Free-Space RTP Electro-Optical Modulator

(2, 4, 6, 8mm aperture, 400nm to 2000nm)

DATASHEET

Return to the Webpage

RTP (Rubidium Titanyl Phosphate) crystals offer some of the best electro-optic properties among known materials. Advantages include low driving voltage, no piezoelectric ringing, high optical damage threshold (without gray-track formation under intense laser exposure), high resistivity, a broad transmission range (0.35–3.5 μm), short-wavelength durability, non-hygroscopicity, low insertion loss, and compatibility with high-repetition-rate applications. To ensure long-term thermal and environmental stability, our RTP Pockels cells use a matched pair of crystals to cancel out birefringence drift due to thermal expansion. The electric field is applied perpendicular to the optical axis, which ensures a uniform electro-optic response and minimal distortion of the laser's spatial mode. These cells operate at low voltage and are available in aperture sizes of 2 mm, 4 mm, 6 mm, and 8 mm. Polarization beam splitter cubes can be aligned and mounted at both input and output ends to configure the device as an intensity modulator. The voltage required to induce a half wave or a π phase shift (Vπ) in the optical signal is given by the equation:

$$V\pi = (\lambda \times d) / (n^3 \times r \times L)$$

where: **λ** is the wavelength of light, **d** is the electrode spacing, **n** is the refractive index of the crystal, **r** is the electro-optic coefficient, **L** is the crystal length along the light path. The **Vπ** voltage is proportional to the wavelength and inversely proportional to the crystal length.

Features

- High Power Damage Threshold
- Short Wave Operation High Stability
- Low Driving Voltage
- No Piezoelectric Ringing
- High Speed
- High Transparency
- Wide Wavelength Range
- Non-Hygroscopic

Applications

- Q-Switch
- Phase/Power Modulation
- Pulse Picker

Specifications

Parameter		Min	Typical	Max	Unit
Wavelength Range [1]		350		450	nm
		400		600	
		600		900	
		900		1250	
		1250		1650	
Clear Aperture [2]		2		8	mm
Halfwave Voltage[3]	532nm	400		4000	V
	1064nm	800		8000	
Material Purity		99.8			%
Transmission		98			%
Extinction (on/off) [4]		20		35	dB
Rise/Fall Time (10-90%)		0.5		1.1	ns
Angle Tolerance (perpendicularity)			± 0.15		degree
Parallelism		5			"
Humidity (non-condensing)				80	%
Capacitance (dielectric constant e~13)			14		pF
Damage Threshold	532nm			1	MW/cm^2
	1064nm			600	
Surface Scratch/Dig			20/10		mm
Operation Temperature		-40		80	°C
Material Density			3.6		g/cm^3
Material Hardness			5		Mohs
Material Melting Point			1000		°C
Ferroelectric Transition Temperature			810		°C
Thermal Optical Coefficients			-0.029		nm/°C
Electrooptic Coefficients		r23=12.5	r33=35	R51=38.5	pm/V
Material Electrical Resistivity			10^{11}		Ω·cm

[1]: These are standard AR coatings, custom AR coating is available with narrower band for lower loss
[2]: These are standard sizes, custom size is available with max length up to 25mm for lower driving voltage
[3]: This relates to crystal size; the smaller the aperture, and the longer the length, the lower the driving voltage
[4]: Measure at DC using two crossed polarizers

Note: The specifications provided are for general applications with a cost-effective approach. If you need to narrow or expand the tolerance, coverage, limit, or qualifications, please [click this link]:

