1xN Fiber Optical Switch Pluggable

(Bidirectional, Passive, up to 1x168, 70dB on/off)

The MEMS FIBER Optical switches establish optical signal paths passively in milliseconds, supporting all data rates, and are ideally suited to manage and monitor large optical networks intelligently and remotely. The MEMS switches are reliable and have longevity suited for continuous operation. The module is designed to be housed within a management rack that can be purchased separately. The control is a net-based GUI that is compatible with standard network management protocols. The size depends on connector choice and fiber port count. A 1U management rack box front panel can house approximately 40 LC connectors (1x36).

The order table includes a list of standard control interfaces. Additionally, we provide a list of commands to assist customer engineers in coding. For those who require it, we offer a code-writing service for customer interfaces at an additional charge.

Features

- Low Cost
- High Reliability
- Low Insertion Loss
- Broad Band
- Compact Design
- Low Voltage

Applications

- Optical Signal Routing
- Network Protection
- Wavelength Management
- Signal Monitoring
- Instrumentation

Specifications [1]

Parameters	Min	Typical	Max	Unit
Operation Wavelength	1270		1630	nm
Insertion Loss [1] (SM)	0.4	0.8	1.6	dB
Insertion Loss [1] (MM)	0.5	1	4.3	dB
Crosstalk, On/Off Ratio		70		dB
Switch Speed (Rise, Fall) [2]		5	20	ms
Durability	10^9			cycle
Polarization Dependent Loss		0.04	0.2	dB
Wavelength Dependence Loss [3]		0.1	0.3	dB
Return Loss	50 [7]			dB
Repeatability		0.05	0.1	dB
Operating Temperature [4]	-5		65	°C
Port to Port Time Delay Difference			0.5	ns
Optical Power Handling (CW) [5]		300	500	mW
Storage Temperature	-40		85	°C
Electrical Power Consumption			50 [6]	W
Switch type	Non-Latching			

Notes:

[1]. Measured without connectors for SM only, each connector adds 0.2-0.3dB

[2]. This is for a switch component. The remote control adds substantial delay (Ethernet is the longest)

[3]. Within 50nm bandwidth

[4]. -25°C~75°C version is also available.

[5]. High power version available

[6]. For the non-latching version

[7]. For SM fiber, MM fiber is 35dB

RoHS COMPLIANT

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]:

Rev 04/30/26

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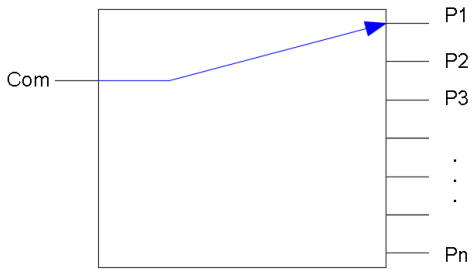
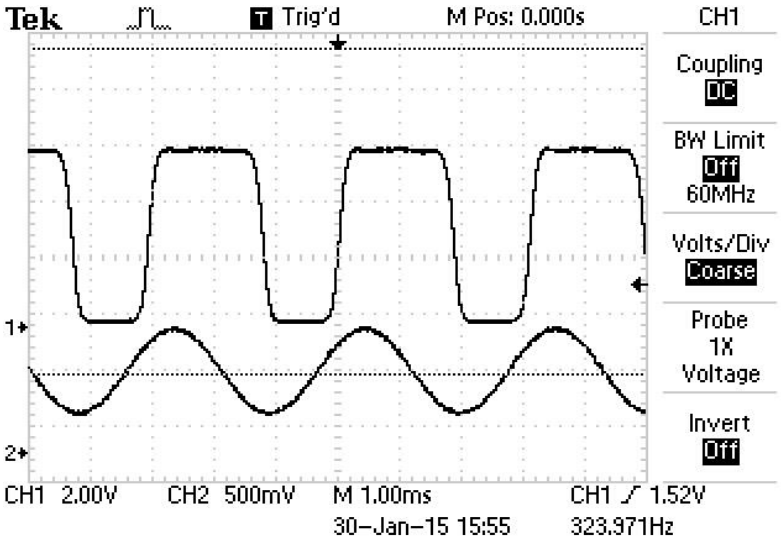
Optical Path Illustration



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

10^9 Switching Cycle Test (This was performed on 1x2 component, not the switch system)

We have tested MEMS 1x2 switch at the resonant frequency ~300Hz for more than 40 days, as shown in the attachment, which corresponds over 10^9 switching cycles. The measurements show little changes in Insertion loss, Cross Talk, Return loss, etc, all parameters are within our specs.



