PRODUCT SPECIFICATION

Product Name	MEMS 1xN Optical Switch Series
Product Model	Singlemode
Description	Module 1

	Drafter	**Reviewer**	**Approver**	**Customer Confirm**
Signature				
Date				

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Document History

Version	DATE	DESCRIPTION	Modifier
V1.0	2019.6.13	First release	GL
V1.1 - V2.3	2019.8.22 - 2021.7.6	Edit	SH

Product List

CODE	P/N
	MS-1x2-15-S-09-1-LC/UPC-M1
	MS-1x4-15-S-09-1-LC/UPC-M1
	MS-1x8-15-S-09-1-LC/UPC-M1
	MS-1x16-15-S-09-1-LC/UPC-M1
	MS-1x32-15-S-09-1-LC/UPC-M1
	MS-1x48-15-S-09-1-LC/UPC-M1
	MS-1x64-15-S-09-1-LC/UPC-M1

1 DESCRIPTION

MEMS 1xN optical switch is based on micro-electro-mechanical system technology. It allows channel selection between an input fiber and up to N output fibers by rotating the MEMS mirror.

The switch is bi-directional and can also be used as a Nx1 selector switch. The optical switch offers highly reliable, durable, long-life operation in a compact package.

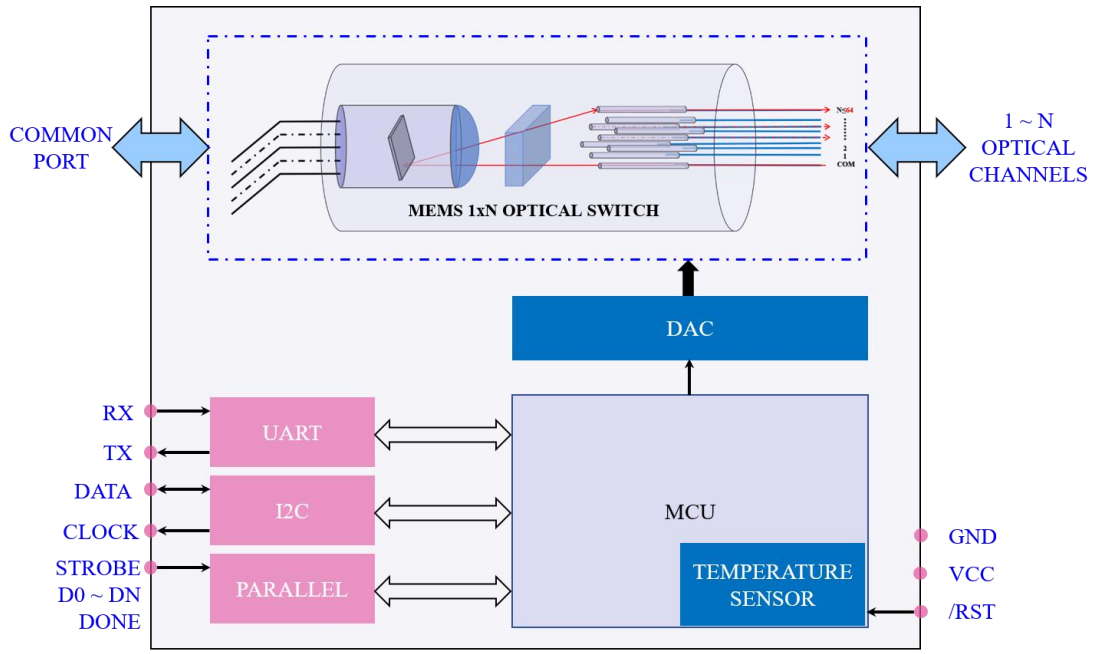


Figure 1 Functional Block Diagram

1.1 Features

- ✓ Proven MEMS durability and reliability
- ✓ Compact form factor
- ✓ Fast switching time
- ✓ Qualified to Telcordia GR-1073-CORE and RoHS requirements

1.2 Applications

- ✓ Fiber monitoring (Working with OTDR or OCM)
- ✓ Optical network routing
- ✓ Fiber sensing
- ✓ Resource sharing

✓ Optical network protection and restoration

2 MAIN SPECIFICATIONS

Table 1 Optical Specifications[1]

