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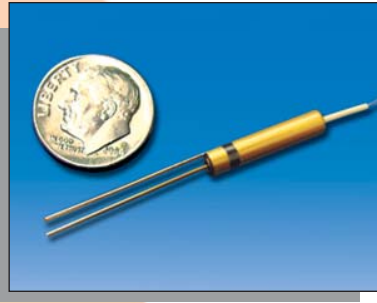
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Single-Channel Miniature Optical Power Monitor

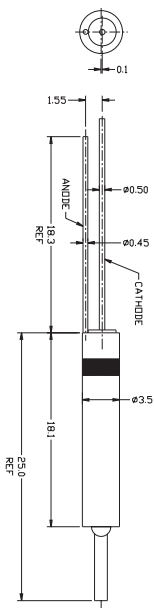
Features/Benefits

- Wide wavelength coverage (C-, L-band and C- & L-band)
- Compact coaxial package
- Small responsivity ripple
- Excellent responsivity linearity
- Low insertion loss
- Low polarization dependent loss
- Low wavelength dependent loss
- Low polarization dependent responsivity
- Minimizes fiber splicing
- Saves board space
- Simplifies logistic management
- Cost effective

Applications

- EDFA
- Raman amplifier
- DWDM mux/demux
- OADM
- Protection switch
- Other monitoring applications

Dimensions



Unit: mm

General Specifications

Parameters		Unit	Min.	Typ.	Max.
Operating Wavelength Range	C-band	nm	1525	1550	1565
	L-band	nm	1570	1593	1615
	C- & L-band	nm	1525	1570	1615
Polarization Dependent Loss		dB	-	0.03	0.1
Wavelength Dependent Loss		dB	-	0.05	0.15
Polarization Mode Dispersion		ps	-	-	0.1
Optical Return Loss		dB	45	-	-
Responsivity Flatness (with respect to band center)		dB	-	-	± 0.3
Polarization Dependent Responsivity		dB	-	0.03	0.1
Linearity		%	-	-	± 5
Reverse Voltage		V	-	5	20
Forward Current		mA	-	-	10
Dark Current @ 23°C, -5V		nA	-	0.5	1.0
High Frequency Response Limit		GHz	0.6	-	-
Operating Temperature		°C	- 5	-	70
Storage Temperature		°C	- 40	-	85
Fiber Pigtail		-	SMF-28, 250µm bare fiber or 900µm loose tube		
Dimension		mm	Φ 3.5 × 18.1		

Optical Performance vs Splitting Ratio

Tap Ratio (%)	Max. Insertion Loss (dB)				Min. Responsivity (µA/mW)	Max. Input Optical Power (mW)
	C or L band		C+L band			
	Premium	A Grade	Premium	A Grade		
1	0.3	0.4	0.4	0.5	8	500
3	0.4	0.5	0.5	0.6	24	300
5	0.5	0.6	0.6	0.7	45	300

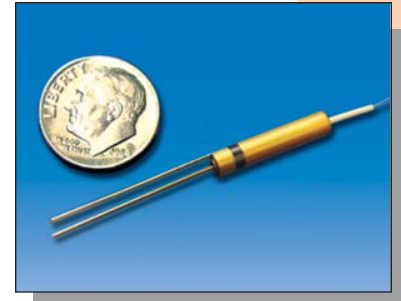
Note: Insertion loss and return loss values are without connectors.

Ordering Information

M	O	P	M			T		0	0	0					
Tapping Wavelength				Tapping Ratio		Grade	Fiber Type		Buffer Type		Connector				
C= C-band L= L-band E= C- & L-band				1= 1 % 3= 3 % 5= 5 %		P= Premium A= A grade	0= SMF-28		0= 250µm bare fiber 1= 900µm loose tube		0= None 1= FC/UPC 2= FC/APC 3= SC/UPC 4= SC/APC 5= LC/UPC 6= MU/UPC				
												Pigtail Length			
												10= 1.0m 15= 1.5m (not avail. with connector)			

This product information is subject to change without notice.

Single Channel Unidirectional Miniature Optical Power Monitor



General Specifications

Parameters		Unit	Min.	Typ.	Max.
*Operating Wavelength Range	C-band	nm	1525	1550	1565
	L-band	nm	1570	1593	1615
	C- & L-band	nm	1525	1570	1615
Isolation (Directivity) from Output to PD		dB	25	-	-
Polarization Dependent Loss		dB	-	0.03	0.1
Wavelength Dependent Loss		dB	-	0.05	0.15
Polarization Mode Dispersion		ps	-	-	0.1
Optical Return Loss		dB	45	-	-
Responsivity Flatness (with respect to band center)		dB	-	-	± 0.3
Polarization Dependent Responsivity		dB	-	0.03	0.1
Linearity		%	-	-	± 5
Reverse Voltage		V	-	5	20
Forward Current		mA	-	-	10
Dark Current @ 23°C, - 5V		nA	-	0.5	1.0
High Frequency Response Limit		GHz	0.6	-	-
Operating Temperature		°C	- 5	-	70
Storage Temperature		°C	- 40	-	85
Fiber Pigtail		-	SMF-28, 250µm bare fiber or 900µm loose tube		
Dimension		mm	Φ 3.5 × 20.5 (bare fiber) Φ 3.5 × 26.0 (900µm loose tube)		

* Dual band (1310 nm and 1550 nm) is available upon request

Optical Performance vs Splitting Ratio

Tap Ratio (%)	Max. Insertion Loss (dB)				Min. Responsivity (µA/mW)	Max. Input Optical Power (mW)
	C or L band		C+L band			
	Premium	A Grade	Premium	A Grade		
1	0.3	0.4	0.4	0.5	7	500
3	0.4	0.5	0.5	0.6	21	300
5	0.5	0.6	0.6	0.7	35	300

Note: Insertion loss and return loss values are without connectors.

Ordering Information

U O P M [] [] T [] 0 0 0 [] [] []

Tapping Wavelength
C= C-band
L= L-band
E= C- & L-band

Tapping Ratio
1= 1 %
3= 3 %
5= 5 %

Grade
P= Premium
A= A grade

Fiber Type
0= SMF-28

Buffer Type
0= 250µm bare fiber
1= 900µm loose tube

Pigtail Length
10= 1.0 m
15= 1.5 m (not avail. with connector)

Connector
0= None
1= FC/UPC
2= FC/APC
3= SC/UPC
4= SC/APC
5= LC/UPC
6= MU/UPC

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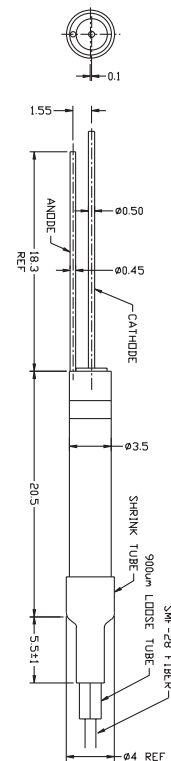
Features/Benefits

- Unidirectional monitoring
- Compact coaxial package
- Excellent responsivity linearity
- Low insertion loss
- Cost effective
- High isolation

