

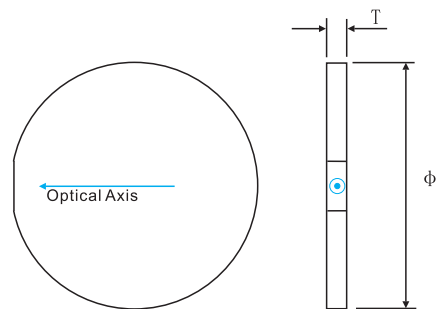
## Multiple Order Waveplates

Multiple order waveplates are made from a single crystalline plate, which are designed to give a retardance of several full waves, plus the desired fraction.

Multiple order waveplates are more susceptible to change in wavelength and they should not be used more than several nanometers outside of design wavelength.

### General Specifications

Material	Quartz
Dimension tolerance	$\pm 0.1\text{mm}$
Parallelism	2 arc sec
Surface quality	20-10 S/D
Wavefront distortion	$\lambda/8 @ 632.8\text{nm}$
Retardation accuracy	$\lambda/200$
Clear aperture	>90%
Coating on both sides	$R < 0.25\% @ \text{design wavelength}$



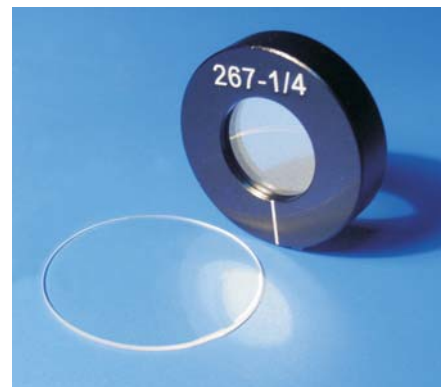
### Typical Retardation

$\lambda/4$	$\lambda/2$	$1\lambda$	$\lambda/8$
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### Typical Diameters

$\varnothing 5.0$	$\varnothing 10.0$	$\varnothing 12.7$	$\varnothing 15.0$
$\varnothing 20.0$	$\varnothing 25.4$	$\varnothing 30.0$	$\varnothing 38.1$

Thickness: approx 0.3-0.5mm



Mounted Waveplates are available,  
 please refer to [Page 59](#) to select a proper holder.

Price  
on request

Volume  
Discount

Custom  
Design

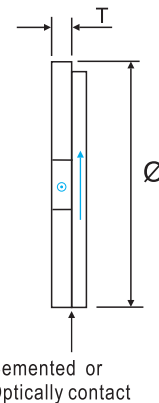
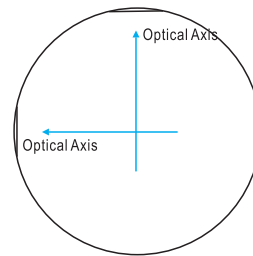
## Zero Order Waveplates

Zero order waveplates are constructed of two multiple order waveplates with their axes crossed. Thus the effect of the first plate is cancelled by the second, except for the residual difference between them.

Zero order waveplates are much less susceptible to wavelength and temperature changes. Zero-order waveplates are frequently preferred to use despite their somewhat higher cost: They maintain optimum performance across a much larger range of temperatures and wavelengths. For use with laser diodes having variable wavelength, or in instruments that warm up over time, or in locations subject to the environment, their stability is paramount.

### General Specifications

Material	Quartz
Dimension tolerance	$\pm 0.1\text{mm}$
Parallelism	2 arc sec
Surface quality	20-10 S/D
Wavefront distortion	$\lambda/8 @ 632.8\text{nm}$
Retardation accuracy	$\lambda/300$
Clear aperture	>90%
Coating on both sides	$R < 0.25\%$ @ design wavelength



### Typical Retardation

$\lambda/4$	$\lambda/2$	$1\lambda$	$\lambda/8$
-------------	-------------	------------	-------------

### Typical Diameters

$\varnothing 5.0$	$\varnothing 10.0$	$\varnothing 12.7$	$\varnothing 15.0$
$\varnothing 20.0$	$\varnothing 25.4$	$\varnothing 30.0$	$\varnothing 38.1$

Thickness: approx 0.8-2.0mm

Zero order Waveplates are available in **Cement type** and **optically contact type**.