Control & Electric Interface

The switch default control is Ethernet with a GUI.

- Physical Layer: 10/100Base-T
- Data Link Layer: Ethernet Protocol per IEEE 802.3
- Network Layer: IPv4
- Transport Layer: UDP
- Application Protocol: SNMP
- Connector Type: RJ-45
- Dual 48V/110-220V Power Input

We provide a command list for customers to write their control code, such as Python

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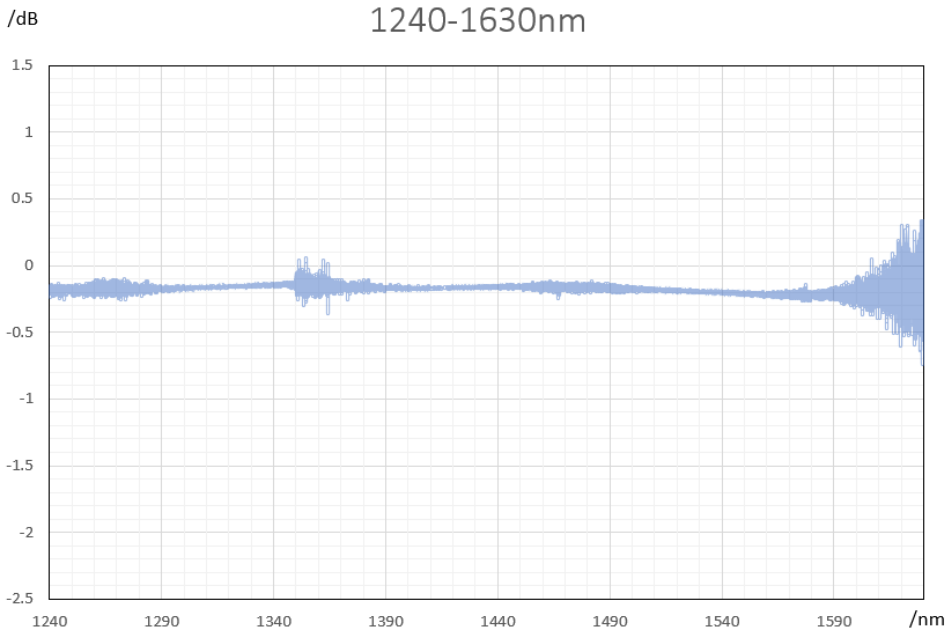
Typical Insertion Loss vs Wavelength (1240-1630nm)



Ordering Information (Part Number)

	□□□	□	2	5	□	□	□	□
Prefix	**Type**	**Wavelength [1]**	**Control Interface**	**Package**	**Fiber Type**	**Connector[3]**	**On/Off**	**Rack**
MEMS-	1x8 = AA8 1x12 = A12 1x16 = A16 1x32 = A32 1x64 = A64 1x96 = A96 1x128 = 128 Special = 000	1240-1640nm = 1 1310 = 3 1410 = 4 1550 = 5 1310/1550 = 2 1060 = 6 850 = 8 Special = 0	Ethernet = 2 Special = 0	Pluggable=5 Special = 0	SMF-28 = 1 MM 50/125 = 2 Special = 0	FC/PC = 2 FC/APC = 3 SC/PC = 4 SC/APC = 5 ST/PC = 6 LC/PC = 7 Duplex LC/PC = 8 LC/APC = A LC/UPC = U Special = 0	Regular = 1 SM70dB = 2 MM50dB = 3	Non = 1 1U Ethernet = 2 1U RS232 = 3 2U Ethernet = 4

[1]. Measured wavelength. The device has a wider wavelength coverage. Customer can request to measure at several wavelengths.

[2]. For PM fiber version, please call us to get more information.

[3]. The default connector configuration uses fiber with 0.9 mm buffer protection. The connector cannot be installed directly onto bare fiber because the bare fiber is prone to damage during shipping. However, the connector can be assembled on bare fiber if a 3 cm protective loose tube is added for reinforcement. The customer may remove this protective tube after testing. The optical power handling of a standard connector is less than 0.5 W for SMF-28 fiber and decreases further for smaller-core fibers.