PARAMETER		VALUE	UNIT	NOTE
Wavelength Range		13:1290~1330 15:1525~1568 16:1600-1650	nm	Single-band: 13 or 15 or 16 Dual-band: 13&15 or 15&16 Full-band: 1290~1650
Test Wavelength		1310/1550/1625	nm	Each test wavelength is the CWL of a specific wavelength range
Channels		2~64		N
Insertion Loss	1x2	≤0.6, typical 0.5	dB	1. IL is measured at CWL, 23°C 2. IL is for Single-band. Dual-band adds 0.2dB 3. If with connectors, IL increases by 0.2~0.3dB
	1x4	≤0.8, typical 0.6		
	1x8	≤0.6, typical 0.5(LOW IL)		
	1x12	≤1.0, typical 0.9		
	1x16	≤0.8, typical 0.6(LOW IL)		
	1x24	≤1.2, typical 1.0		
	1x32	≤1.0, typical 0.8(LOW IL)		
	1x48	≤1.3, typical 1.1		
	1x64	≤1.1, typical 0.9(LOW IL)		
Return Loss		≥45	dB	Or customer specify
Repeatability		≤0.05	dB	Repeatability is defined after 100 cycles
Crosstalk	N≤2	≥50	dB	Or customer specify
	2<N≤64	≥45		
Polarization Dependent Loss		≤0.2	dB	
Wavelength Dependent Loss	N≤32	≤0.3	dB	WDL is measured at CWL±20nm, 23°C
	32<N≤64	≤0.4		
Temperature Dependent Loss	N≤16	≤0.3	dB	
	16<N≤64	≤0.4		
Switch Time	N≤16	≤5	ms	1. Excluding protocol transmission time 2. When using optimized voltage ramp 3. Faster 1xN switching time version available as a special request
	16<N≤64	≤10		
Durability		≥1x10^9	cycle	
Maximum Optical Power		≤500	mW	

1. All specifications are without connectors unless otherwise specified.

Table 2 Electrical and Mechanical Specifications[1]

PARAMETER	VALUE	UNIT	NOTE
Latching Type	Non-latching		
Control Type	UART or parallel		
Supply Voltage	5±0.25	V	
Power Consumption	≤0.7, typical 0.55	W	
Dimension	68x30x13	mm	2≤N≤16
	75x30x13		16<N≤32
	75x30x16		32<N≤48
	80x34x18		48<N≤64

1. All specifications belong to MS M1.

3 OPERATION/STORAGE TEMPERATURE/HUMIDITY

Table 3 Environmental Conditions

PARAMETER	VALUE	UNIT	NOTE
Operation Temperature	-5~65	℃	
Storage Temperature	-40~85	℃	
Operation Humidity	5~95	%RH	
Storage Humidity	5~95	%RH	

4 PIGTAIL AND CONNECTOR

Table 4 Pigtail and Connector Type/Length

PARAMETER	VALUE	UNIT	NOTE
Fiber Type	G657A2/G657B3		
Fiber Pigtail (All Ports)	250um fiber or 900um loose tube		
Fiber Length (All Ports)	1.00±0.05	m	Or customer specify
Optical Connector (All port)	None		Or customer specify