Cement type: Two parts are cemented with glue.

Optically contact type: The Surfaces of two parts are bonded to each other through the mutual attraction of Van der Waals forces.



Price  
on request

Volume  
Discount

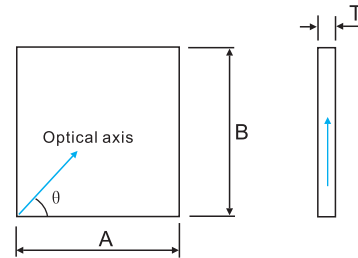
Custom  
Design

## True Zero Order Waveplates

True order waveplate is designed for wavelength range 1300-- 1700nm for telecom application. These waveplates provide best possible angle, temperature and wavelength performance. The thickness of these waveplates are very thin (approx 100µm).

### General Specifications

Material	Quartz
Dimension tolerance	±0.1mm
Parallelism	1 arc sec
Surface quality	20-10 S/D
Wavefront distortion	$\lambda/8@632.8\text{nm}$
Retardation tolerance	$\lambda/300$
Clear aperture	>90%
Coating on both sides	R<0.25% @ design wavelength



typical  $\theta = 22.5^\circ, 45^\circ$

### Typical Sizes

Square	Round	Thickness
1.0x1.0	Ø1.0	0.03--0.10
2.0x2.0	Ø2.0	0.03--0.10
3.0x3.0	Ø3.0	0.03--0.10
5.0x5.0	Ø5.0	0.03--0.10

Thickness: approx < 0.1mm

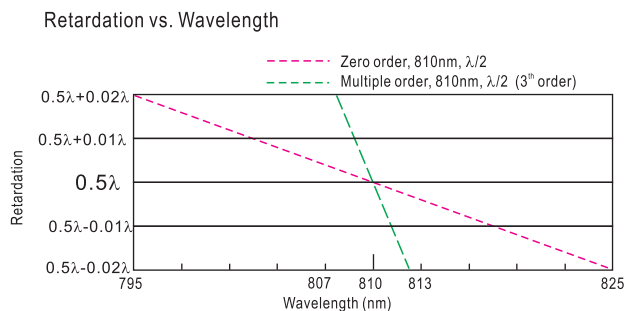
### Typical Retardation

$\lambda/4$	$\lambda/2$
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### How to order true zero order waveplate? Example:

Type	Size	Wavelength	Retardation	Coating
True zero order	2x2mm	1550nm	$\lambda/2$	AR

### Comparison of Multiple order Waveplate and Zero order waveplate:



### Retardation vs. Temperature

Temperature change from 10°C 35°C

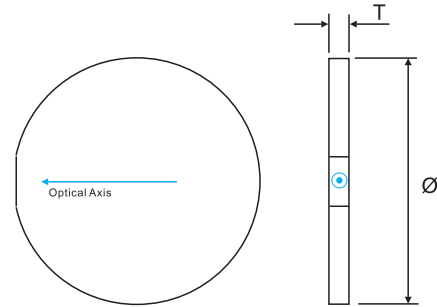
	Variation of Retardation
Zero order $\lambda/2, 633\text{nm}$	$0.02\lambda$
7 <sup>th</sup> order $\lambda/2, 633\text{nm}$	$0.65\lambda$

## Dual Wavelength Waveplates

Dual wavelength waveplates are multiple order waveplate that provide a specific retardance at two different wavelengths. Its application is separation of different wavelengths with a polarization beamsplitter by rotating the polarization of one wavelength by 90deg, and leaving the other unchanged.

