# *MEMS* 1x16 Fiber Optical Switch/VOA

**(Bidirectional, SM, PM, 1260-1620 nm)**

**(Protected by US Patent 10752492B2)**

## Features

- Hitless
- High Reliability
- ESD Tolerance

## Product Description

The MEMS 1x16 Series Fiber Optical Switch uses a patented thermal activated micro-mirror, moving-in and -out optical paths to direct an incoming light into a selected output fiber without hitting other ports, by which the degradation of multi-fiber collimator due to the laser steering in long period is entirely eliminated. It uniquely offers unprecedented high stability over a wide temperature range, compact size, exceptionally long operation life, insensitive to moisture and ESD, no long-term drifts, and high-reliability for over 25 years of continuous operation. The switches are Telcordia GR1221 qualified.

The device can also simultaneously functions as a variable attenuator in which the output light intensity is partially coupled into a selected fiber port, while the rest of light is isolated from other ports. The device is conveniently controlled by directly applying a voltage to a selected mirror actuator.


## Performance Specifications

| MEMS 1x16 Series Switch | | Min | Typical | Max | Unit |
|---|---|---|---|---|---|
| | | 1260 | | 1620 | nm |
| Insertion Loss [1] [2] | | | 1.2 | 2.2 | dB |
| Wavelength Dependent Loss | | | 0.2 | 0.3 | dB |
| Polarization Dependent Loss （SM） | | | | 0.15 | dB |
| Extinction Ratio (PM) | | 18 | 25 | | dB |
| Return Loss [1] [2] | | 50 | | | dB |
| Cross Talk [1] [2] | | 50 | | | dB |
| Repeatability | | | | ±0.05 | dB |
| Switching Time | | | 10 | | ms |
| Durability | | $10^{10}$ | | | Cycle |
| Switching Type | | | Non-Latching | | |
| Operating Temperature | | -5 | | 70 | °C |
| Storage Temperature | | -40 | | 85 | °C |
| Optical Power Handling [3] (CW) | | | 300 | 500 | mW |
| Fiber Type | SM | | SMF-28 fiber or equivalent | | |
| | PM | | Panda 250 fiber or equivalent | | |

[1]. Within operating temperature and SOP.
[2]. Excluding connectors.
[3]. Continuous operation, for pulse operation call.

## Applications

- Channel Blocking
- Configurable Add/Drop
- System Monitoring
- Instrumentation

RoHS Compliant

Revised on 11/27/22

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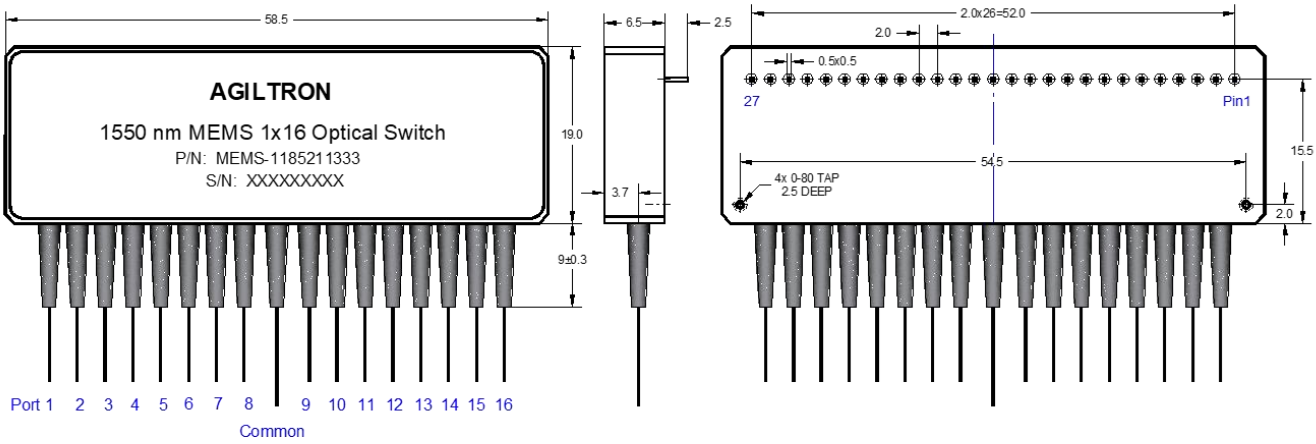
## (Bidirectional, SM, PM, 1260-1620 nm)

