OZ Optics LIMITED

# OZ Optics

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# FIBER OPTIC ISOLATORS

## Features:

- >10W Optical power handling capability
- Polarization Sensitive and Insensitive versions
- Product offerings over 532–2000 nm wavelength range
- High isolation levels and low return loss
- Low Insertion Loss and Polarization Dependent Losses
- Different compact sizes, including miniature packaged versions
- Stable and high reliability designs

## Applications:

- High power laser to fiber coupling systems
- Optical amplifiers
- CATV systems
- OCT systems

## Product Description:

OZ Optics offers a complete line of fiber pigtailed isolators for wavelengths ranging from 532nm to 2000nm. These isolators combine a free space Faraday rotator with polarizing optics to provide up to 60 dB of isolation and high power handling with minimum losses.

Our isolators are manufactured using OZ Optics's patented tilt alignment technique. Input light from an optical fiber is first collimated, then transmitted through the isolator optics. A focusing lens on the output side of the isolator then couples the light back into the output fiber. This method is highly flexible, and allows OZ Optics to offer isolators capable of handling up to 10 Watts of optical power through singlemode fibers.

Isolators are offered in two different versions, polarization sensitive and polarization insensitive. Both block any returning light regardless of the input polarization. However the insertion losses of polarization sensitive isolators depend on the input polarization, while for polarization insensitive isolators the insertion losses are constant.

Polarization sensitive isolators are simpler in construction. They are well suited for polarization maintaining fiber applications and for some applications where an input free space beam of constant polarization enters the Faraday optics. In either case linearly polarized light from the source or polarization maintaining fiber is aligned with the transmission axis of the isolator. However these isolators are not recommended for applications using standard singlemode fibers, as these fibers do not maintain polarization. Instead when polarized light is launched into singlemode fibers, any bends or stresses in the fiber will change the polarization state of the light traveling through the fiber. As a result, transmission through a polarization sensitive isolator will vary with any bending of the fiber or changes in temperature.

In contrast a polarization insensitive isolator first splits the light into separate polarizations and isolates each beam separately. The two beams are then recombining and transmitted through the output fiber. This method ensures low losses regardless of the input polarization state. For this reason we recommend using polarization insensitive isolators with standard singlemode fibers. Please note however that polarization insensitive isolators are not necessarily available for all wavelengths or power levels.

This data sheet is for products with less than 10 Watt power levels. For higher power levels, refer to our data sheet titled *High Power Free Space and Fiber Pigtailed Isolators* http://www.ozoptics.com/ALLNEW_PDF/DTS0123.pdf.