### General Specifications

Material	Quartz
Dimension tolerance	$\pm 0.1\text{mm}$
Parallelism	2 arc sec
Surface quality	20-10 S/D
Wavefront distortion	$\lambda/8@632.8\text{nm}$
Retardation tolerance	$\lambda/100$
Clear aperture	>90%
Coating on both sides	$R < 0.25\%$ @ design wavelength



### Typical Retardation

$\lambda/4$	$\lambda/2$	$1\lambda$	$\lambda/8$
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### Typical Diameters

Ø5.0	Ø10.0	Ø12.7	Ø15.0
Ø20.0	Ø25.4	Ø30.0	Ø38.1

Thickness: approx 0.3-0.5mm

Price  
on request

Volume  
Discount

Custom  
Design

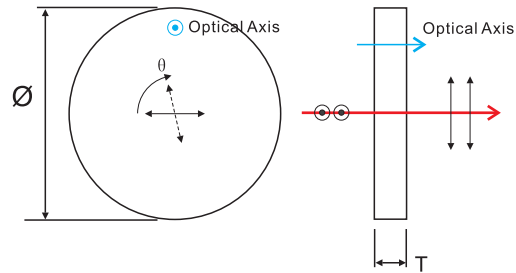
## Polarization Rotators

Crystal quartz plate with optical axis perpendicular to surfaces can rotate the plane of polarization of an input beam of light. The rotation angle at a particular wavelength is a function of thickness of crystal quartz.

With particular thickness the quartz plates can rotate the plane of polarization of incident linearly polarized single wavelength of light by 45 or 90 degrees.

### General Specifications

Material	Quartz
Dimension tolerance	$\pm 0.1\text{mm}$
Parallelism	10 arc sec
Surface quality	20-10 S/D
Wavefront	$\lambda/4@632.8\text{nm}$
Rotate tolerance	$<5$ arcmin
Clear aperture	$>90\%$
Coating on both sides	AR coating

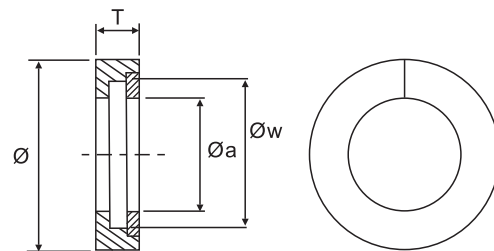


## Holders For Waveplates

The holders are designed to mount waveplates.

### Specifications

Material: Black anodized aluminum  
 Dimension tolerance:  $\pm 0.1\text{mm}$



Item#	Holder Ø (mm)	Holder T (mm)	Waveplate Ø <sub>w</sub> (mm)	Clear aperture Ø <sub>a</sub> (mm)
WH-01	Ø25.4	6.0	10.0	8.0
WH-02	Ø25.4	6.0	12.7	10.5
WH-03	Ø25.4	6.0	15.0	13.5
WH-04	Ø30.0	6.0	20.0	18.0
WH-05	Ø30.0	6.0	25.4	23.0

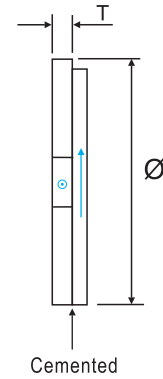
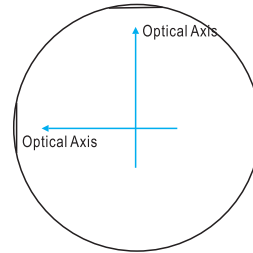


## Achromatic Waveplates

Achromatic Waveplates provide a constant phase shift independent of the incident wavelength of light. This wavelength independence is achieved by using two different birefringent crystalline materials. The relative shifts in retardation over the wavelength range are balanced between the two materials used.

### General Specifications

Material	Quartz + MgF2
Dimension tolerance	±0.1mm
Parallelism	10 arc sec
Surface quality	20-10 S/D
Wavefront	$\lambda/4@632.8\text{nm}$
Rotate tolerance	<5 arcmin
Clear aperture	>90%
Coating on both sides	AR coating



**Typical Retardation:**      $\lambda/2$       $\lambda/4$

**Wavelength Ranges:**     400-700nm,  
    700-1000nm,  
    950-1300nm,  
    1200-1600nm

### Typical Diameters

Ø10.0	Ø12.7	Ø15.0	Ø20.0
Ø25.4	Ø30.0	Ø38.1	

Price  
on request

Volume  
Discount

Custom  
Design