

MEMS NxM Latching Fiber Optic Switch

Latching, < 1 dB Low Loss, ER 28 dB, Bidirectional, SM, PM, 780–250 nm

(Protected by U.S. patent 8,203,775, 20170184840A1, and other patents pending)



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Features

- Reliable
- Compact
- No Drift
- Low Loss

Specifications

Parameter		Min	Typical	Max	Unit
Operation Wavelength	Singe Band	1260~1360 or 1510~1610			nm
	Dual Band	1260~1360 and 1510~1610			
	Broad Band	1260~1620			
Insertion Loss ^{[1], [2]}		0.6	0.8	1.2	dB
Wavelength Dependent Loss		0.1	0.15	0.2	dB
Polarization Dependent Loss (SM)				0.2	dB
Extinction Ratio (PM)		18	25	30	dB
Return Loss ^{[1], [2]}		55			dB
Cross Talk On/Off ^{[1], [2]}		55	65	70	dB
Response Time		3	10	20	ms
Repetition Rate			4		Hz
Latency				10	ns
Repeatability				± 0.05	dB
Durability		10 ⁹			Cycle
Operating Temperature ^[3]		−40	−5 to +65	+70	°C
Storage Temperature		−40		+85	°C
Optical Power Handling (CW)			300	500	mW

Notes:

- [1]: Within operating temperature and SOP
[2]: Excluding connectors
[3]: −40 °C version is special

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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MEMS NxM Latching Fiber Optic Switch