FOPI-21 Style Polarization
Insensitive Isolator for 1550 nm

FOI-11 Style Polarization
Sensitive Isolator for 633–830 nm


FOPI-11 Style Polarization
Insensitive Isolator for 850 or 1060 nm

FOI-11 Style Polarization
Sensitive Isolator for 980–1064 nm

## Fiber Optic Isolator Product Specifications:

| | | Polarization Insensitive Isolators "FOPI" Specifications | | | | | Polarization Sensitive Isolators "FOI" Specifications | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Center Wavelength[1] $\lambda_C$(nm) | | 633<br>670 | 780<br>830<br>850<br>860 | 980<br>1064 | 1310<br>1480, 1550,<br>1590 | 1625,<br>2000 | 532<br>543<br>633<br>670 | 780<br>830<br>850 | 980,<br>1064 | 1310<br>1480, 1550,<br>1590 | 1625,<br>2000 |
| Bandwidth[2] (nm) | | ±10 | ±10 | ±10 | ±15 | ±15 | ±15 | ±10 | ±10 | ±15 | ±15 |
| Typical Peak Isolation (dB) | | 25 | 30 | 30 | >40 Single stage<br>55 Dual Stage | 35 | 35 | 40 | 40 | >40 Single Stage<br>60 Dual Stage | 35 |
| Minimum Isolation[3] (dB) | | 20 | 25 | 25 | 40 Single Stage<br>50 Dual Stage | 30 | 30 | 35 | 35 | 40 Single Stage<br>55 Dual Stage | 30 |
| Typical Insertion Loss[4] (dB) | | 1.2 | 0.8 | 0.8 | 0.5 Single Stage<br>0.6 Dual Stage | 1 | 2.0 | 1.5 | 1.2 | 0.6 Single Stage<br>0.8 Dual Stage | 1 |
| Maximum Insertion Loss[4] (dB) | | 1.4 | 1.2 | 1.2 | 0.6 Single Stage<br>0.8 Dual Stage | 1.5 | 2.5 | 1.8 | 1.6 | 0.8 Single Stage<br>1.0 Dual Stage | 1.5 |
| Return Loss[5] (dB) | | 40 | 40 | 40 | 60 | 40, 55 | 40 | 40 | 40 | 40, 50, 60 | 40, 55 |
| Power Handling (Watts)[6] | Standard | 0.3 | 0.3 | 0.3 | 0.3 | 0.5 | 0.2 | 0.2 | 0.2 | 0.2 | 0.5 |
| | High Power Options | 0.5 | 0.5<br>1<br>2<br>5 | 0.5<br>1<br>2<br>5<br>10 | 0.5<br>1<br>2<br>5 | N/A | 0.5<br>1<br>2<br>5 | 0.5<br>1<br>2<br>5 | 0.5<br>1<br>2<br>5<br>10 | 0.5<br>1<br>2<br>5 | N/A |
| PDL (dB) | | 0.2 | 0.2 | 0.2 | 0.1 | 0.1 | NA | NA | NA | NA | NA |
| Fiber Options Available | | SM | SM | SM | SM | SM | SM or PM | SM or PM | SM or PM | SM or PM | SM or PM |
| Operating Temperature (º C) | | +10 to +55 | | | | | | | | | |
| Storage Temperature (º C) | | -40 to +85 | | | | | | | | | |

**Notes:**

1. For other wavelengths, please contact OZ Optics.
2. This is the range of wavelengths over which the specified isolation is maintained.
3. At 23ºC and specified bandwidth and over all polarization states.
4. Over specified operating temperature range, at specified bandwidth and over all polarization states.
5. Excluding connectors.
6. For the power handling levels, please contact OZ Optics.

**Figure 1:**

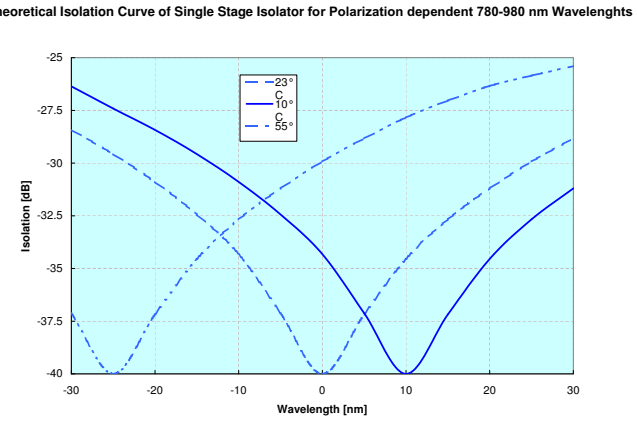



**Figure 2:**

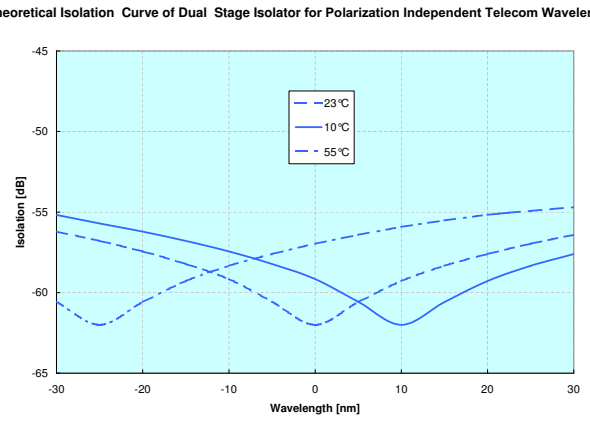
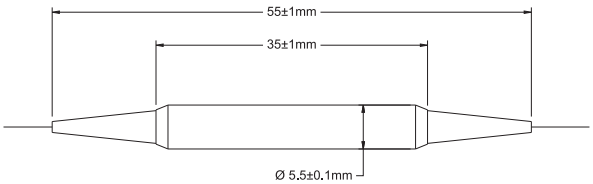