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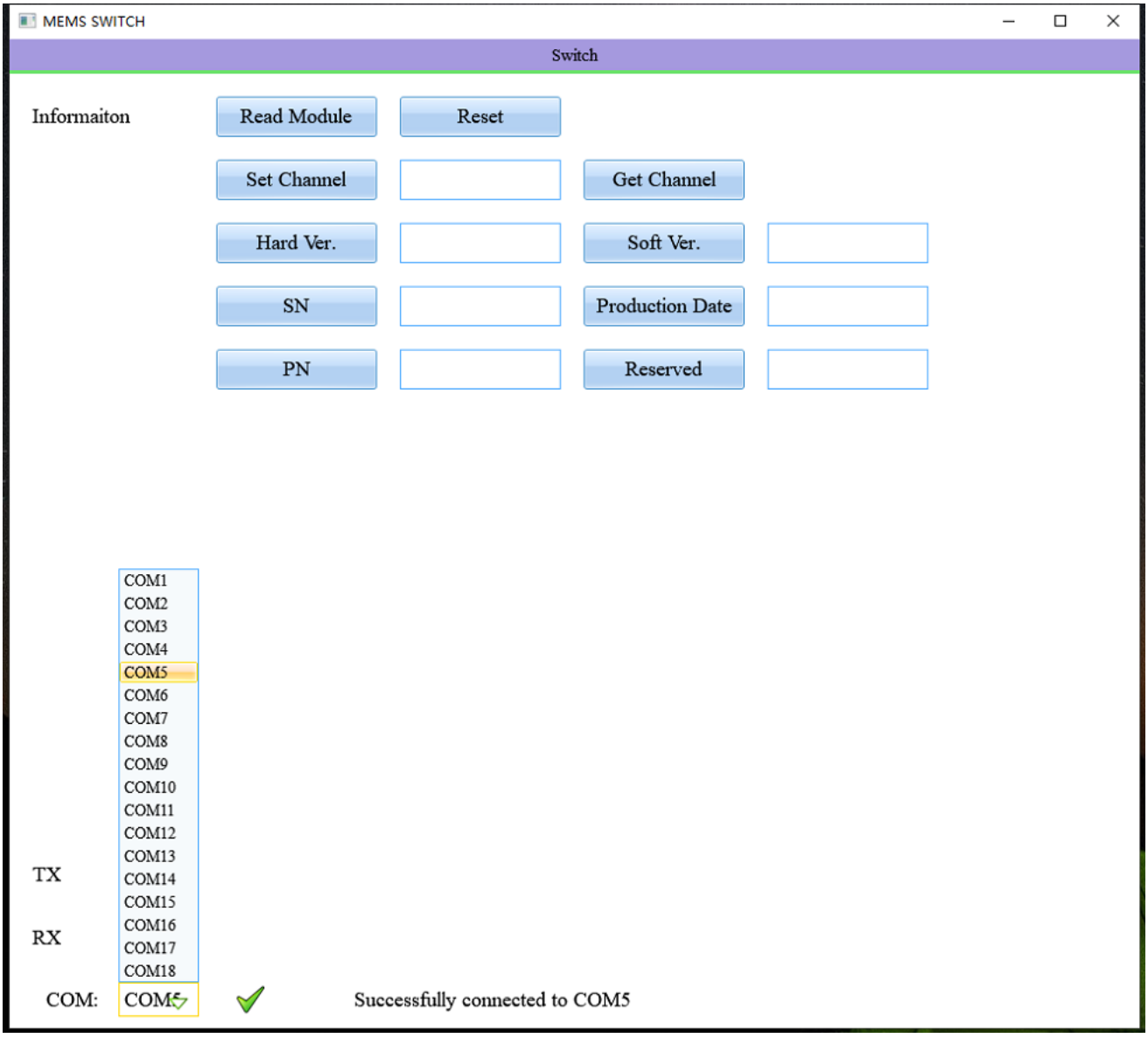
Example of RS232 Remote Control GUI