## Mechanical Dimensions (mm)




| Port Color | Green | Black | Red | Blue | White | Yellow |
|---|---|---|---|---|---|---|
| Port # | Common | 1, 6, 11, 16 | 2, 7, 12 | 3, 8, 13 | 4, 9, 14 | 5, 10, 15 |

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

## Driving Table and Requirement

**Only one mirror needs to be activated for all configurations, consuming < 170 mW electrical power.**

**MEMS 1x16 Non-Latching Switch Driving Table**

| Optical Path | Control Signal Applied on Pin # | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 |
| C ↔ P1 | +V | | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | | |
| C ↔ P2 | 0 | | +V | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | | |
| C ↔ P3 | 0 | | 0 | +V | | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | | |
| C ↔ P4 | 0 | | 0 | 0 | | +V | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | | |
| C ↔ P5 | 0 | | 0 | 0 | | 0 | +V | | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | | |
| C ↔ P6 | 0 | | 0 | 0 | | 0 | 0 | | +V | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | | |
| C ↔ P7 | 0 | | 0 | 0 | | 0 | 0 | | 0 | +V | | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | | |
| C ↔ P8 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | | +V | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | | |
| C ↔ P9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | +V | 0 | +V | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | NC |
| C ↔ P10 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | +V | | 0 | +V | | 0 | 0 | | 0 | 0 | | 0 | 0 | | |
| C ↔ P11 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | +V | | 0 | 0 | | +V | 0 | | 0 | 0 | | 0 | 0 | | |
| C ↔ P12 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | +V | | 0 | 0 | | 0 | +V | | 0 | 0 | | 0 | 0 | | |
| C ↔ P13 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | +V | | 0 | 0 | | 0 | 0 | | +V | 0 | | 0 | 0 | | |
| C ↔ P14 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | +V | | 0 | 0 | | 0 | 0 | | 0 | +V | | 0 | 0 | | |
| C ↔ P15 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | +V | | 0 | 0 | | 0 | 0 | | 0 | 0 | | +V | 0 | | |
| C ↔ P16 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | +V | | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | +V | | |

**Note :** [1].C: Common port. [2]. +V: 3.8 ~ 4.2VDC @ T<=45°C operation; 3.8 ~ 4.0VDC @ T>45°C operation. [3]. NC: No electronic connection.

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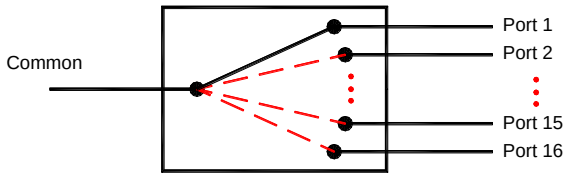
## Functional Diagram




MEMS 1x16 Switch

Note:

1) Standard version: None of ports is connected optically without voltage. In addition of On-Off operation, the attenuation can be realized in each port. When the applied voltage is increased, IL of the relevant port will be reduced from IL in max (>50dB) to IL in min, realizing VOA function.
2) Default version: Port #1 is connected as default without voltage. VOA function isn't available any more in all ports.