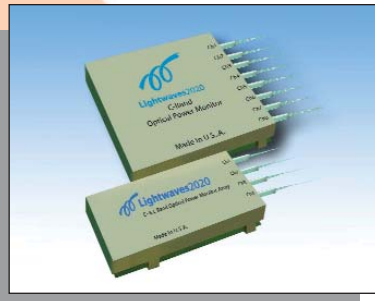
Applications

- EDFA
- Raman amplifier
- DWDM mux/demux
- OADM
- Protection switch
- OXC
- Other monitoring applications

Dimensions



Unit: mm



Multi-Channel Optical Power Monitor Array

Features/Benefits

- Wide wavelength coverage (C-, L- and C- & L-bands)
- Small footprint
- Small responsivity ripple
- Excellent responsivity linearity
- Low insertion loss
- Low polarization dependent loss
- Low wavelength dependent loss
- Low polarization dependent responsivity
- Minimizes fiber splicing
- Saves board space
- Plug-in socket design for easy mounting
- Simplifies logistic management

Applications

- EDFA
- Raman amplifier
- DWDM mux/demux
- Multi-channel OADM
- Protection switch
- Dynamic gain equalizer
- Other monitoring applications

General Specifications

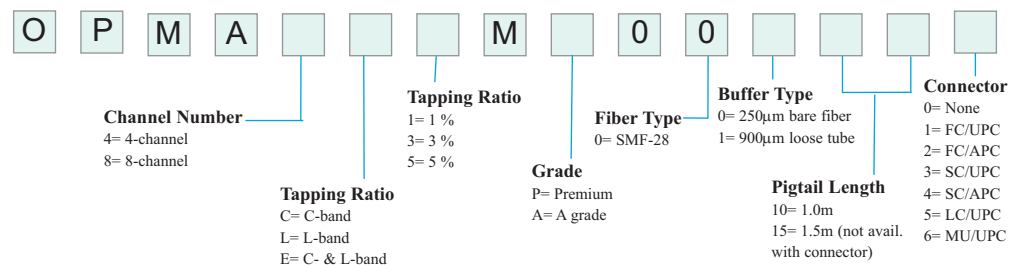
Parameters		Unit	Min.	Typ.	Max.
Operating Wavelength Range	C-band	nm	1525	1550	1565
	L-band	nm	1570	1593	1615
	C- & L-band	nm	1525	1570	1615
Polarization Dependent Loss		dB	-	0.03	0.1
Wavelength Dependent Loss		dB	-	0.05	0.15
Polarization Mode Dispersion		ps	-	-	0.1
Optical Return Loss		dB	45	-	-
Responsivity Flatness (with respect to band center)		dB	-	-	± 0.3
Polarization Dependent Responsivity		dB	-	0.03	0.1
Linearity		%	-	-	± 5
Reverse Voltage		V	-	5	20
Forward Current		mA	-	-	10
Dark Current @ 23°C, - 5V		nA	-	0.5	1.0
High Frequency Response Limit		GHz	0.6	-	-
Operating Temperature		°C	- 5	-	70
Storage Temperature		°C	- 40	-	85
Fiber Pigtail		-	SMF-28, 250µm bare fiber or 900µm loose tube		
Dimension	4-channel	mm	16.4 × 32 × 6		
	8-channel	mm	31 × 32 × 6		

Optical Performance vs Splitting Ratio

Tap Ratio (%)	Max. Insertion Loss (dB)				Min. Responsivity (µA/mW)	Max. Input Optical Power (mW)
	C or L band		C+L band			
	Premium	A Grade	Premium	A Grade		
1	0.3	0.4	0.4	0.5	8	500
3	0.4	0.5	0.5	0.6	24	300
5	0.5	0.6	0.6	0.7	45	300

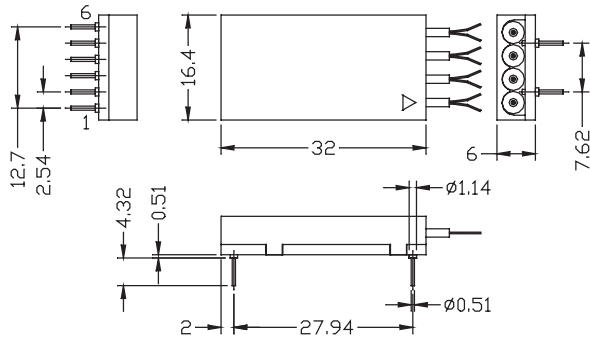
Note: Insertion loss and return loss values are without connectors.

Ordering Information



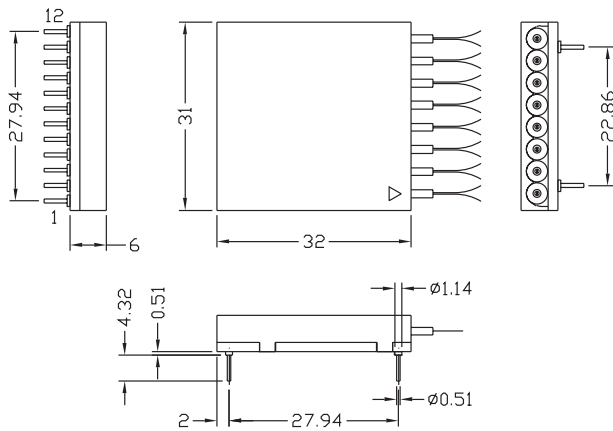
This product information is subject to change without notice.

Dimensions for 4-Channel OPMA



Unit: mm

Dimensions for 8-Channel OPMA



Unit: mm

Pin Assignments

Pin Number	Description
1	Anode com
2	Ch 1 cathode
3	Ch 2 cathode
4	Anode com
5	Ch 3 cathode
6	Ch 4 cathode
7	Mounting
8	Mounting

Pin Assignments

Pin Number	Description
1	Anode com
2	Ch 1 cathode
3	Ch 2 cathode
4	Anode com
5	Ch 3 cathode
6	Ch 4 cathode
7	Ch 5 cathode
8	Anode com
9	Ch 6 cathode
10	Ch 7 cathode
11	Anode com
12	Ch 8 cathode
13	Mounting
14	Mounting



1310 / 1550nm WDM Filter Integrated Optical Power Monitor

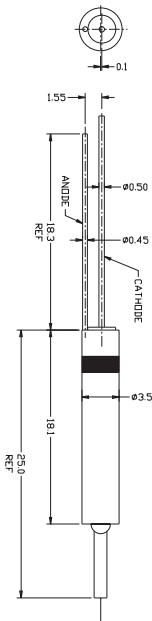
Features/Benefits

- Compact coaxial package
- Low insertion loss
- High isolation between detected signal and reflected signal
- Low polarization dependent loss
- Low wavelength dependent loss
- Excellent responsivity linearity
- High frequency response capability
- Eliminates fiber splicing
- Minimizes part number
- Improves fiber routing
- Saves board space

Applications

- Dual window WDM systems

Dimensions



Unit: mm [inch]