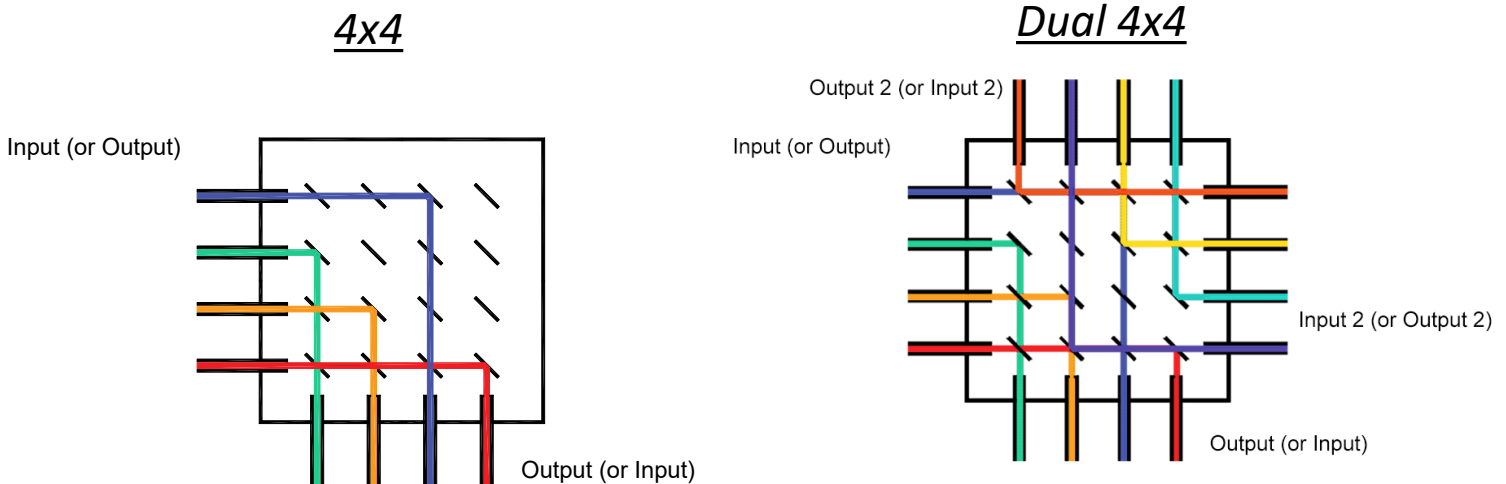


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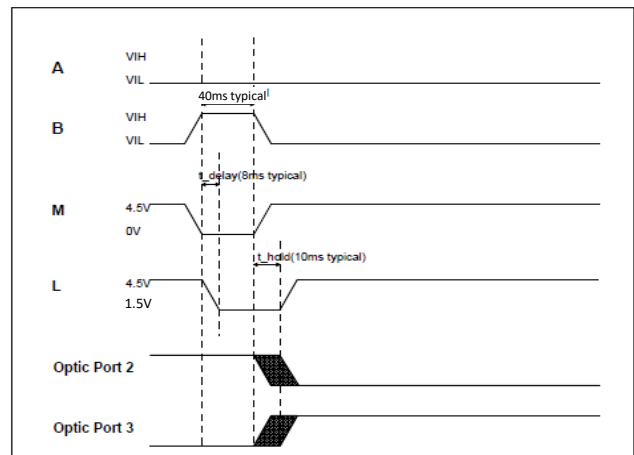
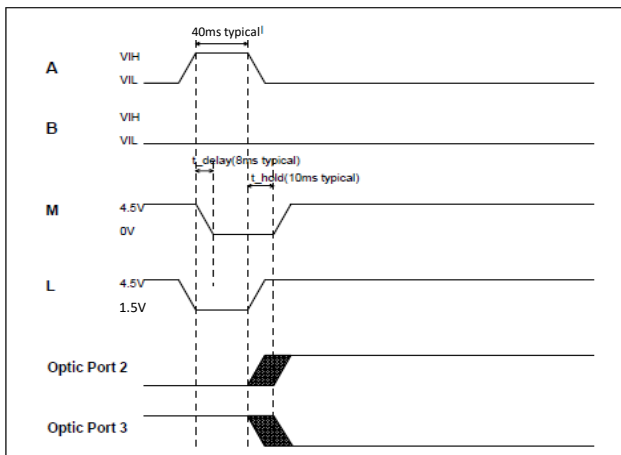
Functional Diagram



Driving Instruction

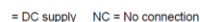
- The MEMS switch consists of an array of individually actuated mirrors positioned at 45° relative to the optical path.
- Each mirror employs two separate actuators: Mirror Actuator (M): Moves the mirror into the beam reflection position; driven by a 4.5–5.0 V pulse with a 40–100 ms pulse width. Latching Actuator (L): Latches the mirror in place; driven by a 3.0–3.5 V pulse with a 40–100 ms pulse width.
- Activation Sequence: Apply the latching pulse (L) first. After an 8–10 ms delay, apply the mirror pulse (M). Maintain both pulses for 40 ms, then release both simultaneously. The optical path is established in less than 10 ms from start.
- Deactivation Sequence: Apply the mirror pulse (M) first. After an 8–10 ms delay, apply the latching pulse (L). Maintain both pulses for 40 ms, then release both simultaneously. The optical path is disconnected in less than 10 ms.
- The driving sequence is illustrated below, where M designates the mirror actuator and L designates the latching actuator.
- A recommended circuit for a mirror and latching pair is provided in the following page. 4.5~5.0VDC should be applied on PIN-3.

ATTENTION: Over driving on time and voltage may burn the MEMS latching chip.



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Mechanical Dimensions (mm) @ Electrical Pin Layout for N and M ≤ 8

3

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Ordering Information (Part Number)

Prefix	Type	Wavelength	Channel	Driver	Fiber Type	Fiber Cover	Fiber Length	Connector ^[1]	PER
MEIS-	2x4 = 0204 3x4 = 0304 4x4 = 0404 8x8 = 0808 12x12 = 1212	1260~1620nm = 5 780nm = 7 850nm = 8 1060nm = 1 980nm = 9	Single = 1 Duplex = 2	None = N USB = U RS232 = R	SMF-28 = 1 PM1550 = 5 PM1310 = 3 Hi980 = 9 Hi1060 = H PM980 = E PM850 = F Special = 0	900 um tube = 3 Special = 0	0.25m = 1 0.5m = 2 1.0m = 3 Special = 0	None = 1 FC/PC = 2 FC/APC = 3 SC/PC = 4 SC/APC = 5 ST/PC = 6 LC/PC = 7 LC/APC = 8 Duplex LC/APC = 9	Non = 1 18 = 2 25 = 3 27 = 4 29 = 5

[1]: 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. High ER connectors can be ordered specially

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.

Operation Manual For Driving PCB

1. Connect the device to a PC using the accompanied cable
2. Plug in the accompanied power supply
3. Install the accompanied software in the PC
4. Run the software, using the GUI to control the device.

Warning do not touch the PCB since the static will damage the ICs, do not adjust the setting on the PCB.