5 MECHANICAL DIMENSIONS

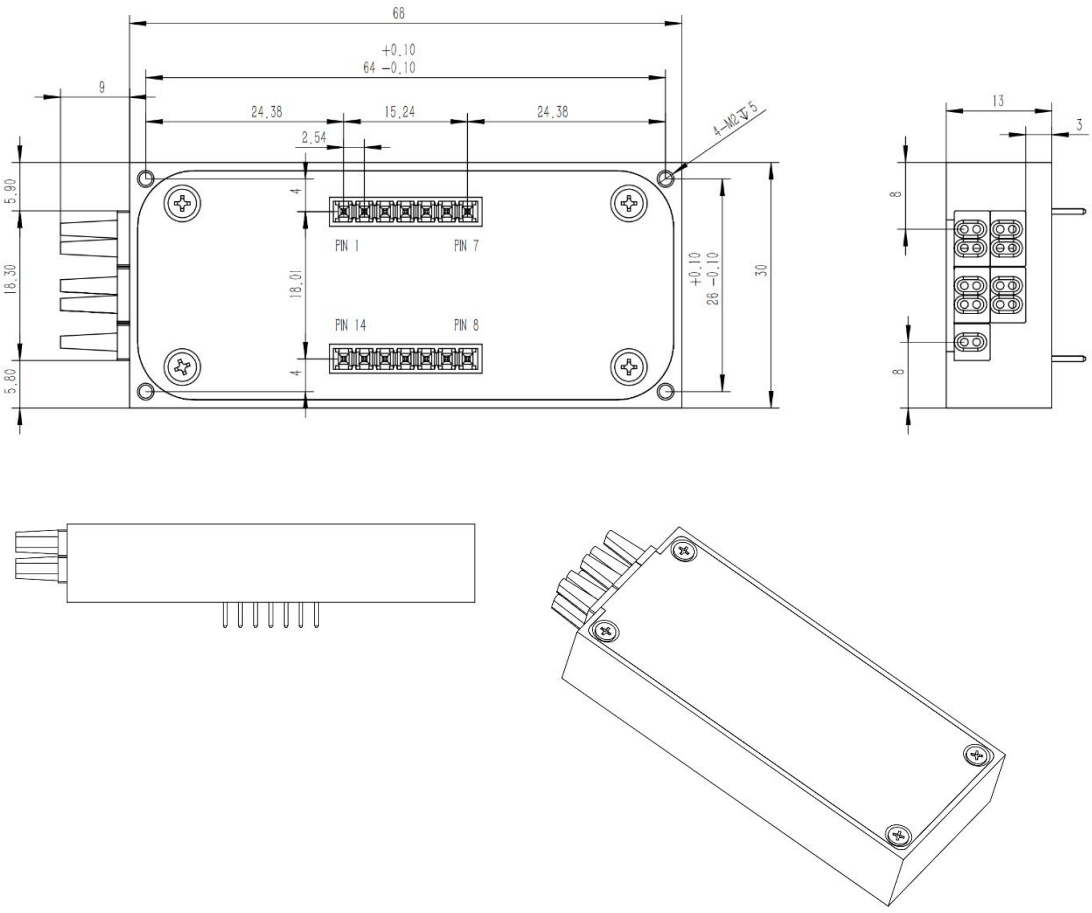


Figure 2 Module Type 1 (1xN, 2≤N≤16)

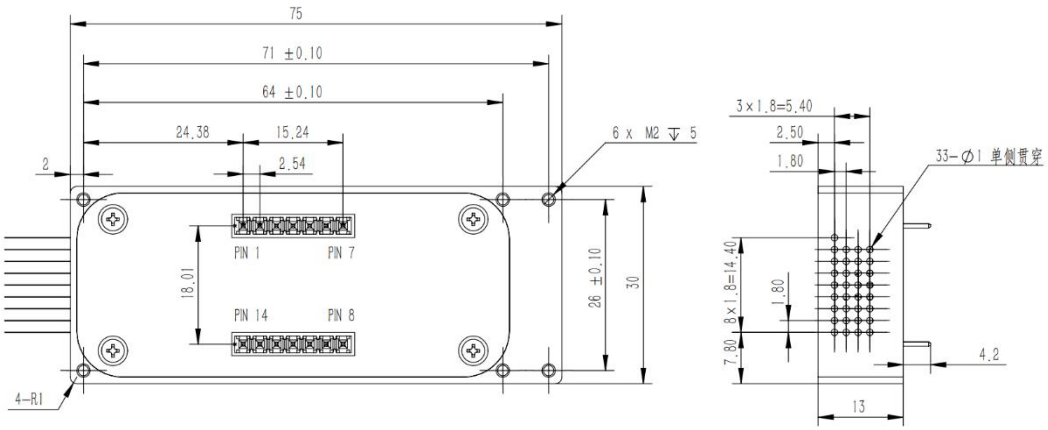


Figure 3 Module Type 1 (1xN, 16<N≤32)