RS232 Command List (1x196 example) (start)

```
##### COM SET #####
UART Control Setting
Baud Rate: 115200
Start Bits: 1
Data Bits: 8
Parity: None
Stop Bits: 1
Flow Control: None
```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RS232 Command List (1x196 example) (ending)

```
##### 1, Command Format #####
1.1 Command
FLAG            LEN             RES             CMD             DATA            SUM
2 Byte          1 Byte          1 Byte          1 Byte          0-N Byte        1 Byte

FLAG: 0xEFEF or 0xAAAA
LEN: Total number of bytes from RES to SUM
RES: 0xFF
SUM: Checksum, SUM=FLAG+LEN+RES+CMD+DATA

1.2 Response
FLAG            LEN             RES             RESP            DATA            SUM
2 Byte          1 Byte          1 Byte          1 Byte          0-N Byte        1 Byte

FLAG: 0xEDFA
LEN: Total number of bytes from RES to SUM
RES: 0xFF
SUM: Checksum, SUM=FLAG+LEN+RES+ RESP+DATA


##### 2, Command List #####
2.1 Set Channel
Command
     FLAG1      LEN             RES             CMD             DATA            SUM
     0xEFEF     0x04            0xFF            0x04            1 byte          SUM
     DATA = Channel
Response
     FLAG2      LEN             RES             RESP            DATA            SUM
     0xEDFA     0x04            0xFF            0x04            1 byte          SUM
     DATA = Result
Result = 0xEE  Success
Result = 0xEF  Fail

Example (Set Channel=180):
Command
     EF EF 04 FF 04 B4 99
Response
     ED FA 04 FF 04 EE DC

2.2 Get Channel
Command
     FLAG1      LEN             RES             CMD             DATA            SUM
     0xEFEF     0x03            0xFF            0x02            1 byte          SUM
Response
     FLAG2      LEN             RES             RESP            DATA            SUM
     0xEDFA     0x04            0xFF            0x02            1 byte          SUM
     DATA = Channel

Example (Get Channel=0):
Command
     EF EF 03 FF 02 E2
Response
     ED FA 04 FF 02 00 EC
```


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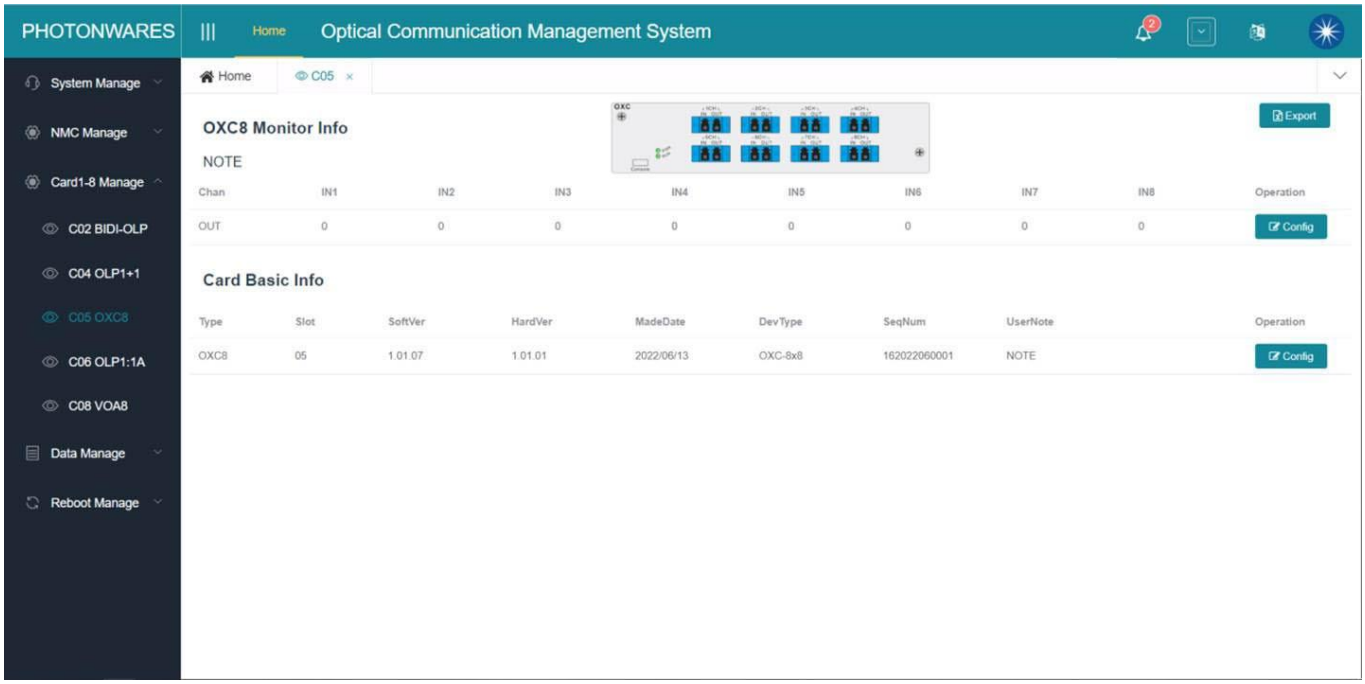
Example of Ethernet Remote Control GUI



