064 nm for 4 mm aperture LightGate 4). BBO Pockels cells operate from approximately 0.2 to 1.65 μm and are not subject to tracking degradation. Due to the low piezoelectric coupling coefficients of BBO, LightGate cells function at repetition rates of hundreds of kilohertz.

LightGate Pockels cells work in regenerative amplifiers, high pulse repetition rate micro-machining lasers, and high-average power lasers for material processing and metal annealing.

Gooch & Housego also offers single crystal cells, extra-long, reduced voltage cells, attenuated cells for applications requiring ultra-low piezoelectric response, and cells with water-cooled apertures for high average power operation.



Key Features

- Solid state – no index matching fluid
- High pulse rate operation to 600 kHz
- Low acoustic noise
- Damage resistant ceramic apertures
- Compact design
- High-reliability
- Reduced voltage version requires lower voltage than other BBO cells
- Operation to high repetition rate and high average power

Key Benefits

- Ideal for high average power systems
- Low absorption leading to reduced thermal lensing/thermal depolarization
- Field proven performance
- Excellent, accessible technical support

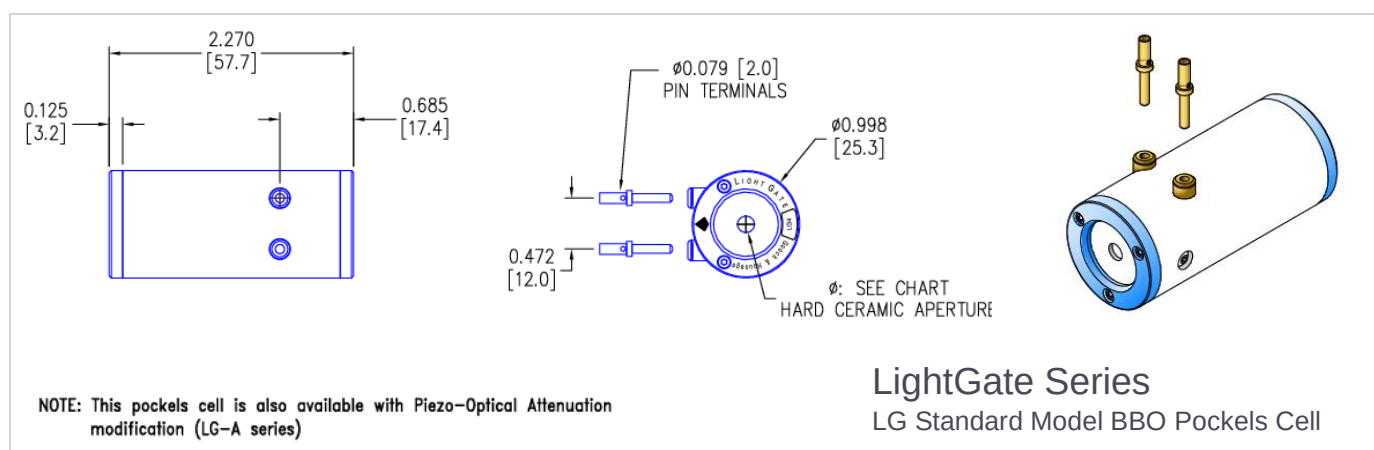
Applications

- OEM and replacement laser systems:
 - Machining, marking, via drilling
 - Ophthalmology
 - Q-switching and regenerative amplifiers
 - Research
- Military

Performance Data (Standard Configuration)

Typical specifications for standard cell	LG2.6	LG3	LG4	LG5	LG7
PHYSICAL					
Hard aperture diameters	2.6 mm	3.25 mm	4 mm	5.5 mm	7 mm
Single pass Insertion Loss @ 1064 nm	< 1.5%	< 1.5%	< 1.5%	< 1.5%	< 1.5%
Intrinsic contrast ratio (ICR) @ 1064 nm	> 1000:1	> 1000:1	> 1000:1	> 1000:1	> 1000:1
Voltage contrast ratio (VCR) @ 1064 nm (parallel polarizers)	> 500:1	> 500:1	> 500:1	> 500:1	> 500:1
Single pass wavefront distortion @ 1064 nm	< $\lambda/6$	< $\lambda/6$	< $\lambda/6$	< $\lambda/6$	< $\lambda/6$
LIDT ¹ , 10 Hz @1064 nm, 10ns, ~1 mm diameter	10 J/cm ²	10 J/cm ²	10 J/cm ²	10 J/cm ²	10 J/cm ²
ELECTRICAL					
Capacitance (DC)	~4 pF	~4 pF	~4 pF	~4 pF	~4 pF
DC quarter wave voltage ($\pm 6\%$) @ 1064nm	1.9 kV	2.3 kV	2.9 kV	3.8 kV	4.7 kV
10-90% rise time (theoretical) into 50 Ω line	~ 1 ns	~ 1 ns	~ 1 ns	~ 1 ns	~ 1 ns
Duty cycle in 1 s (applied voltage time / total time)	< 5%	< 5%	< 5%	< 5%	< 5%

¹ Recommended operation at 1/10 this fluence level for increased longevity. LIDT will vary with wavelength and beam parameters.