General Specifications

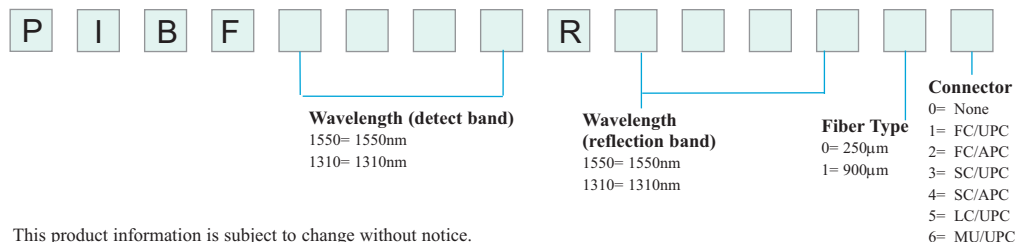
Parameters	Unit	Min.	Typ.	Max.	
Reflect Port	Operating Wavelength Range	nm	1540±30 or 1310±50		
	Insertion Loss	dB	-	-	0.6
	Polarization Dependent Loss	dB	-	0.05	0.1
	Isolation	dB	15	-	-
	Polarization Mode Dispersion	ps	-	-	0.1
	Optical Return Loss	dB	45	-	-
Detect Port	Operating Wavelength Range	nm	1540±30 or 1310±50		
	Isolation	dB	40	-	-
	Responsivity**	A/W	0.7 @ 1550-band 0.55 @ 1310-band	-	-
	Input Optical Power	dBm	-	-	15
	Polarization Dependent Responsivity	dB	-	-	0.2
	Operating Bias Voltage	V	-	- 5.0	-
	Linearity	%	-	-	± 5
	Dark Current @ 23°C, - 5V	nA	-	0.5	1.0
	High Frequency Response Limit	GHz	0.6	-	-

** The ratio of photodiode current to device input optical power.
Note: insertion loss and return loss values are without connectors.

Absolute Maximum Ratings

Parameters	Unit	Min.	Max.
Reverse Voltage	V	-	20
Forward Current	mA	-	10
Operating Temperature	°C	- 5	70
Storage Temperature	°C	- 40	85
Operating Humidity	%RH	-	95

Ordering Information



This product information is subject to change without notice.

Liquid Crystal Based Variable Optical Attenuator



Specifications

Parameters		Unit	Normal-on		Normal-off		
			Grade P	Grade A	Grade P	Grade A	
Operating Wavelength Range	-	nm	C-band , L-band or C- & L-band				
Attenuation Range	Min	dB	20 , 30 or 40		21 or 33		
Insertion Loss	Max	dB	1.0	1.2	1.1	1.3	
Polarization Dependent Loss	@10dB	Max	dB	0.15	0.2	0.25	0.3
	@20dB	Max	dB	0.25	0.4	0.35	0.5
Wavelength Dependent Loss	@10dB	Max	dB	0.4 @ C-band or L-band			
Polarization Mode Dispersion	Max	ps	0.1				
Chromatic Dispersion	Max	ps/nm	0.2				
Return Loss	Min	dB	45				
Attenuation Resolution	Min	dB/mV	Continuous				
Maximum Optical Power	Min.	mW	300				
Response Rise Time	Max	ms	5				
Response Fall Time	Max	ms	35 (-5°C ~ 23°C), 15 (23°C ~ 70°C)				
Driving Voltage (without driver)	-	V	0 ~ 30 Peak to Peak, 10 KHz Square Wave				
Driving Voltage (with driver)	-	V	0 ~ 5 DC				
Operating Temperature	-	°C	-5 ~ 70				
Storage Temperature	-	°C	-40 ~ 85				
Fiber Pigtail	-	-	SMF-28, 250µm bare fiber or 900µm loose tube, 1.0±0.1m				
Dimensions	-	mm	$\phi 7.2 \times 23.5$ without driver $36.3 \times 12.7 \times 11.5$ with driver				

Features/Benefits

- Small footprint in a coaxial package
- Continuous tuning without moving parts
- Resistant to mechanical vibration
- Wide operating wavelength range
- Low PDL, WDL
- Slow tuning slope without backlash and hysteresis
- Low cost

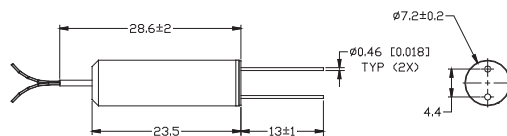
Applications

- Channel balancing in DWDM systems (pre-emphasis)
- Power equalization in optical add/drop modules and optical cross-connects
- Gain-tilt and power adjustment in EDFAs
- Receiver protection

Note 1: Insertion loss and return loss don't include connectors.

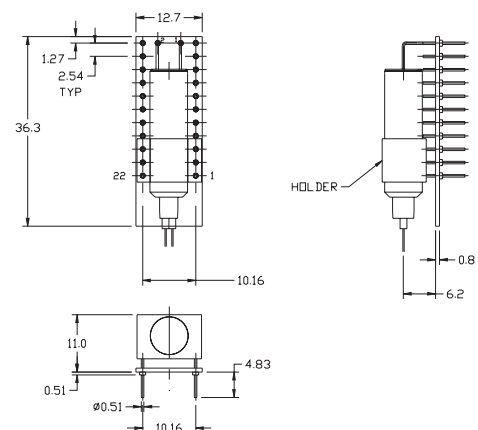
Note 2: response time includes contributions from electrically driving circuits; measured between 10 % and 90 % of maximum attenuation.

VOA Dimensions



Unit: mm (inch)

VOA + Driver Assembly Diagram



Driver Characteristics

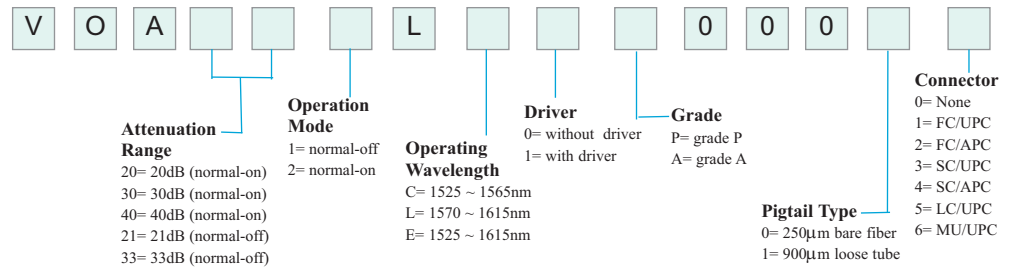
Parameter	Unit	Specification
Power Supply	V	+ 5
Power Consumption	mW	≤ 300
Driving Voltage	V	0 ~ 5
Dimension (excluding electric pin)	mm	36.3 × 12.7 × 1.3
Electric Pin Dimension	mm	φ0.51 × 4.83
Electric Pin Pitch	mm	2.54

Driver Pin Assignment

Pin	Function	Pin	Function
1	NC	12	VOA pin B (for off-board connection)*
2	GND	13	NC
3	NC	14	NC
4	NC	15	NC
5	NC	16	NC
6	NC	17	NC
7	Analog Input (0 to 5V)	18	NC
8	GND	19	NC
9	+5V Power Supply	20	NC
10	NC	21	GND
11	VOA Pin A (for off-board connection)*	22	NC

* Pin 11 and 12 can be used to test VOA. Otherwise, please let these two pins open and don't connect them to the ground.

Ordering Information



This product information is subject to change without notice.