Ethernet Command List For Telnet/Python Control (start)

```
Login:
1, Use the Windows Command Prompt,
2, telnet 192.168.1.200 or the current IP address
3, Username: root
4, Password: fs19681086

 Command List
1, Request Switch Status:
CARD -c xx B_?
xx is the slot number of card. For example, to show the status of the card in slot 2:
[FT@\h \W]# CARD -c 02 B_?

Show Card Info:
===== CARD Monitor Info =====
Chan            MaxRoute        CurrRoute
1               64              64

===== CARD Basic Info =====
Type            Slot            SoftVer         HardVer         MadeDate        DevType         SeqNum
OSW64           02              1.01.07         1.02.01         2021/10/22      MOSW64-DEV      333333333333
[FT@\h \W]#
2, Set Switch status:
CARD -c xx S01_y
xx is the slot number of the card.
01 is the input channel number of the switch, for 1xN products this is fixed.
y is the output channel number of the switch, for a 1x64 switch it's 1~64.
Return value: Success means operation succeed, Fail means operation failed.
```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Ethernet Command List For Telnet/Python Control (ending)

```
For example,:
1> Set the input #1 to output #1:
   [FT@\h \W]# CARD -c 02 S01_1
   Send: S01_1
   Return: Operation Success
   [FT@\h \W]#

2> Set the input #1 to output #64
   [FT@\h \W]# CARD -c 02 S01_64
   Send: S01_64
   Return: Operation Success
   [FT@\h \W]#

3> Request the current status:
   [FT@\h \W]# CARD -c 02 B_?
   Show Card Info:
   ===== CARD Monitor Info =====
   Chan        MaxRoute       CurrRoute
   1           64             64
   ===== CARD Basic Info =====
   Type        Slot           SoftVer        HardVer        MadeDate       DevType        SeqNum
   OSW64       02             1.01.07        1.02.01        2021/10/22     MOSW64-DEV     333333333333
```


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Questions and Answers

Q: If the device were to fail, would the switch continue to pass the fiber light through the switch as configured before failure?
A: This depends, if one mirror fails, it only affects the light going through that mirror.

Q: When power is restored, does the IN/OUT configuration before failure remain in place?
A: Yes, when power back up it will go to the previous flightpath

Q: If the power to the device were shut off, would the device continue to pass the fiber light as configured before failure?
A: This function is called latching. We uniquely offer MEMS latching switches but cost more.

Q: With the Ethernet Control Option, does the switch support SNMPv3
A: Yes. This internet standard protocol allows user to write their own control code

Q: With the Ethernet Control Option, what type of encryption does the SNMPv3 use?
A: MD5/DES

Q: With the Ethernet Control Option, could this device be controlled by multiple users at different locations and all users will also see the configuration updates?
A: Yes

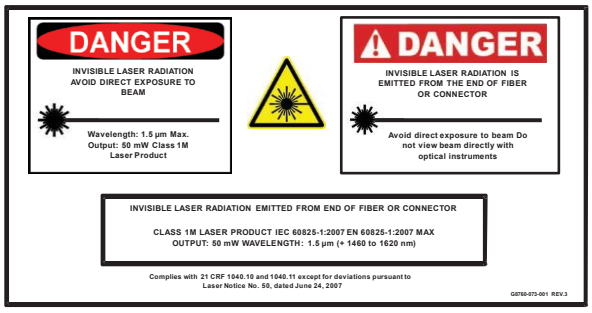
Q: With the Ethernet Control Option, does the user need to install any software on their computer other than a web browser?
A: No

Laser Safety

This product meets the appropriate standard in Title 21 of the Code of Federal Regulations (CFR). FDA/CDRH Class 1M laser product. This device has been classified with the FDA/CDRH under accession number 0220191. All versions of this laser are Class 1M laser products, tested according to IEC 60825-1:2007 / EN 60825-1:2007. An additional warning for Class 1M laser products. For diverging beams, this warning shall state that viewing the laser output with certain optical instruments (for example eye loupes, magnifiers, and microscopes) within a distance of 100 mm may pose an eye hazard. For collimated beams, this warning shall state that viewing the laser output with certain instruments designed for use at a distance (for example telescopes and binoculars) may pose an eye hazard.