Optional Configurations

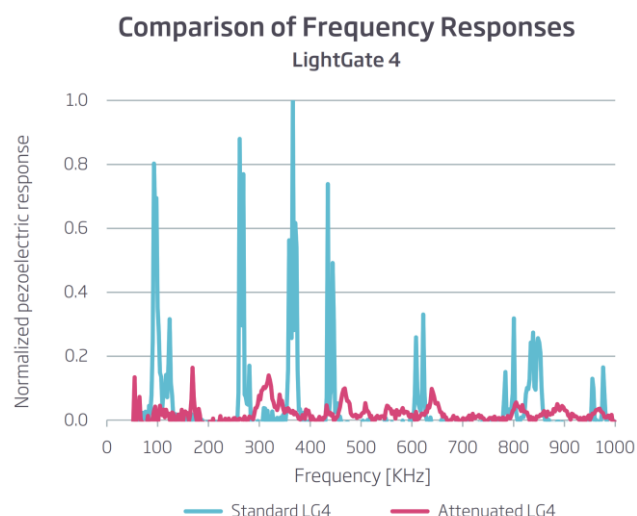
G&H provides LightGate series Pockels cells in a range of configurations to address unique and challenging applications. Modifications include acoustic resonance attenuation, reduced voltage operation and water-cooled apertures. We can offer recommendations regarding suitability for your particular application.

Attenuated Version

Attenuation reduces the impact of the piezoelectric effect. Crystals demonstrating the piezoelectric effect will mechanically deform in the presence of an electric field inducing an acoustic wave that moves through the material. For materials with large piezoelectric coupling, such as LiNbO₃ or KD*P, this acoustic response, or 'ringing', modulates the intensity of light passing through the crystal. The ringing decreases over time, but it takes several cycles before it damps out enough for the effect to reach a level that no longer interferes with the electrical signals intentionally applied to the cell.

For materials with small piezoelectric coupling, the piezoelectric response is only seen as a resonant effect, as demonstrated in BBO. The attenuation option dampens the piezoelectric ringing at resonance frequencies. When used at a single repetition rate, the cell may not require attenuation unless the pulse repetition frequency sits right on the resonance. However, varying the repetition rate over a range of frequencies that may include a resonance demands the use of an attenuated cell.

The piezoelectric response curves (right) illustrate the effectiveness of reducing piezoelectric ringing on a LightGate 4 BBO Pockels cell. The external dimensions of a cell with the attenuation option are the same as those of the standard model.



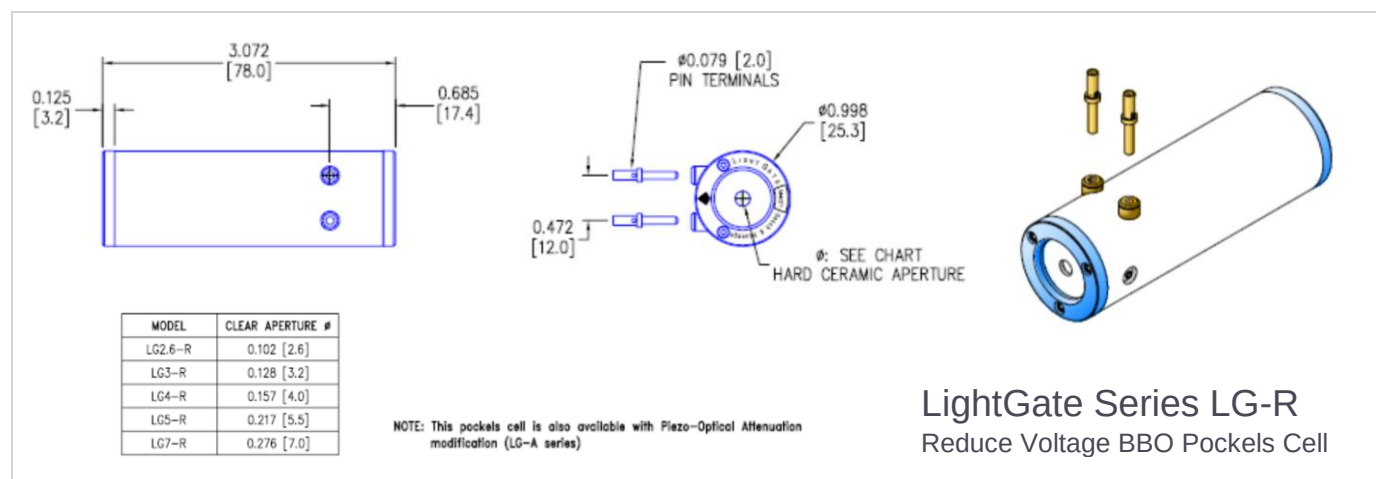
Reduced Voltage Versions

In situations that require a lower operating voltage than necessary for the standard LightGate cell, select the reduced voltage LightGate option.