Liquid Crystal Based 8-Channel Variable Optical Attenuator Array



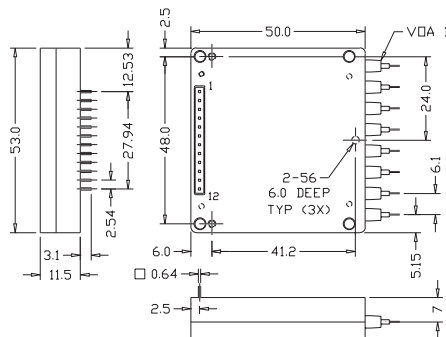
Specifications

Parameters		Unit	Normal-on		Normal-off	
			Grade P	Grade A	Grade P	Grade A
Operating Wavelength Range	-	nm	C-band , L-band or C- & L-band			
Attenuation Range	Min	dB	20, 30 or 40		21 or 33	
Insertion Loss	Max	dB	1.0	1.2	1.1	1.3
Polarization Dependent Loss	@10dB	Max	0.15	0.2	0.25	0.3
	@20dB	Max	0.25	0.4	0.35	0.5
Wavelength Dependent Loss	@10dB	Max	0.4 @ C-band or L-band			
Polarization Mode Dispersion	Max	ps	0.1			
Chromatic Dispersion	Max	ps/nm	0.2			
Return Loss	Min	dB	45			
Attenuation Resolution	Min	dB/mV	Continuous			
Maximum Optical Power	Min.	mW	300			
Response Rise Time	Max	ms	5			
Response Fall Time	Max	ms	35 (-5°C ~ 23°C), 15 (23°C ~ 70°C)			
Driving Voltage (DC)	-	V	0 ~ 5			
Power Supply (DC)	-	V	+ 5			
Power Consumption	Max	mW	200			
Operating Temperature	-	°C	-5 ~ 70			
Storage Temperature	-	°C	-40 ~ 85			
Fiber Pigtail	-	-	SMF-28, 250µm bare fiber or 900µm loose tube, 1.0 ± 0.1m			
Dimensions	-	mm	50 x 53 x 11.5			

Note 1: insertion loss and return loss don't include connectors.

Note 2: response time includes contributions from electrically driving circuits; measured between 10% and 90% of maximum attenuation.

Dimensions



Unit: mm

Ordering Information

A	V	O	A			0	8			1		0		
<p>Attenuation Range 20= 20dB (normal-on) 30= 30dB (normal-on) 40= 40dB (normal-on) 21= 21dB (normal-off) 33= 33dB (normal-off)</p> <p>Operation Mode 1= normal off 2= normal on</p> <p>Operating Wavelength C= 1525 ~ 1565nm L= 1570 ~ 1615nm E= 1525 ~ 1615nm</p> <p>Grade P= grade P A= grade A</p> <p>Pigtail Type 0= 250µm bare fiber 1= 900µm loose tube</p> <p>Connector 0= None 1= FC/UPC 2= FC/APC 3= SC/UPC 4= SC/APC 5= LC/UPC 6= MU/UPC</p>														

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Features/Benefits

- Small footprint
- Built-in driver
- Continuous tuning without moving parts
- Resistant to mechanical vibration
- Wide operating wavelength range
- Low PDL, WDL
- Slow tuning slope without backlash and hysteresis
- Low cost

Applications

- Channel balancing in DWDM systems (pre-emphasis)
- Power equalization in optical add/drop modules and optical cross-connects
- Gain-tilt and power adjustment in EDFAs
- Receiver protection

Driver Pin Assignment

Pin	Function
1	5V DC
2	Channel 1 driving
3	Channel 2 driving
4	GND
5	Channel 3 driving
6	Channel 4 driving
7	Channel 5 driving
8	GND
9	Channel 6 driving
10	Channel 7 driving
11	GND
12	Channel 8 driving

Pin dimension is 0.64 x 0.64mm and pin pitch is 2.54mm.



Ultra-Compact Low Cost Booster EDFA (Gain Block)

Features/Benefits

- Low cost
- Low power consumption
- Wide operating temperature range
- Smallest footprint
- Output power monitor

Applications

- Metropolitan and access networks
- Digital CATV
- Amplifier for long-haul network
- Single-channel or DWDM sub-systems
- Optical cross-connects
- Optical add/drop modules
- Amplifier for transmitter line card
- Power equalization and flexible pre-emphasis

Gain Block Pin Assignment

Pin	Description
1	Pump laser diode anode (+)
2	Pump laser diode cathode (-)
3	Pump laser PD anode (+)
4	GND
5	Output monitor PD anode(+)
6	Output monitor PD cathode (-)

Pump laser diode anode shares the same pin with pump laser PD cathode

Safety Information

ESD Protection

The laser diodes and photodiodes in the module can be easily destroyed by electrostatic discharge. Use wrist straps, grounded work surfaces, and anti-static techniques when operating this module. When not in use, the module shall be kept in a static-free environment.

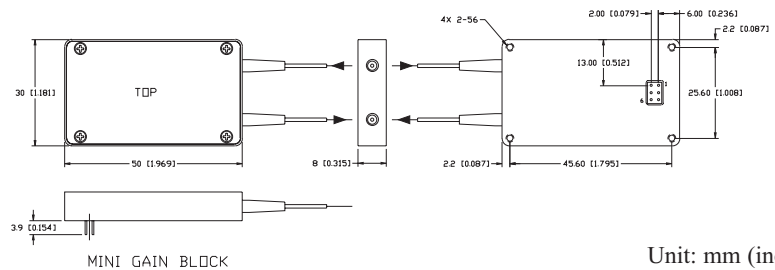
Optical Specifications

Parameters	Unit	Min.	Typ.	Max.
Operating Wavelength Range	nm	1528	-	1562
Input Optical Power (pin)	dBm	- 10	-	0
Total Output Power @ Pin= -6 ~ 0dBm	dBm	8	-	-
		10	-	-
Noise Figure	dB	-	6	7
Polarization Dependent Gain	dB	-	-	0.5
Polarization Mode Dispersion	ps	-	-	0.5
Return Loss (pump LD off)	dB	35	-	-
Operating Temperature Range	°C	-5	-	70
Fiber Type	-	SMF-28, 250µm or 900µm		
Dimensions	mm	30 x 50 x 8		

Electrical Specifications

Parameters	Unit	Min.	Typ.	Max.
Pump Laser Threshold Current	mA	-	-	150
Pump Laser Forward Current (BOL)	mA	-	210	300
Pump Laser Forward Voltage	V	-	1.66	1.95
Pump Laser Reverse Voltage	V	-	-	2.0
Output Monitor PD Responsivity	µA / mW	20	-	-
Output Monitor PD Reverse Voltage	V	-	5	20
Output Monitor PD Forward Current	mA	-	-	10
Dark Current (- 5V, 25°C)	nA	-	-	1

Dimensions



Ordering Information

T	O	A	B	G			0	0	0	0	0	1		
												Output Power @ Pin= -6dBm	Fiber Length	Connector
												08= 8dBm	1= 1.0 ± 0.1m	0= None
												10= 10dBm		1= FC/UPC
														2= FC/APC
														3= SC/UPC
														4= SC/APC
														5= LC/UPC
														6= MU/UPC

This product information is subject to change without notice.