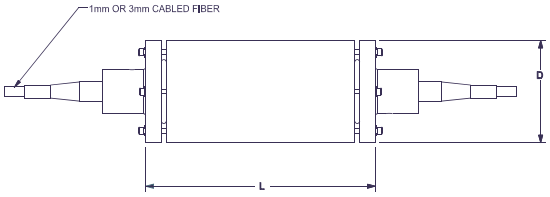
**Figure 3:**




**FIBER PIGTAILED POLARIZATION SENSITIVE AND INSENSITIVE ISOLATORS IN MINIMATURE 5.5 mm OD HOUSING (FOI-21 & FOPI-21 MODELS), FOR 1064NM, 1310NM OR 1550NM WAVELENGTHS**

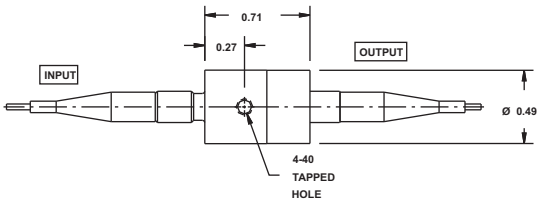
**Figure 4:**

| WAVELENGTH | 630~850nm | 980~1060nm |
|---|---|---|
| D | 1.3" | 1.3" |
| L | 2.5" | 3.5" |



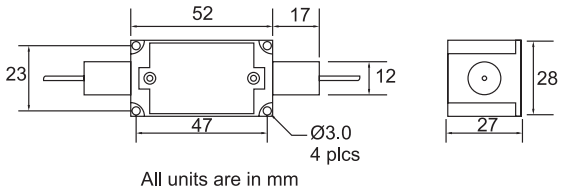

**FIBER PIGTAILED POLARIZATION SENSITIVE ISOLATOR IN STANDARD (FOI-11) PACKAGING, FOR 630nm TO 1064nm WAVELENGTHS**

**Figure 5:**




**STANDARD HOUSING FOR POLARIZATION SENSITIVE (FOI-11) AND POLARIZATION INSENSITIVE (FOPI-11) ISOLATORS FOR 1064 nm,1310 nm AND 1550 nm**

**Figure 6:**




**POLARIZATION INSENSITIVE ISOLATOR (FOPI-11) FOR 830 TO 1064nm WAVELENGTHS, FOR LOW TO MEDIUM POWER APPLICATIONS**

## Ordering Information for Custom Parts:

**Questionnaire:**

1. What is the wavelength of operation?
2. What is the optical power level seen by the device?
3. Do you require polarization sensitive OR polarization insensitive isolator?
4. What is the desired level of isolation and return losses?
5. What type of fibers do you want on the input and output ends?
6. What is the length of required pigtails (both on input side and output side)?
7. What kind of fiber protection jacket and connector type is required?

**Ordering Information:** For standard parts please see our online catalog http://shop.ozoptics.com

## Description

**Polarization Sensitive Isolator**

## Part Number

**FOI-A1-11-*W*-*a/b*-*F*-*LB*-*XY*-*JD*-*L*-*I*(-*HP*)**

***A1*** = Isolator size:
1 for Standard size
2 for Miniature size (For up to 0.5 Watt power handling)

***W*** = Wavelength: Specify in nanometers
(Example: 1550 for 1550 nm)

***a/b*** = Fiber core/cladding sizes, in microns
9/125 for 1300/1550 nm SM fiber
See Tables 1 to 5 of the *Standard Tables*
http://www.ozoptics.com/ALLNEW_PDF/DTS0079.pdf
for other standard fiber sizes

***F*** = Fiber type: S = Singlemode
P = Polarization maintaining

***LB*** = Backreflection level: 40, 50, 55, or 60 dB version available for 1300 nm and 1550 nm wavelengths only.

***X***,***Y*** = Connector Code:
3S = Super NTT-FC/PC
3U = Ultra NTT-FC/PC
3A = Angled NTT-FC/PC
8 = AT&T-ST
SC = SC
SCA = Angled SC
See Table 6 of the *Standard Tables*
http://www.ozoptics.com/ALLNEW_PDF/DTS0079.pdf
for other connectors

***HP*** = High power handling option
HP for 0.5 Watt power handling
HP1 for 1 Watt power handling
HP2 for 2 Watt power handling
HP3 for 3 Watt power handling
HP5 for 5 Watt power handling
HP10 for 10 Watt power handling-
(Only available for selected wavelengths)