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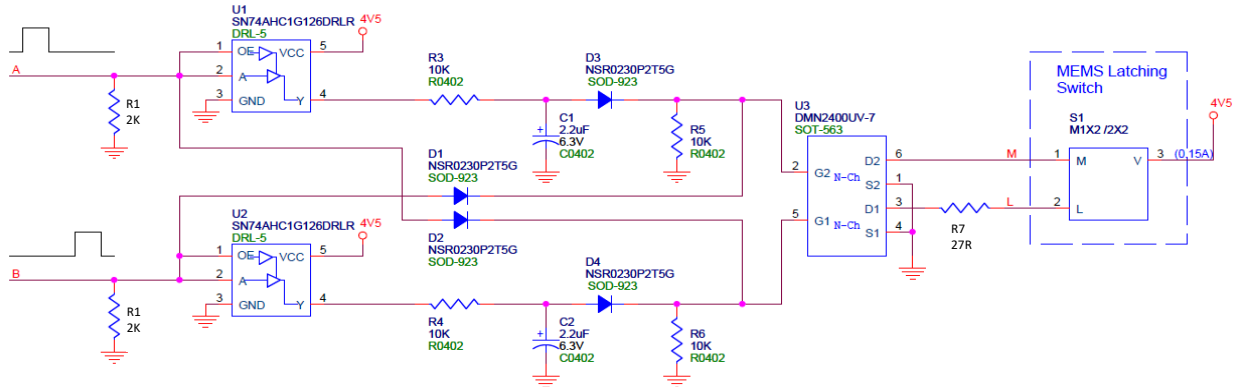
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Recommended Driving Circuit and Dring Pulse Timing

1) A recommended circuitry



- 1) 4.5~5V for all VDC.
- 2) R7: 27~30ohm for avoiding the over-current applied on latching arms.

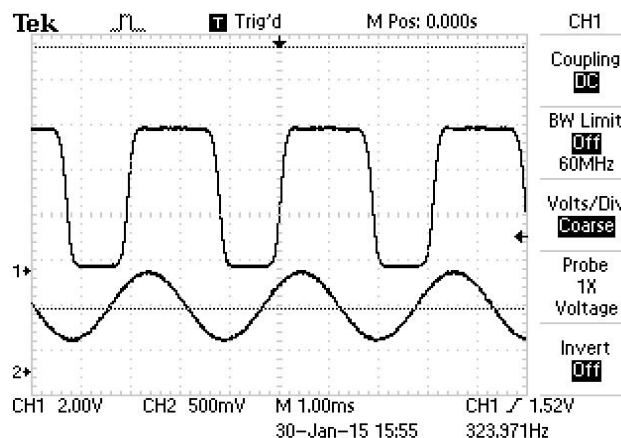
2) Driving Pulses

The latching switch requires the timed driving pulses of 4.5~5.0V for pulse-M and 3.0~3.5V for pulse-L to operate MEMS latching chip. The driving pulses-M and -L are generated with different time sequence in this circuit by control signal Pulse-A or Pulse-B.

- 1) Pulse-A and -B are the control signals. The pulse width and the voltage are 40~100ms and 5V typically. Pulse-A is used for Status I of switches shown in the driving table above, while Pulse-B is used for Status II.
- 2) The driving pulses-M and -L are generated in this circuit and applied on PIN-1 and -2 of switch respectively, while PIN-3 is connected to 4.5~5.0VDC.
- 3) Under the control pulse-A, driving pulse-M is delayed to pulse-L.
- 4) Under the control pulse-B, driving pulse-L is delayed to pulse-M.
- 5) The delay between two driving pulses is ~10ms typically in this circuitry.
- 6) The optical path changes is shown for 1x2 as example, and also valid for other optical configurations.

10⁹ Switching Cycle Test

We have tested MEMS 1x2 switch at the resonant frequency ~300Hz for more than 40 days, as shown in the attachment, which corresponding over 10⁹ switching cycles. The measurements show little changes in Insertion loss, Cross Talk, Return loss etc., all parameters are within our specs.



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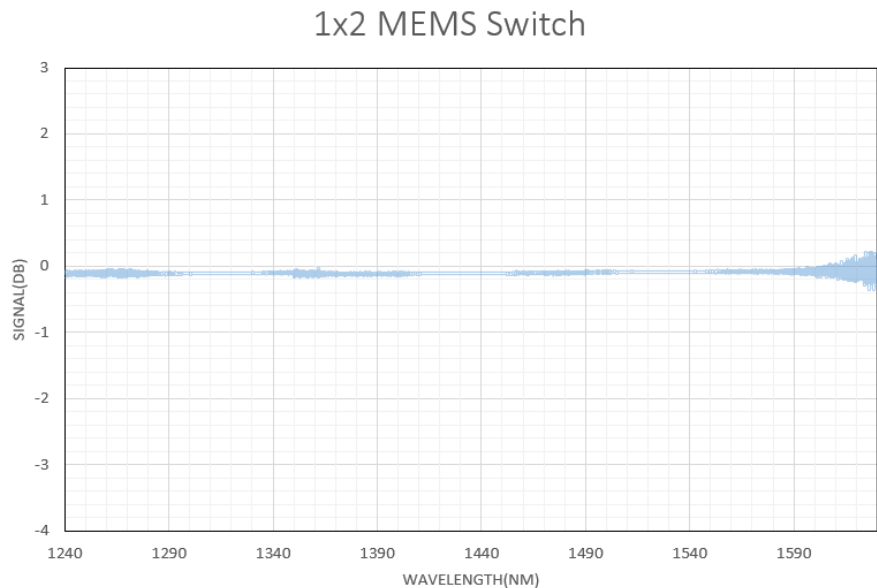