Compact Low Cost Booster EDFA (Gain Block)



Features/Benefits

- Low cost
- Low power consumption
- Wide operating temperature range
- Small footprint
- Output power monitor

Applications

- Metropolitan and access networks
- Digital CATV
- Amplifier for long-haul network
- Single-channel or DWDM sub-systems
- Optical cross-connects
- Optical add/drop modules
- Amplifier for transmitter line card
- Power equalization and flexible pre-emphasis

Gain Block Pin Assignment

Pin	Description
1	Pump laser diode anode (+)
2	Pump laser diode cathode (-)
3	Pump laser PD anode (+)
4	GND
5	Output monitor PD anode(+)
6	Output monitor PD cathode (-)

Pump laser diode anode shares the same pin with pump laser PD cathode

Safety Information

ESD Protection

The laser diodes and photodiodes in the module can be easily destroyed by electrostatic discharge. Use wrist straps, grounded work surfaces, and anti-static techniques when operating this module. When not in use, the module shall be kept in a static-free environment.

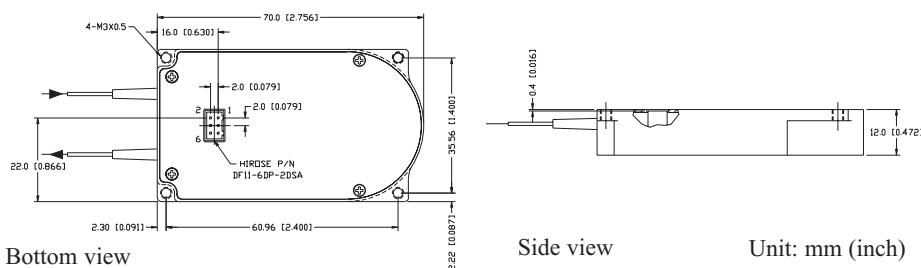
Optical Specifications

Parameters	Unit	Min.	Typ.	Max.
Operating Wavelength Range	nm	1528	-	1562
Input Optical Power (Pin)	dBm	- 10	-	0
Total Output Power @ Pin=-6~0dBm	dBm	8	-	-
		10	-	-
Noise Figure	dB	-	6	7
Polarization Dependent Gain	dB	-	-	0.5
Polarization Mode Dispersion	ps	-	-	0.5
Return Loss (Pump LD off)	dB	35	-	-
Operating Temperature Range	°C	-5	-	70
Fiber Type	-	SMF-28, 900µm loose tube		
Dimensions	mm	40 x 70 x 12		

Electrical Specifications

Parameters	Unit	Min.	Typ.	Max.
Pump Laser Threshold Current	mA	-	-	150
Pump Laser Forward Current (BOL)	mA	-	210	300
Pump Laser Forward Voltage	V	-	1.66	1.95
Pump Laser Reverse Voltage	V	-	-	2.0
Output Monitor PD Responsivity	µA/mW	20	-	-
Output Monitor PD Reverse Voltage	V	-	5	20
Output Monitor PD Forward Current	mA	-	-	10
Dark Current (- 5V, 25°C)	nA	-	-	1

Dimensions



Ordering Information

N	O	A	B	G			0	0	0	0	0	1	1	
				Output Power@Pin= -6dBm						Fiber Length			Connector	
				08= 8dBm						1=1.0±0.1m			0= None	
				10= 10dBm									1= FC/UPC	
													2= FC/APC	
													3= SC/UPC	
													4= SC/APC	
													5= LC/UPC	
													6= MU/UPC	
													1= 900µm loose tube	

This product information is subject to change without notice.



Compact Low Cost Booster EDFA (Full Function)

Features/Benefits

- Low cost
- APC, ACC mode
- Low power consumption
- Wide operating temperature range
- Standard communication interface (RS232, I²C)

Applications

- Metropolitan and access networks
- Digital CATV
- Amplifier for long-haul network
- Single-channel or DWDM sub-systems
- Optical cross-connects
- Optical add/drop modules
- Amplifier for transmitter line card
- Power equalization and flexible pre-emphasis

Full Function Pin Assignment

Pin	RS-232	I ² C
1	Serial input	Serial bi-di data
2	GND	GND
3	Serial output	Serial clock
4	Alarm status	Alarm status
5	GND	GND
6	Power supply +3.3V	Power supply +3.3V

Safety Information

ESD Protection

The laser diodes and photodiodes in the module can be easily destroyed by electrostatic discharge. Use wrist straps, grounded work surfaces, and anti-static techniques when operating this module. When not in use, the module shall be kept in a static-free environment.

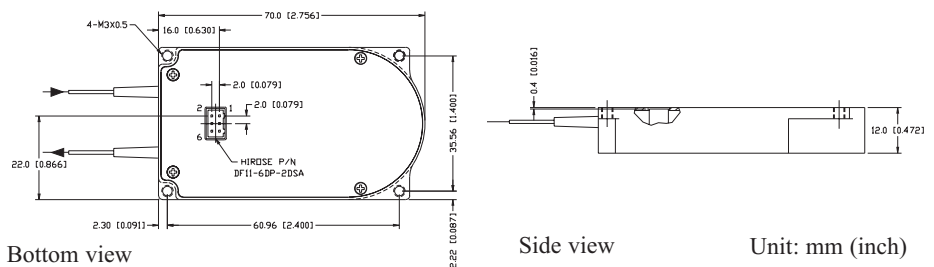
Optical Specifications

Parameters	Unit	Min.	Typ.	Max.
Operating Wavelength Range	nm	1528	-	1562
Input Optical Power (pin)	dBm	-10	-	0
Total Output Power @ Pin= -6 ~ 0dBm	dBm	8	-	-
		10	-	-
Noise Figure	dB	-	6	7
Polarization Dependent Gain	dB	-	-	0.5
Polarization Mode Dispersion	ps	-	-	0.5
Return Loss (pump LD off)	dB	35	-	-
Operating Temperature Range	°C	-5	-	70
Fiber Type	-	SMF-28, 900µm loose tube		
Dimensions	mm	40 x 70 x 12		

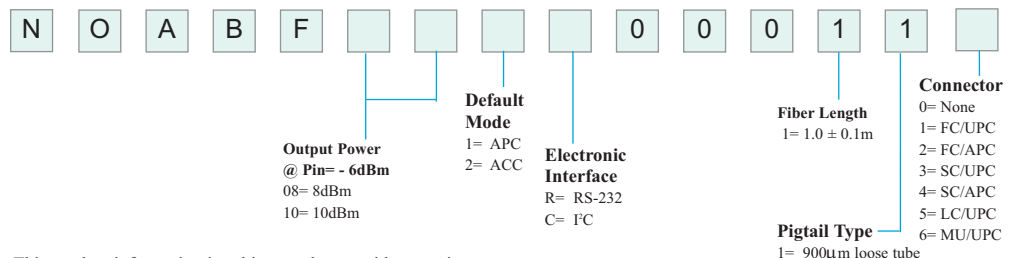
Electrical Specifications

Parameters	Unit	Min.	Typ.	Max.
Output Monitor Accuracy	dB	-0.5	-	+0.5
Power Supply Voltage	V	3.1	3.3	3.5
Power Consumption	W	-	-	1.0

Dimensions



Ordering Information



This product information is subject to change without notice.