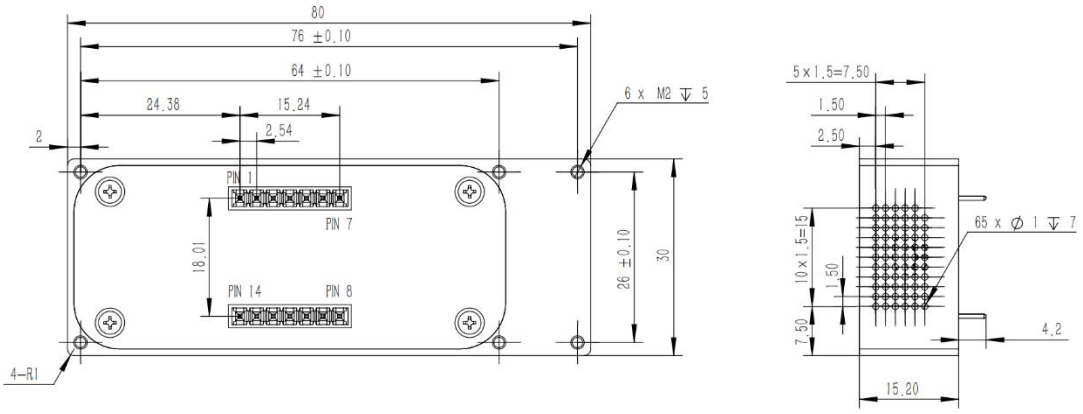


Figure 4 Module Type 1 (1xN, 48<N≤64)

6 ELECTRONIC PINS DEFINITION

6.1 UART Definition (Default)

Table 5 Electronic PIN Definition

Pin NO.	Name	Input/Output	Level	Function
1	NC	No connect		
2	VCC	Power supply		+(5.0±5%) V Power Supply Max 150mA
3	I/O		LVTTL	Reserved
4	GND			Power supply ground
5	I/O		LVTTL	Reserved
6	TXD	Output	LVTTL	UART serial data output
7	RXD	Input	LVTTL	UART serial data input
8	I/O		LVTTL	Reserved
9	I/O		LVTTL	Reserved
10	I/O		LVTTL	Reserved
11	Case GND			Case ground
12	I/O		LVTTL	Reserved
13	I/O		LVTTL	Reserved
14	Reset	Input	LVTTL	Reset, low active, the pulse width needs 4ms

6.2 UART & Parallel Definition (Optional)

Table 6 Electronic PIN Definition

Pin NO.	Name	Input/Output	Level	Function
1	NC	No connect		
2	VCC	Power supply		+(5.0±5%) V Power Supply Max 150mA
3	STROBE	Input	LVTTL	Falling edge active
4	GND			Power supply ground
5	D0	Input	LVTTL	
6	TXD	Output	LVTTL	UART serial data output
7	RXD	Input	LVTTL	UART serial data input
8	D4	Input	LVTTL	
9	D2	Input	LVTTL	
10	DONE	Output	LVTTL	Switch done, active low
11	Case GND			Case ground
12	D1	Input	LVTTL	
13	D3	Input	LVTTL	
14	Reset	Input	LVTTL	Reset, low active, the pulse width needs 4ms

6.3 IIC Definition (Optional)

Table 7 Electronic PIN Definition

Pin NO.	Name	Input/Output	Level	Function
1	NC	No connect		
2	VCC	Power supply		+(5.0±5%) V Power Supply Max 150mA
3	I/O		LVTTL	Reserved
4	GND			Power supply ground
5	I/O		LVTTL	Reserved
6	I2C Data[1]	I/O	LVTTL	I2C interface Data
7	I2C Clock[1]	I/O	LVTTL	I2C interface Clock
8	I/O		LVTTL	Reserved
9	I/O		LVTTL	Reserved
10	I/O		LVTTL	Reserved
11	Case GND			Case ground
12	I/O		LVTTL	Reserved
13	I/O		LVTTL	Reserved

Pin NO.	Name	Input/Output	Level	Function
14	Reset	Input	LVTTL	Reset, low active, the pulse width needs 4ms

NOTE:

1) Please pull up 4.75k resistor to 3.3V in the module;

2) Please pull up 4.75k resistor to 3.3V on mother board;

3) Please pull up 4.75k resistor to 3.3V in the module. A negative pulse ≥1ms.