## Ordering Information

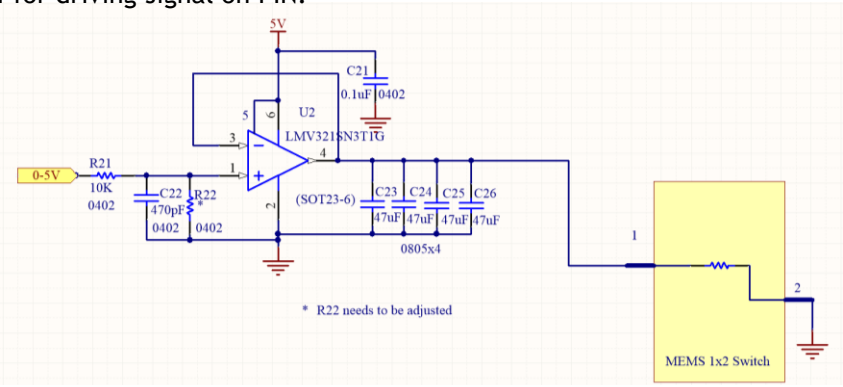
| | □□□ | □ | 2 | □ | □ | □ | □ | □ |
|---|---|---|---|---|---|---|---|---|
| **Prefix** | **Type** | **Wavelength** | **Switch** | **Version** | **Fiber Type** | **Fiber Cover** | **Fiber Length** | **Connector** |
| MEMS- [1]<br>MEMP- [2] | 1x13=113<br>1x14=114<br>1x15=115<br>1x16=116<br>Special=000 | 1260~1620=B<br>1550=5<br>1310 & 1550=9<br>Special=0 | Non-Latching=2 | Standard=1<br>Default = D<br>Special=0 | SMF-28=1<br>PM1550=B<br>PM1400=C<br>PM1310=D<br>PM980=E<br>PM850=F<br>Special=0 | Bare fiber=1<br>900 um tube=3<br>Special=0 | 0.25m=1<br>0.5m=2<br>1.0m=3<br>Special=0 | None=1<br>FC/PC=2<br>FC/APC=3<br>SC/PC=4<br>SC/APC=5<br>LC=7<br>Duplex LC=8<br>Special=0 |

[1]. **MEMS: MEMS 1x16 Mini Single Mode Switch.**

**[2]. MEMP: MEMP 1x16 Mini PM Switch.**

## Recommendation Control Circuit

In order to minimize the overshooting and oscillation in optics, the following circuit is recommended for driving signal on PIN.

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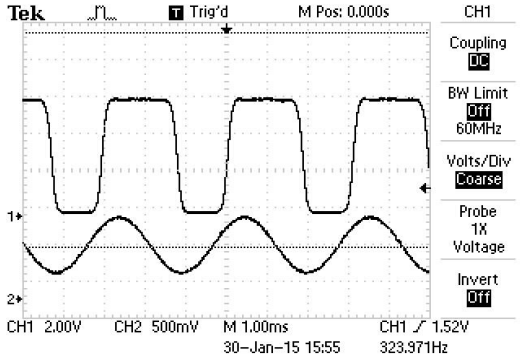
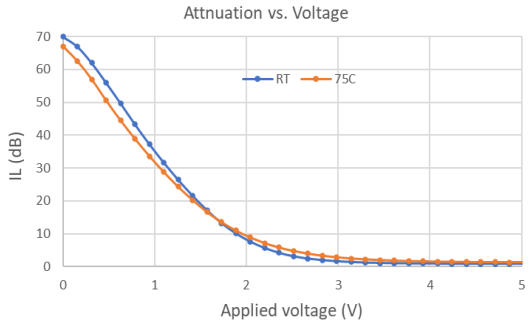
## $10^9$ Switching Cycle Test

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



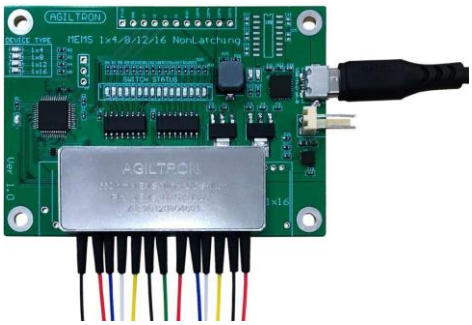

## VOA Capability on Port

The attenuation in each channel can be implemented in this MEMS switch without scarifying the switch performances. The attenuation is realized by the applied voltage, as shown in the following figure (typical).




## Demo Driver

**USB RS232/GUI, Pushbutton/LED Channel Indicators**
**Applicable to Non-latching MEMS-1x4, 1x8, 1x12 and 1x16 ($255)**



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