Compact Low Cost Pre-Amplifier EDFA (Gain Block)



Features/Benefits

- Low cost
- Low power consumption
- Wide operating temperature range
- Small footprint
- Output power monitor

Applications

- Metropolitan and access networks
- Digital CATV
- Amplifier for long-haul network
- Single-channel or DWDM sub-systems
- Optical add/drop modules

Gain Block Pin Assignment

Pin	Description
1	Pump laser diode anode (+)
2	Pump laser diode cathode (-)
3	Pump laser PD anode (+)
4	GND
5	Output monitor PD anode (+)
6	Output monitor PD cathode (-)

Pump laser diode anode shares the same pin with pump laser PD cathode

Safety Information

ESD Protection

The laser diodes and photodiodes in the module can be easily destroyed by electrostatic discharge. Use wrist straps, grounded work surfaces, and anti-static techniques when operating this module. When not in use, the module shall be kept in a static-free environment.

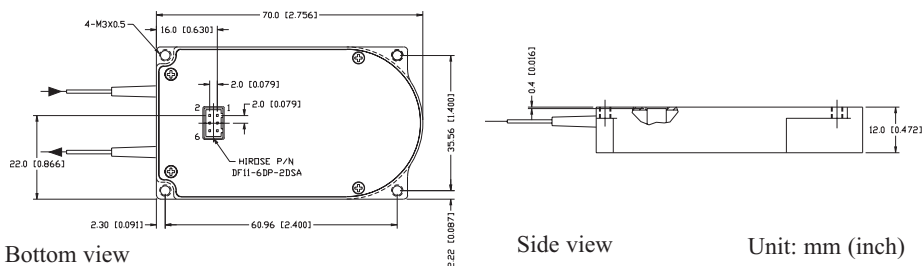
Optical Specifications

Parameters	Unit	Min.	Typ.	Max.
Operating Wavelength Range	nm	1528	-	1562
Input Optical Power (Pin)	dBm	-30	-	-10
Signal Gain @ Pin= -30dBm	dB	20 25	-	-
Noise Figure @ Pin= -30dBm	dB	-	5	6
Polarization Dependent Gain	dB	-	-	0.5
Polarization Mode Dispersion	ps	-	-	0.5
Return Loss (Pump LD off)	dB	35	-	-
Operating Temperature Range	°C	-5	-	70
Fiber Type	-	SMF-28, 900µm loose tube		
Dimensions	mm	40 x 70 x 12		

Electrical and Mechanical Specifications

Parameters	Unit	Min.	Typ.	Max.
Pump Laser Threshold Current	mA	-	-	150
Pump Laser Forward Current (BOL)	mA	-	210	300
Pump Laser Forward Voltage	V	-	1.66	1.95
Pump Laser Reverse Voltage	V	-	-	2.0
Output Monitor PD Responsivity	µA / mW	20	-	-
Output Monitor PD Reverse Voltage	V	-	5	20
Output Monitor PD Forward Current	mA	-	-	10
Dark Current (-5V, 25°C)	nA	-	-	1

Dimensions



Ordering Information

N	O	A	P	G			0	0	0	0	0	1	1	
					Signal Gain @ Pin= -30dBm							Fiber Length	Connector	
					20= 20dB							1= 1.0±0.1m	0= None	
					25= 25dB								1= FC/UPC	
											2= FC/APC			
											3= SC/UPC			
											4= SC/APC			
											5= LC/UPC			
											6= MU/UPC			
										Pigtail Type				
										1= 900µm loose tube				

This product information is subject to change without notice.



Compact Low Cost Pre-Amplifier EDFA (Full Function)

Features/Benefits

- Low cost
- APC, ACC mode
- Low power consumption
- Wide operating temperature range
- Standard communication interface (RS232, I²C)

Applications

- Metropolitan and access networks
- Digital CATV
- Amplet for long-haul network
- Single-channel or DWDM sub-systems
- Optical cross-connects
- Optical add/drop modules
- Power equalization and flexible pre-emphasis

Full Function Pin Assignment

Pin	RS-232	I ² C
1	Serial input	Serial bi-di data
2	GND	GND
3	Serial output	Serial clock
4	Alarm status	Alarm status
5	GND	GND
6	Power supply +3.3V	Power supply +3.3V

Safety Information

ESD Protection

The laser diodes and photodiodes in the module can be easily destroyed by electrostatic discharge. Use wrist straps, grounded work surfaces, and anti-static techniques when operating this module. When not in use, the module shall be kept in a static-free environment.

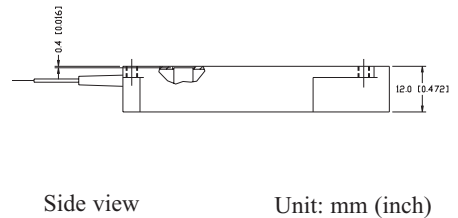
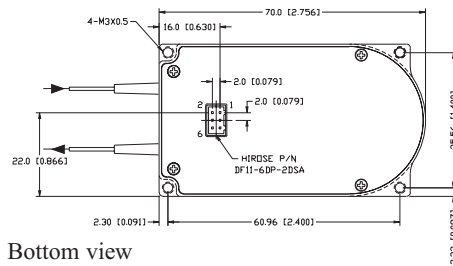
Optical Specifications

Parameters	Unit	Min.	Typ.	Max.
Operating Wavelength Range	nm	1528	-	1562
Input Optical Power (Pin)	dBm	- 30	-	- 10
Signal Gain @ Pin= -30dBm	dB	20	-	-
		25	-	-
Noise Figure @Pin= -30dBm	dB	-	5	6
Polarization Dependent Gain	dB	-	-	0.5
Polarization Mode Dispersion	ps	-	-	0.5
Return Loss (Pump LD off)	dB	35	-	-
Operating Temperature Range	°C	- 5	-	70
Fiber Type	-	SMF-28, 900µm loose tube		
Dimensions	mm	40 x 70 x 12		

Electrical Specifications

Parameters	Unit	Min.	Typ.	Max.
Output Monitor Accuracy	dB	-0.5	-	+ 0.5
Power Supply Voltage	V	3.1	3.3	3.5
Power Consumption	W	-	-	1.0

Dimensions



Unit: mm (inch)

Ordering Information

N	O	A	P	F					0	0	0	1	1	
				Signal Gain @ Pin= -30dBm 20= 20dB 25= 25dB		Default Mode 1= APC 2= ACC		Electronic Interface R= RS-232 C= FC		Fiber Length 1= 1.0±0.1m		Connector 0= None 1= FC/UPC 2= FC/APC 3= SC/UPC 4= SC/APC 5= LC/UPC 6= MU/UPC		
												Pigtail Type 1= 900µm loose tube		

This product information is subject to change without notice.