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Typical Insertion Loss vs Wavelength (1240-1630nm)



Vibration (40-1200Hz) Test Results

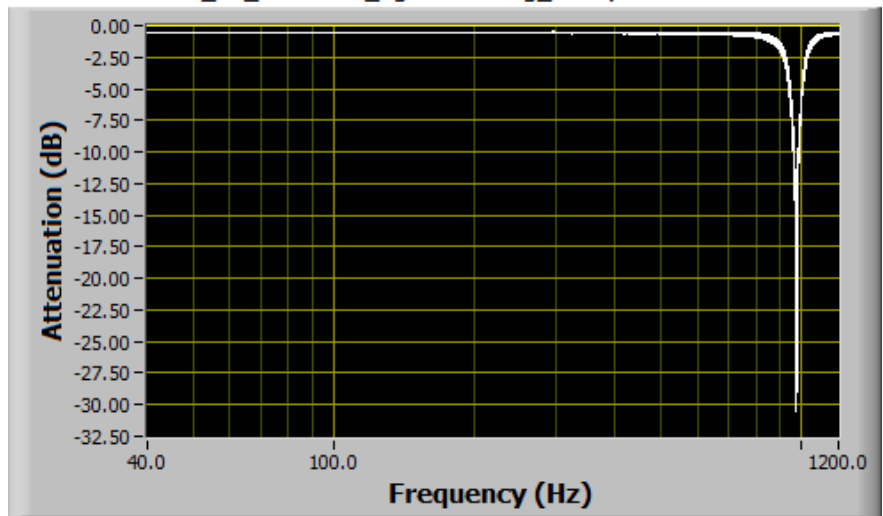
Test condition:

1. Acceleration: 1g from 40Hz to 100Hz, and then from 100Hz to 1200Hz, from 1g to 2g
2. Vibration direction: Z axis of MSOA SN# U03081
3. Measure fiber optical insertion loss change

Results:

1. Resonance frequency: ~976Hz, max IL change ~30dB
2. IL change <0.1dB for frequency <200Hz, 0.1-0.2dB for frequency 200-500Hz.

MSOA-U03081-Z_OV_40-100Hz_1g-1000Hz-2g_1 oct/min



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Control Interface Information

The control interface is Micro-USB with GUI and/or command list. RS232 can be an alternative option with the adaption cable of converter, but USB and RS232 can't be implement on same driver.



Cable for RS232

GUI SCREEN SHOT

FileEditDeviceConfigureInfo

Online Mode

PHOTONWARES

Switch Operation Program

MEMS 4X4 Switch Run Time Test

Running Status

Current StepStep Duration (ms)Loop Count

Action Buttons

of Loops0Run

Loop ActivatePause

ADDDEL

Programmable Running Sheet

Steps	Duration(ms)	Status (Click to Set to Light Path/Double Click to Reset The Light Paths)
1	1000	I1-O1 I2-O2 I3-O3 I4-O4
2	1000	I1-O1 I2-O2 I3-O4 I4-O3
3	1000	I1-O1 I2-O3 I3-O2 I4-O4
4	1000	I1-O1 I2-O3 I3-O4 I4-O2
5	1000	I1-O1 I2-O4 I3-O2 I4-O3
6	1000	I1-O1 I2-O4 I3-O3 I4-O2
7	1000	I1-O2 I2-O1 I3-O3 I4-O4
8	1000	I1-O2 I2-O1 I3-O4 I4-O3
9	1000	I1-O2 I2-O3 I3-O1 I4-O4
10	1000	I1-O2 I2-O3 I3-O4 I4-O1
11	1000	I1-O2 I2-O4 I3-O1 I4-O3

Light Path Status

Input 1Output 1

Input 2Output 2

Input 3Output 3

Input 4Output 4

Start Status #

01

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Command List

Command/Echo /Comments

BaudRate Setting: 9600-N-8-1

CMD: 0x01 0x12 0x00 x(HEX) /Switch to CH, x: 0, 1, 2, 3 ... 23.