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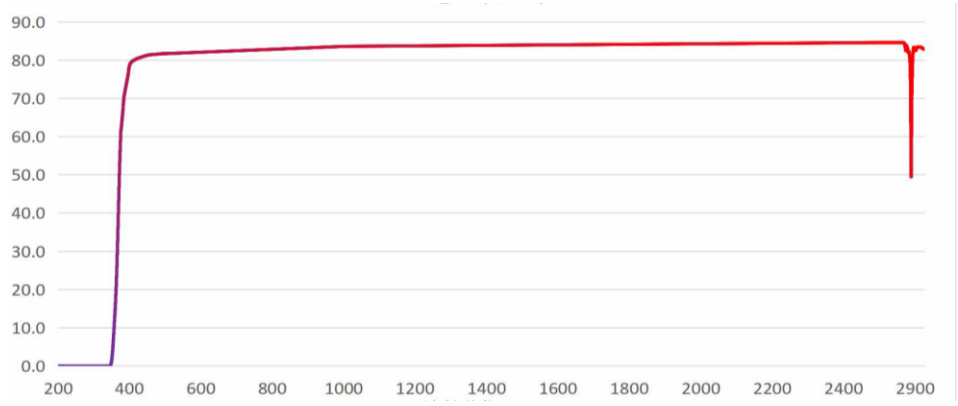
Modulator Half-Wave Voltage @1060nm

Specification	Half-Wave Voltage	Capacitance
2×2×12	1600V±15%	≤ 3.5pF
2×2×22	800V±15%	≤ 6pF
2×2×44	400V±15%	≤ 12pF
3×3×14	2400V±15%	≤ 3.5pF
3×3×20	1500V±15%	≤ 6pF
3×3×40	750V±15%	≤ 12pF
3×3×80	375V±15%	≤ 24pF
4×4×14	3200V±15%	≤ 6pF
4×4×28	1600V±15%	≤ 12pF
4×4×56	800V±15%	≤ 24pF
4×4×112	400V±15%	≤ 48pF
5×5×14	4000V±15%	≤ 6pF
5×5×25	2000V±15%	≤ 6pF
6×6×14	4800V±15%	≤ 6pF
6×6×25	2400V±15%	≤ 6pF
7×7×14	5600V±15%	≤ 6pF
7×7×18	3900V±15%	≤ 6pF
7×7×25	2800V±15%	≤ 6pF
8×8×14	6400V±15%	≤ 6pF
8×8×20	3900V±15%	≤ 6pF
8×8×25	3200V±15%	≤ 6pF
10×10×14	8000V±15%	≤ 6pF

RTP Transmission Without AR Coating



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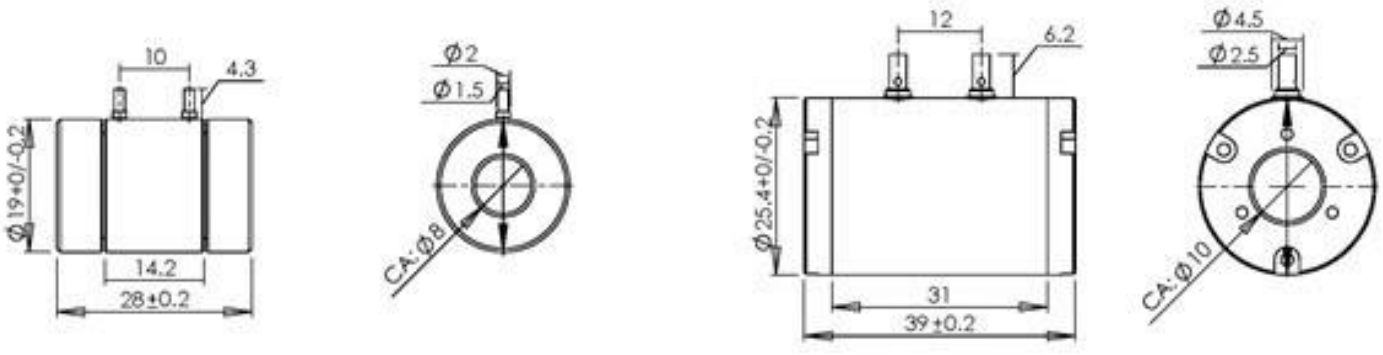
High Voltage and High Optical Power Safety Warning

- Do not look at the device – Even indirect exposure to high-power laser light can cause serious eye damage.
- Do not touch the device – The driving high voltage can cause serious injury.
- Do not clean the optical surfaces improperly – Mishandling may damage coatings or surfaces.
- Do not solder directly to the crystal – This can cause internal cracking and device failure.