MSA Compact Low Cost Booster EDFA (Gain Block)



Optical Characteristics

Parameter	Unit	Condition	Specification		
			Min.	Typ.	Max.
Operating Wavelength Range	nm		1528	-	1562
Input Optical Power (p _{in})	dBm		- 10	-	+ 4
Total Output Power	dBm	P _{in} = -6dBm	+ 13	-	-
			+ 15	-	-
			+ 17	-	-
Noise Figure	dB	P _{in} = -6dBm, P _{out} = 13 ~ 17dBm	-	5.0	6.0
		P _{in} = +4dBm, P _{out} = 13dBm	-	7.0	8.0
		P _{in} = +4dBm, P _{out} = 15dBm	-	6.5	7.5
		P _{in} = +4dBm, P _{out} = 17dBm	-	6.0	7.0
Polarization Dependent Gain	dB		-	-	0.5
Polarization Mode Dispersion	ps		-	-	0.5
Return Loss	dB	Pump LD off	35	-	-
Operating Temperature	°C		- 5	-	70
Fiber Type	-	SMF-28, 900μm loose tube			
Dimensions	mm	70 x 90 x 12			

Specifications listed in this section are guaranteed under single channel operation over operating wavelength range and operating temperature range and without connectors.

Input and Output Monitor PD Specifications

Parameters	Unit	Min.	Typ.	Max.
Input Monitor PD Responsivity	μA / mW	30	-	75
Output Monitor PD Responsivity	μA / mW	4	-	25
Monitor PD Reverse Voltage	V	-	5	20
Monitor PD Forward Current	mA	-	-	10
Dark Current (- 5V, 25°C)	nA	-	-	1

Uncooled Pump Laser Specifications

Parameters	Unit	Output power of 13 to 15dBm			Output power of 16 to 17dBm		
		Min.	Typ.	Max.	Min.	Typ.	Max.
Pump Laser Threshold Current	mA	-	-	60	-	-	60
Pump Laser Forward Current (BOL)	mA	-	240	370	-	450	550
Pump Laser Forward Voltage	V	-	1.55	2.0	-	1.75	2.2
Pump Laser Reverse Voltage	V	-	-	2.0	-	-	2.0

TEC Cooled Pump Laser Specifications

Parameters	Unit	Output power of 13 to 15dBm			Output power of 16 to 17dBm		
		Min.	Typ.	Max.	Min.	Typ.	Max.
Pump Laser Threshold Current	mA	-	-	50	-	-	50
Pump Laser Forward Current (BOL)	mA	-	-	250	-	-	400
Pump Laser Forward Voltage	V	-	-	2.5	-	-	2.5
Pump Laser Reverse Voltage	V	-	-	2.0	-	-	2.0
TEC Current (Max. ΔT= 50°C)	A	-	1.1	1.3	-	1.1	1.3
TEC Voltage (Max. ΔT= 50°C)	V	-	2.4	2.9	-	2.4	2.9
Thermistor Resistance (25°C)	kΩ	9.5	10	10.5	9.5	10	10.5

Features/Benefits

- Package size (70 x 90 x 12mm)
- Input monitor/isolator
- Output monitor/isolator
- User-friendly 20-pin interface
- 980 nm pump laser
- Low power consumption
- Low cost

Applications

- Single-channel or narrow-band amplification
- Metropolitan and access networks
- Amplet for long haul networks
- Optical cross-connect
- Switch matrix
- Optical add/drop module
- Amplifier for transmitter line card
- Power equalization and pre-emphasis
- Digital CATV

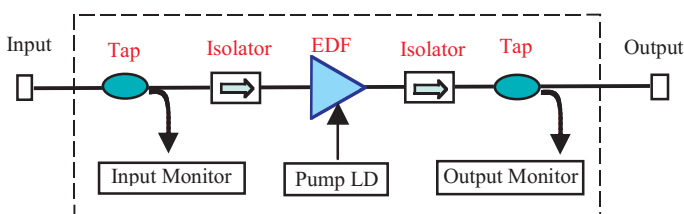
Gain Block Pin Assignment

Pin	Function	Pin	Function
1	Ground, optical power monitor PD	2	Input monitor PD cathode (-)
3	Input monitor PD anode (+)	4	Output monitor PD cathode (-)
5	Output monitor PD anode (+)	6	Thermistor
7	Pump laser diode anode (+)	8	Pump laser diode anode (+)
9	Pump backfacet monitor PD cathode (-)	10	Pump backfacet monitor PD anode (+)
11	TEC anode (+), (NC for uncooled)	12	TEC anode (+), (NC for uncooled)
13	TEC anode (+), (NC for uncooled)	14	TEC cathode (-), (NC for uncooled)
15	TEC cathode (-), (NC for uncooled)	16	TEC cathode (-), (NC for uncooled)
17	Ground, pump laser diode	18	Thermistor
19	Pump laser diode cathode (-)	20	Pump laser diode cathode (-)

Note1: Electrical connection is made via a male 20 PIN connector (2 rows of 10, pin pitch 2.0mm, 0.5x0.5mm), Samtec TMMH-110-01-G-DV-EC or equivalent.

Note2: The gain block case is isolated with the pump laser diode case.

Functional Diagram

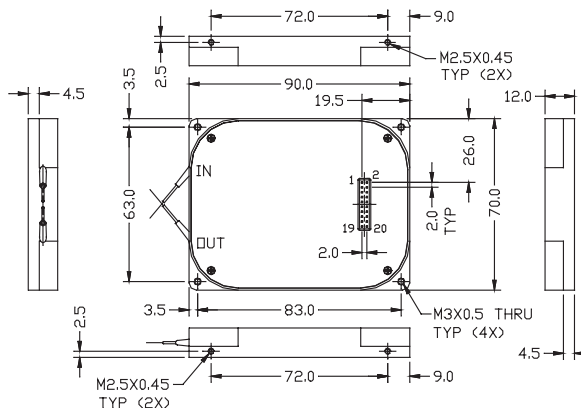


Safety Information

ESD Protection

The laser diodes and photodiodes in the module can be easily destroyed by electrostatic discharge. Use wrist straps, grounded work surfaces, and anti-static techniques when operating this module. When not in use, the module shall be kept in a static-free environment.

Dimensions



Unit: mm

Ordering Information

M	O	A	B	G			N		5	1	0		1		
				Output Power @ Pin= -6dBm 13 = 13dBm 14 = 14dBm 15 = 15dBm 16 = 16dBm 17 = 17dBm				Pump U= uncooled C= cooled		Input Tap Ratio 5= 5%		Output Tap Ratio 1= 1%		Fiber Length 1= 1.0 ± 0.1m 5= 1.5 ± 0.1m	
													Pigtail Type 1= 900µm loose tube		
													Connector 0= None 1= FC/UPC 2= FC/APC 3= SC/UPC 4= SC/APC 5= LC/UPC 6= MU/UPC		

This product information is subject to change without notice.

MSA Compatible Full Function Booster EDFA



Optical Characteristics

Parameter	Condition	Specification			
		Min.	Typ.	Max.	
Operating Wavelength Range	nm	1528	-	1562	
Input Optical Power (pin)	dBm	- 10	-	+ 4	
Total Output Power	Pin= -6dBm	+ 13	-	-	
		+ 15	-	-	
		+ 17	-	-	
Noise Figure	dB	Pin= -6dBm, Pout= 13 ~ 17dBm	-	5.0	6.0
		Pin= +4dBm, Pout= 13dBm	-	7.0	8.0
		Pin= +4dBm, Pout= 15dBm	-	6.5	7.5
		Pin= +4dBm, Pout= 17dBm	-	6.0	7.0
Polarization Dependent Gain	dB	-	-	0.5	
Polarization Mode Dispersion	ps	-	-	0.5	
Return Loss	dB	Pump LD off	35		
Operating Temperature	°C		- 5	70	
Fiber Type	-	SMF-28, 900µm loose tube			
Dimensions	mm	70 x 90 x 15			

Unless otherwise noted, specifications listed in this section are guaranteed under single channel operation over operating wavelength range and operating temperature range and without connectors.