***I*** = Peak isolation: 25, 30, 35, 40, 55, or 60 dB

***L*** = Fiber length, in meters, on each side of the device
Example: To order 1 meter of fiber at the input and 7 meters at the output, replace L with 1,7

***JD*** = Fiber Jacket type:
1 = 900 micron OD hytrel jacket
3 = 3 mm OD Kevlar reinforced PVC cable
See Table 7 of the *Standard Tables*
http://www.ozoptics.com/ALLNEW_PDF/DTS0079.pdf
for other jacket sizes

**Note:** Miniature housing size only available for 1064 nm, 1300 - 1625 nm wavelengths and for up to 0.5 W power handling.

## Description

**Polarization Insensitive Isolator**

## Part Number

**FOPI-A1-11-*W*-*a/b*-*F*-*LB*-*XY*-*JD*-*L*-*I*(-*HP*)**

***A1*** = Isolator size:
1 for Standard size
2 for Miniature size (For up to 0.5 Watt power handling)

***W*** = Wavelength: Specify in nanometers
(Example: 1550 for 1550 nm)

***a/b*** = Fiber core/cladding sizes, in microns
9/125 for 1300/1550 nm SM fiber
See Tables 1 to 5 of the *Standard Tables*
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for other standard fiber sizes

***F*** = Fiber type: S = Singlemode
P = Polarization maintaining

***LB*** = Backreflection level: 40, 50, 55, or 60 dB version available for 1300 nm and 1550 nm wavelengths only.

***X***,***Y*** = Connector Code:
3S = Super NTT-FC/PC
3U = Ultra NTT-FC/PC
3A = Angled NTT-FC/PC
8 = AT&T-ST
SC = SC
SCA = Angled SC
See Table 6 of the *Standard Tables*
http://www.ozoptics.com/ALLNEW_PDF/DTS0079.pdf
for other connectors

***HP*** = High power handling option
HP for 0.5 Watt power handling
HP1 for 1 Watt power handling
HP2 for 2 Watt power handling
HP3 for 3 Watt power handling
HP5 for 5 Watt power handling
HP10 for 10 Watt power handling-
(Only available for selected wavelengths)

***I*** = Peak isolation: 25, 30, 40 or 55 dB

***L*** = Fiber length, in meters, on each side of the device
Example: To order 1 meter of fiber at the input and 2 meters at the output, replace L with 1,2

***JD*** = Fiber Jacket type:
1 = 900 micron OD hytrel jacket
3 = 3 mm OD Kevlar reinforced PVC cable
See Table 7 of the *Standard Tables*
http://www.ozoptics.com/ALLNEW_PDF/DTS0079.pdf
for other jacket sizes

**Note:** Miniature housing size only available for 1064 nm, 1300 - 1625 nm wavelengths and for up to 0.5 W power handling.