Mechanical Drawing (mm) – (It is related to the crystal size)



*Product dimensions may change without notice. This is sometimes required for non-standard specifications.

Ordering Information

	☐☐	☐	☐	☐	☐	☐	☐	☐	☐
Prefix	**Wavelength**	**Aperture**	**Length**	**Grade [1]**	**Input Cube [2]**	**Output Cube [2]**	**Package**	**Driver**	**Isolator**
RTPM-	400~600nm = 05 600~900nm = 07 900~1250nm = 09 1250~1650nm = 14 1800~2500nm = 15 350~450nm = 04	2mm = 2 4mm = 4 6mm = 6 8mm = 8	12mm = 1 22mm = 2 30mm = 3 40mm = 4 80mm = 8 112mm = 9	Standard = S Premium = P Ultra = U	No = 1 Polacore = 3 PBS = 4 Glan-Thompson = 5	No = 1 Polacore = 3 PBS = 4 Glan-Thompson = 5	Naked = 1 Tube = 2	Non = 1 Yes = 2	Non = 1 Yes = 2

[1]. **Affect Intrisic Contrast Ratio, Electro-Optic Effect Uniformity, Defect Density (**related to the material selection from an as-grown crystal boule in which near center is the best**)**

[2]. **Polacore** (mounted on the crystal surfaces inside the package) (1060nm)– CW 10W/cm^2
PBS (mounted on the crystal surfaces outside the package) (1060nm) – CW 15W/cm^2
Glan-Thompson (mounted on the crystal surfaces outside the package) (1060nm) – CW 2kW/cm^2

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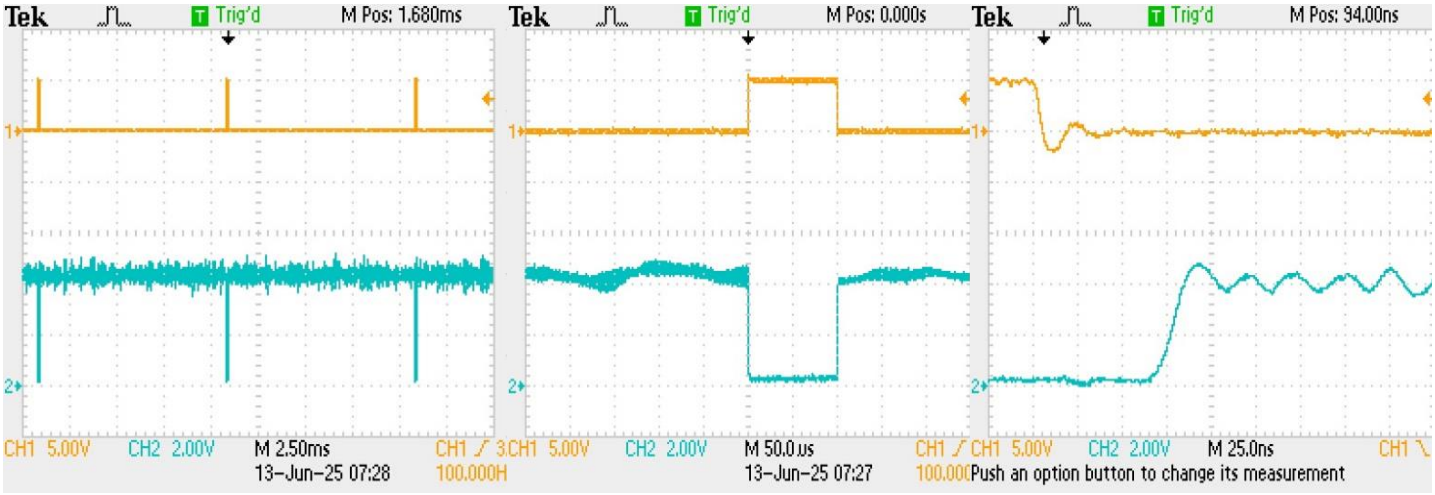
Typical Q Switch Response (yellow is electrical, blue is optical)



Application Notes (Q-switch alignment)

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