The quarter-wave voltage values at 1064 nm ($\pm 5\%$) in the table on the right compare the voltage requirements for both configurations.

Model	Standard configuration	Model	Reduced voltage configuration
LG2.6	1917 V	LG2.6R	1278 V
LG3	2324 V	LG3R	1549 V
LG4	2905 V	LG4R	1937 V
LG5	3777 V	LG5R	2518 V
LG7	4648 V	LG7R	3099 V

The external dimensions of the reduced voltage option are different than the standard LightGate external dimensions. Outline drawings of the reduced voltage (R) LightGate option can be seen in the drawing below.



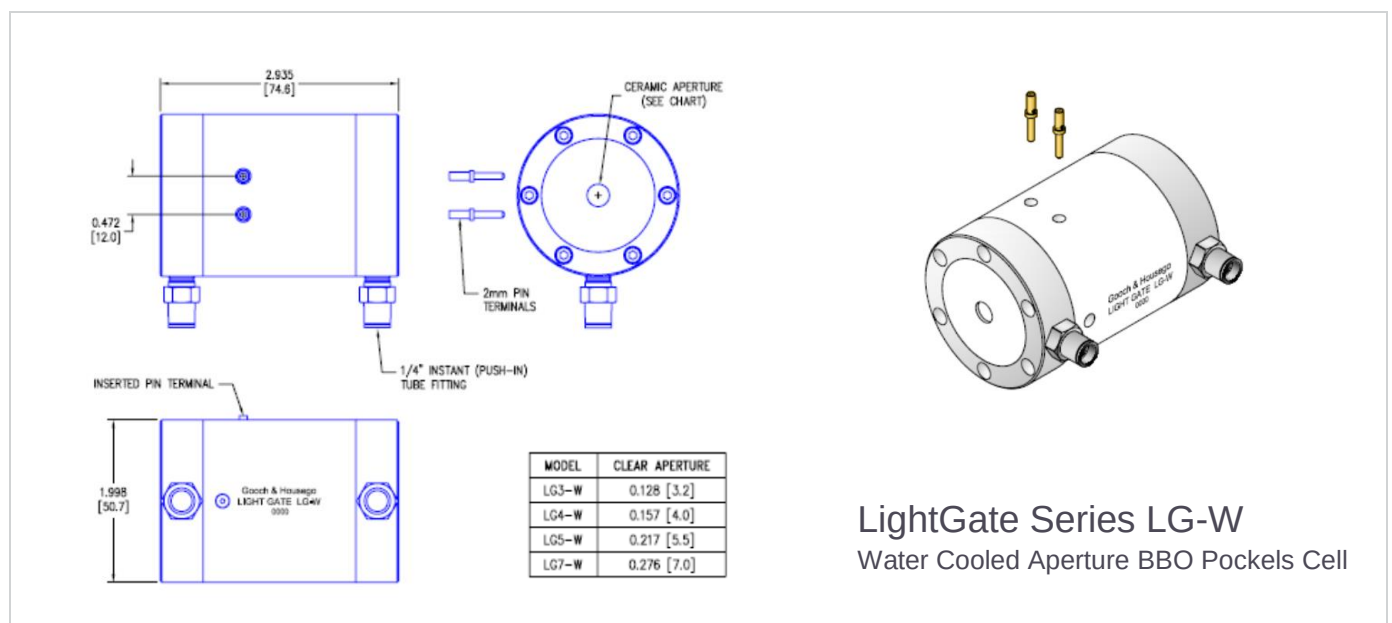
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Water-Cooled Apertures Version

Although all laser energy should always remain well within the clear aperture of the Pockels cell, and the Pockels cell must not function as a limiting aperture, in systems with high average power marking, drilling, and machining lasers, which frequently use BBO Pockels cells, sometimes there exists some relatively small but significant percentage of energy outside the clear aperture of the Pockels cell. For these cases, the LightGate series water-cooled aperture modification may reduce the potential for runaway thermal damage and or resultant thermal depolarization.

While not intended to eliminate the need for careful alignment of the laser beam within the Pockels cell, the water-cooled aperture option serves to dissipate thermal energy at the periphery of the beam.

The table below provides an outline drawing of the LightGate series Pockels cells with water-cooled apertures. Contact G&H to help evaluate the appropriateness of the water-cooled aperture option your application.



For further information

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As part of our policy of continuous product improvement, we reserve the right to change specifications at any time.

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