6.4 UART Control Setting

Baud Rate: 115200

Start Bits: 1

Data Bits: 8

Parity: None

Stop Bits: 1

Flow Control: None

6.5 Parallel Digital I/O Control

TTL control can only be used for optical switches with up to 32 channels with 5 TTL control pins (D0~ D4).

Channel	D4	D3	D2	D1	D0
CH1	0	0	0	0	0
CH2	0	0	0	0	1
CH3	0	0	0	1	0
CH4	0	0	0	1	1
...	...	...	...	...	...
CH8	0	0	1	1	1
CH16	0	1	1	1	1
CH32	1	1	1	1	1

NOTE:

When optical switch is 1x8， D3 and D4 is not used. Similarly for other 1xN.

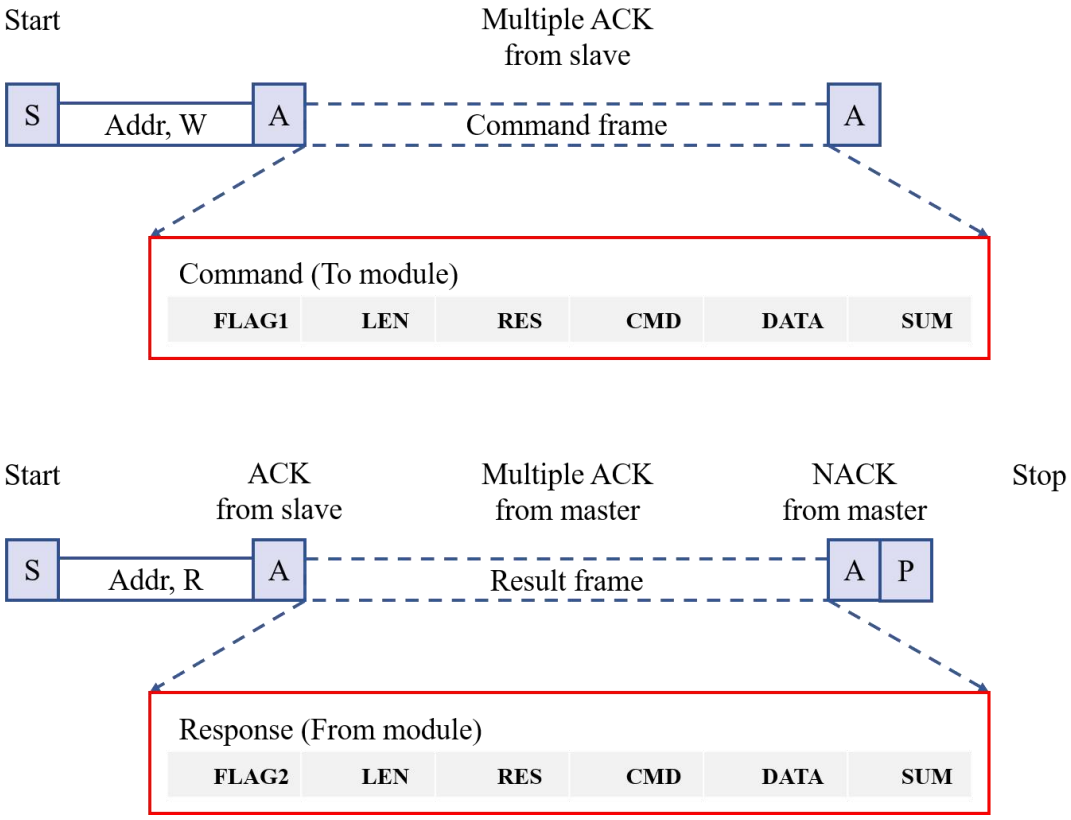
6.6 I2C Bus

I²C bus specifications	Minimum	Typical	Maximum
I²C Clock frequency	10kHz	100kHz	100kHz
Capacitive loading			400pF

I2C address:

1	1	1	0	0	0	0	R/W

The list shows the commands, which are sent to module, and the response from the module.