Wavelength = 1.3/1.5 µm.

Maximum power = 30 mW.



*Caution - Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.
*IEC is a registered trademark of the International Electrotechnical Commission.

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Application Notes

Fiber Core Alignment
Note that the minimum attenuation for these devices depends on excellent core-to-core alignment when the connectors are mated. This is crucial for shorter wavelengths with smaller fiber core diameters that can increase the loss of many decibels above the specification if they are not perfectly aligned. Different vendors' connectors may not mate well with each other, especially for angled APC.

Fiber Cleanliness
Fibers with smaller core diameters (<5 μm) must be kept extremely clean, contamination at fiber-fiber interfaces, combined with the high optical power density, can lead to significant optical damage. This type of damage usually requires re-polishing or replacement of the connector.

Maximum Optical Input Power
Due to their small fiber core diameters for short wavelength and high photon energies, the damage thresholds for device is substantially reduced than the common 1550nm fiber. To avoid damage to the exposed fiber end faces and internal components, the optical input power should never exceed 20 mW for wavelengths shorter 650nm. We produce a special version to increase the how handling by expanding the core side at the fiber ends.

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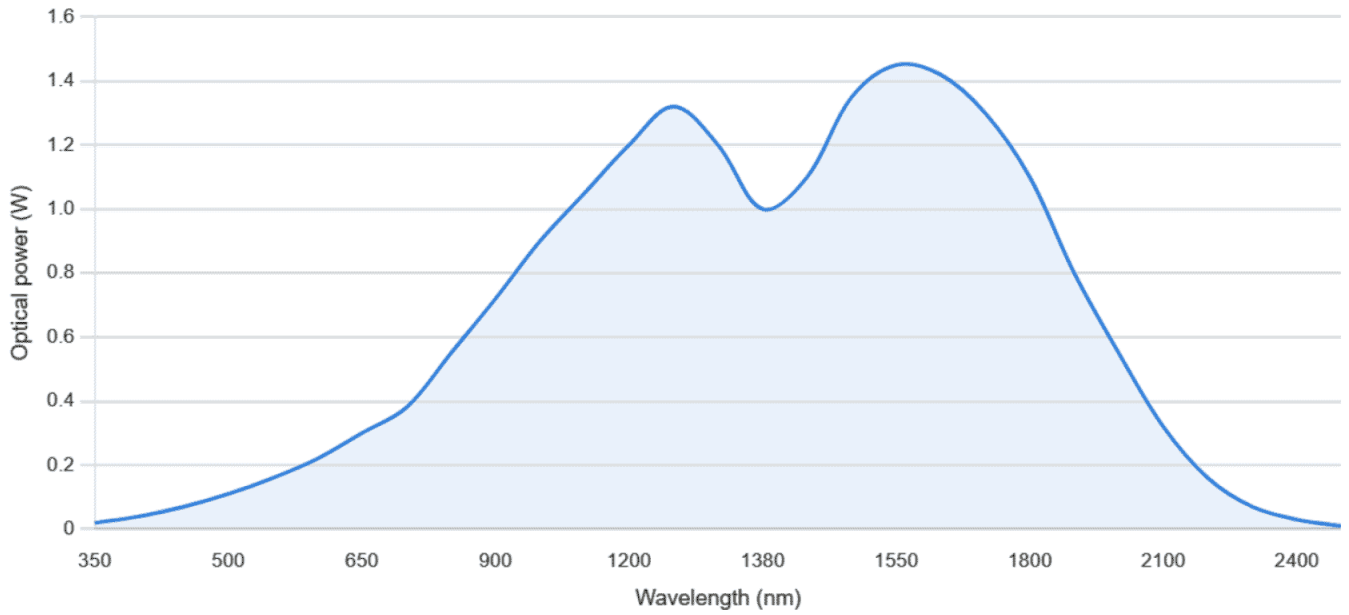
Regular Single Mode / Polarization Maintaining Fiber Optical Power Handing vs Wavelength



Single mode fiber optical power is limited by nonlinear effects in addition to absorption that increase loss and generate heat. The curve shows the approximate safe CW power envelope for standard single-mode fiber. Actual limits depend on fiber design, core size, length, and laser characteristics. Specialty fibers can significantly increase the power limit.

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