## Ordering Examples For Standard Wavelength Parts:

### Polarization Sensitive:

| Type | Wavelength | Bar Code | Part Number | Description |
|---|---|---|---|---|
| FOI-11 FOI-21 with PM Fiber | 1550 | 10619 | FOI-11-11-1550-8/125-P-60-3A3A-3-1-60 | Fiber Optic Polarization Sensitive Isolator with 1meter long 3mm OD PVC cabled 1550nm 8/125 PM fiber pigtails and 60dB isolation with 60dB return loss and angle FC/PC connectors. |
| | 1550 | 27344 | FOI-21-11-1550-8/125-P-60-3A3A-1-1-60 | Fiber Optic Polarization Sensitive Isolator in 5.5mm OD Housing with 1 meter long 900um OD jacketed 1550nm 8/125 PM fiber pigtail with 60dB isolation and 60dB return loss and Angle FC/APC connectors. |
| | 1310 | 19702 | FOI-11-11-1310-7/125-P-40-3A3A-1-1-40 | Fiber Optic Polarization Sensitive Isolator with 1meter long 900um OD jacketed 1310nm 7/125 PM fiber pigtails and 40dB isolation with 40dB return loss and angle FC/PC connectors. |
| | 1310 | 34924 | FOI-21-11-1310-7/125-P-55-3A3A-1-1-40 | Fiber Optic Polarization Sensitive Isolator in Small Housing with 1 meter long 900µ loose tubing 1310nm 7/125 PM fiber pigtail with and 40dB isolation and 55dB return loss and angle FC/APC connectors on input pigtail and output pigtail aligned to slow PM fiber axes. |
| | 1064 | 13401 | FOI-11-11-1064-6/125-P-40-3A3A-3-1-35 | Fiber Optic Polarization Sensitive Isolator with 1 meter long 3mm OD PVC cabled 980nm 6/125 PM fiber pigtails aligned to slow axis and 35dB isolation with -40dB return loss and angle FC/PC connectors. |
| | 850 | 25020 | FOI-11-11-850-5/125-P-40-3A3A-3-1-35 | Polarization Sensitive Isolator with 1 meter long 3mm OD PVC cabled 5/125 850nm PM fiber pigtails and 35dB isolation with 40dB return loss and angle FC/APC connectors. |
| | 633 | 20180 | FOI-11-11-633-4/125-P-40-3A3A-3-1-35 | Fiber Optic Polarization Sensitive Isolator with 1 meter long 3mm OD PVC cabled 633nm 4/125 PM fiber pigtails and 35dB isolation with 40dB return loss and angle FC/APC connectors. |
| FOI-11 FOI-21 with SM Fiber | 1064 | 16243 | FOI-11-11-1064-6/125-S-40-3A3A-3-1-35 | Fiber Optic Polarization Sensitive Isolator with 1 meter long 1mm OD cabled 1064nm 6/125 SM fiber pigtails and 35dB isolation with 40dB return loss and angle FC/PC connectors. |
| | 850 | 31164 | FOI-11-11-850-5/125-S-40-3A3A-0.25-1-35 | Fiber Optic Polarization Sensitive Isolator with 1meter long 250um acrylate jacketed 850nm 5/125 SM fiber pigtails and 35dB isolation with 40dB return loss and angle FC/APC connectors. (Similar to BC 24435) |
| | 633 | 11311 | FOI-11-11-633-4/125-S-40-3A3A-3-1-35 | Fiber Optic Polarization Sensitive Isolator with 1meter long 3mm OD PVC cabled 633nm 4/125 SM fiber pigtails and 35dB isolation with 40dB return loss and angle FC/PC connectors. |

### Polarization Insensitive:

| Type | Wavelength | Bar Code | Part Number | Description |
|---|---|---|---|---|
| FOPI-11 FOPI-21 with SM Fiber | 1550 | 27629 | FOPI-21-11-1550-9/125-S-55-3A3A-1-1-55 | Fiber Optic Polarization Insensitive Isolator in small (5.5 mm OD) package with 1 meter long 900 um OD jacketed 1550nm 9/125 SM fiber pigtails and 55dB isolation with 55 dB return loss and angle FC/PC connectors. |
| | 1310 | 38975 | FOPI-21-11-1310-9/125-S-60-3A3A-1-1-55 | Dual Stage Fiber Optic Polarization Insensitive Isolator in miniature (5.5mm diameter) housing with 1 meter long 1mm jacketed 1310nm 9/125 SM fiber pigtails and 55dB peak isolation with 60dB return loss and terminated with angle FC/APC connectors on boht ends. |
| | 1064 | 26506 | FOPI-11-11-1064-6/125-S-40-3S3S-3-1-30 | Fiber Optic Polarization Insensitive Isolator with 1 meter long, 3mm OD jacketed, 1064nm, 6/125 µ SM fiber with film based isolator for 30 dB isolation with 40 dB return loss and super FC/PC connectors. |
| | 1064 | 25561 | FOPI-21-11-1064-6/125-S-40-3A3A-1-1-30 | Miniature Fiber Optic Polarization Insensitive Isolator with 1 meter long 900 um OD jacketed 1064nm 6/125 SM fiber, 30 dB isolation, 40 dB return loss and Angle FC/APC connectors. |
| | 830 | 45204 | FOPI-11-11-830-5/125-S-40-3A3A-3-1-30 | Fiber optic polarization insensitive isolator for 830nm, with 28-30dB peak isolation and 40dB return loss, with 1 meter long, 3mm OD jacketed 5/125 singlemode fiber pigtails terminated with angled FC/APC connectors on both ends. |