Echo: 0x01 0x12 0x00 x(HEX) /Succesed

0x01 0x12 0xFF 0xFF /Failed

CH Status

0 I1-O1 I2-O2 I3-O3 I4-O4

1 I1-O1 I2-O2 I3-O4 I4-O3

2 I1-O1 I2-O3 I3-O2 I4-O4

3 I1-O1 I2-O3 I3-O4 I4-O2

4 I1-O1 I2-O4 I3-O2 I4-O3

5 I1-O1 I2-O4 I3-O3 I4-O2

6 I1-O2 I2-O1 I3-O3 I4-O4

7 I1-O2 I2-O1 I3-O4 I4-O3

8 I1-O2 I2-O3 I3-O1 I4-O4

9 I1-O2 I2-O3 I3-O4 I4-O1

10 I1-O2 I2-O4 I3-O1 I4-O3

11 I1-O2 I2-O4 I3-O3 I4-O1

12 I1-O3 I2-O1 I3-O2 I4-O4

13 I1-O3 I2-O1 I3-O4 I4-O2

14 I1-O3 I2-O2 I3-O1 I4-O4

15 I1-O3 I2-O2 I3-O4 I4-O1

16 I1-O3 I2-O4 I3-O1 I4-O2

17 I1-O3 I2-O4 I3-O2 I4-O1

18 I1-O4 I2-O1 I3-O2 I4-O3

19 I1-O4 I2-O1 I3-O3 I4-O2

20 I1-O4 I2-O2 I3-O1 I4-O3

21 I1-O4 I2-O2 I3-O3 I4-O1

22 I1-O4 I2-O3 I3-O1 I4-O2

23 I1-O4 I2-O3 I3-O2 I4-O1

CMD: 0x01 0x13 0x00 0x00 /Check current CH

Echo: 0x01 0x13 0x00 x(HEX) /Return current CH

CMD: 0x01 0x02 0x00 0x00 /Check Version

Echo: 0x01 0x02 0x41 0x30

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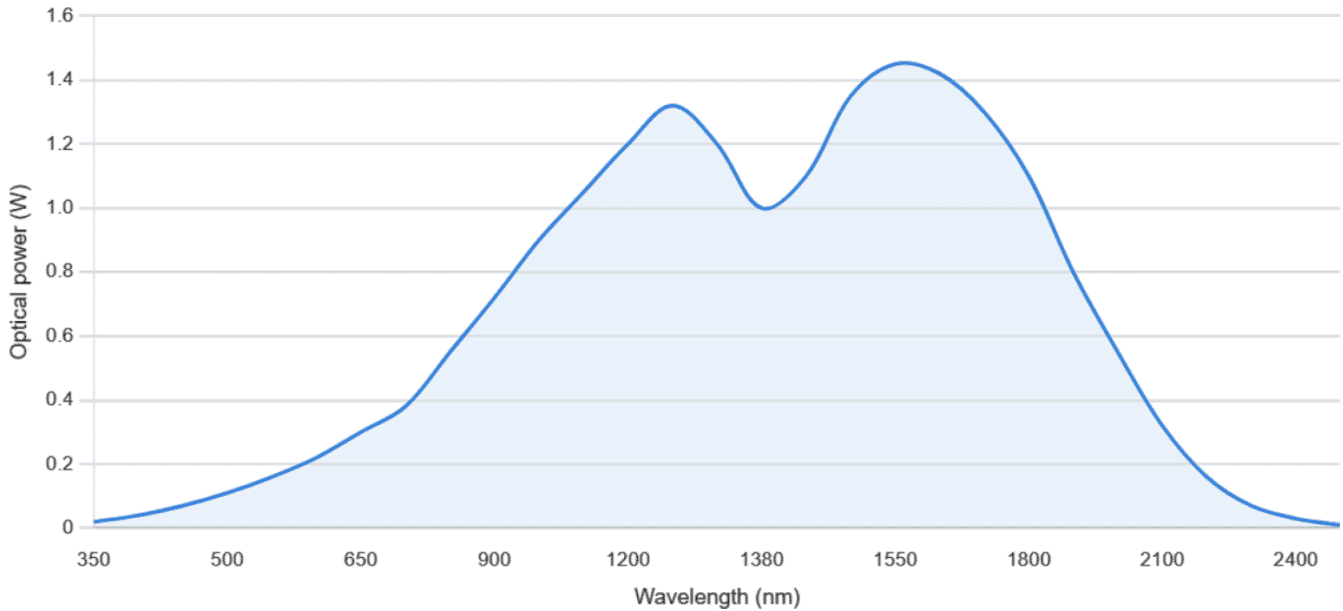


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Regular Single Mode / Polarization Maintaining Fiber Optical Power Handling vs Wavelength



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.