7 COMMUNICATION PROTOCOL

7.1 Protocol 1 (Default)

Command

FLAG	LEN	RES	CMD	DATA	SUM
2 Byte	1 Byte	1 Byte	1 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

Response

FLAG	LEN	RES	RESP	DATA	SUM
2 Byte	1 Byte	1 Byte	1 Byte		1 Byte

FLAG: 0xEDFA

LEN: Total number of bytes from RES to SUM

RES: 0xFF

SUM: Checksum, SUM=FLAG+LEN+RES+ RESP+DATA

Command List

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					

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

3) Read Module Information						
Command	FLAG1	LEN	RES	CMD	DATA	SUM
	0xEFEF	0x03	0xFF	0x01		SUM
Response	FLAG2	LEN	RES	RESP	DATA	SUM
	0xEDFA	0x27	0xFF	0x01	36 bytes	SUM

DATA = Module information

Item	Bytes	Type	Note
Vendor Code	10	ASCII	
Reserved	10	ASCII	Information about the channel and the type
Hardware Version	2	Hex	X.Y (X—byte0 Y—byte1)

Firmware Version	2	Hex	X.Y (X—byte0 Y—byte1)
Production Date	4	Hex	YYYY—MM—DD YYYY—byte0 byte1 MM—byte2 DD—byte3
Serial Number	8	ASCII	

4) Reset Module						
Command	FLAG1	LEN	RES	CMD	DATA	SUM
	0xEFEF	0x03	0xFF	0x03		SUM
Response	FLAG2	LEN	RES	RESP	DATA	SUM
	0xEDFA	0x03	0xFF	0x03		SUM

7.2 Protocol 2 (Optional)

1) Set Channel		
Command	<CHN_XXX>	XXX: 000~N (From 1 to maximun channel)
	Set channel 1: <CHN_001> Set channel 8: <CHN_008> Set channel 64: <CHN_064>	
Response	<CHN_OK>	Set channel successfully
	<CHN_E1>	Channel overflow
	<CHN_E2>	Other error

2) Get Channel		
Command	<STATUS_?>	
Response	<STA_M_C>	M: The maximum channel C: The current channel
	<STA_012_008> means the current channel of 1x12 is channel 8	

8 FIBER LENGTH

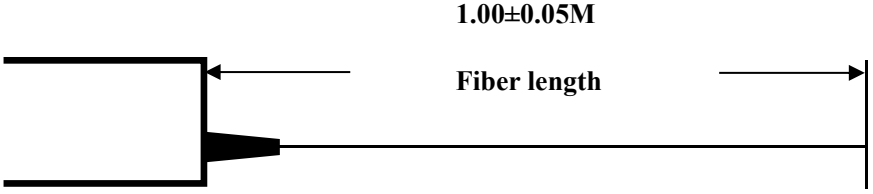


Figure 5 Fiber Length Definition

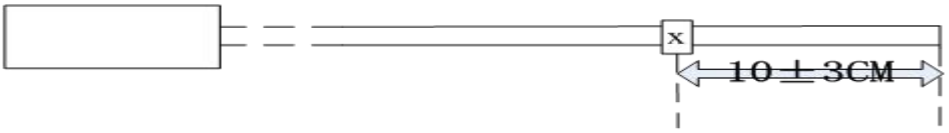
9 LABEL DEFINITION

9.1 On the module

P/N: xxxxxxxxxxx

S/N: xxxxxxxx

9.2 Label Definition



X=com,CH1,CH2,CH3……CHN

Figure 6 Label Definition

9.3 Others

ESD Packing

RoHS and GR-1073 compliance

10 ORDERING INFORMATION

MS - □ - □ - □ - □ - □ - □ - □

Product Code

MS	MEMS Switch

Switch Configuration

1xN	1xN Switch
1x16	
1x32	
1x64	(Specify 1 ≤ N ≤ 64)

Wavelength Range

13	1290 – 1330 nm
15	1525 – 1568 nm
16	1600 – 1650 nm
13/15	1290 – 1330 & 1525 – 1568 nm
15/16	1525 – 1568 & 1600 – 1650 nm
Or customer specify	

Fiber Type

S	Single Mode, G657A2

Jacket Type

09	Φ0.9 mm, loose tube

Pigtail Length

1	1 meter
Or customer specify	

Connector Type

LC/UPC
FC/APC
Or customer specify

Package

M1	Module, single stage, support 1 switch