Electrical Characteristics

Parameter	Unit	Min.	Typ.	Max.
Input Monitor Accuracy	dB	- 0.5	-	+ 0.5
Output Monitor Accuracy for APC and ACC	dB	- 0.5	-	+ 0.5
Output Monitor Accuracy for AGC	dB	- 0.65	-	+ 0.65
Power Supply Voltage	V	3.1	3.3	3.5
Power Consumption (uncooled)	W	-	1	2
Power Consumption (cooled)	W	-	3	6
Cold Start Settle Time	s	-	-	10
Warm Start Settle Time	s	-	-	0.1
Transient Settle Time *	µs	-	150	250
AGC Excursion *	dB	-	0.5	0.8
Transient Gain Steady State Error *	dB	-	0.5	0.8

Note * for AGC mode only and in the condition of 6dB Add/Drop.

Fireware Function, Monitors and Alarms

Parameter	Specification
Firmware Functions	• Field upgradable
	• Automatic Gain Control (AGC) mode
	• Automatic Output Power Control (APC) mode
	• Automatic Pump Current Control (ACC) mode
	• Reset
	• Disable
	• Mute
Monitors	• Total input optical power
	• Total output optical power
	• Pump status
	• Module temperature
Alarms	• Loss of signal alarm
	• Loss of output power alarm
	• Module temperature alarm
	• Pump temperature alarm
	• Pump bias current alarm

Features/Benefits

- Firmware field upgradable
- Multiple control modes (AGC, APC and ACC)
- Comprehensive reporting
- Digital interface with RS-232
- Low Noise Figure (NF)
- Optimized as a booster

Applications

- Single-channel or narrow-band amplification
- Metropolitan and access networks
- Amplet for long haul networks
- Optical cross-connect
- Switch matrix
- Optical add/drop module
- Amplifier for transmitter modules
- Power equalization and pre-emphasis
- Digital CATV

MSA Compact Low Cost Pre-Amplifier EDFA (Gain Block)



Optical Characteristics

Parameter	Unit	Condition	Specification		
			Min.	Typ.	Max.
Operating Wavelength Range	nm		1528	-	1562
Input Optical Power (pin)	dBm		- 30	-	- 10
Signal Gain	dB	P _{in} = -30dBm, λ= 1562nm	20	-	-
			25	-	-
Noise Figure	dB	P _{in} = -30dBm, P _{out} = -5dBm	-	-	5.5
		P _{in} = -20dBm, P _{out} = -5dBm	-	-	6.0
		P _{in} = -10dBm, P _{out} = -5dBm	-	-	7.5
Polarization Dependent Gain	dB		-	-	0.5
Polarization Mode Dispersion	ps		-	-	0.5
Return Loss	dB	Pump LD off	35	-	-
Operating Temperature	°C		- 5	-	70
Fiber Type	-	SMF-28, 900μm loose tube			
Dimensions	mm	70 x 90 x 12			

Unless otherwise noted, specifications listed in this section are guaranteed under single channel operation over operating wavelength range and operating case temperature range and without connectors.

Input and Output Monitor PD Specifications

Parameters	Unit	Min.	Typ.	Max.
Input Monitor PD Responsivity	μA / mW	30	-	75
Output Monitor PD Responsivity	μA / mW	4	-	25
Monitor PD Reverse Voltage	V	-	5	20
Monitor PD Forward Current	mA	-	-	10
Dark Current (5V, 25°C)	nA	-	-	1

Uncooled Pump Laser Specifications

Parameters	Unit	Min.	Typ.	Max.
Pump Laser Threshold Current	mA	-	-	60
Pump Laser Forward Current (BOL)	mA	-	240	370
Pump Laser Forward Voltage	V	-	1.55	2.0
Pump Laser Reverse Voltage	V	-	-	2.0

TEC Cooled Pump Laser Specifications

Parameters	Unit	Min.	Typ.	Max.
Pump Laser Threshold Current	mA	-	-	50
Pump Laser Forward Current (BOL)	mA	-	-	250
Pump Laser Forward Voltage	V	-	-	2.5
Pump Laser Reverse Voltage	V	-	-	2.0
TEC Current (max. ΔT= 50°C)	A	-	1.1	1.3
TEC Voltage (max. ΔT= 50°C)	V	-	2.4	2.9
Thermistor Resistance (25°C)	kΩ	9.5	10	10.5

Features/Benefits

- Package size (70 x 90 x 12mm)
- Input monitor/isolator
- Output monitor/isolator
- User-friendly 20-pin interface
- 980 nm pump laser
- Low power consumption
- Low cost

Applications

- Single-channel or narrow-band amplification
- Metropolitan and access networks
- Amplet for long haul networks
- Optical cross-connect
- Switch matrix
- Optical add/drop module
- Signal loss compensation in optical modules
- Digital CATV

MSA Compatible Full Function Pre-Amplifier EDFA



Optical Characteristics

Parameter		Condition	Specification		
			Min.	Typ.	Max.
Operating Wavelength Range	nm		1528	-	1562
Input Optical Power (p _{in})	dBm		- 30	-	- 10
Signal Gain	dB	P _{in} = -30dBm, λ= 1562nm	20	-	-
			25	-	-
Noise Figure	dB	P _{in} = -30dBm, P _{out} = -5dBm	-	-	5.5
		P _{in} = -20dBm, P _{out} = -5dBm	-	-	6.0
		P _{in} = -10dBm, P _{out} = -5dBm	-	-	7.5
Polarization Dependent Gain	dB		-	-	0.5
Polarization Mode Dispersion	ps		-	-	0.5
Return Loss	dB	Pump LD off	35	-	-
Operating Temperature	°C		- 5	-	70
Fiber Type	-	SMF-28, 900μm loose tube			
Dimensions	mm	70 x 90 x 15			

Unless otherwise noted, specifications listed in this section are guaranteed under single channel operation over operating wavelength range and operating case temperature range and without connectors.

Electrical Characteristics

Parameter	Uni	Min.	Typ.	Max.
Input Monitor Accuracy	dB	- 0.5	-	+ 0.5
Output Monitor Accuracy	dB	- 0.5	-	+ 0.5
Power Supply Voltage	V	3.1	3.3	3.5
Power Consumption (uncooled)	W	-	1	2
Power Consumption (cooled)	W	-	3	6
Cold Start Settle Time	s	-	-	10
Warm Start Settle Time	s	-	-	0.1

Fireware Function, Monitors and Alarms

Parameter	Specification
Firmware Functions	• Field upgradable
	• Automatic Output Power Control (APC) mode
	• Automatic Pump Current Control (ACC) mode
	• Reset
	• Disable
	• Mute
Monitors	• Total input optical power
	• Total output optical power
	• Pump status
	• Module temperature
Alarms	• Loss of signal alarm
	• Loss of output power alarm
	• Module temperature alarm
	• Pump temperature alarm
	• Pump bias current alarm

Features/Benefits

- Firmware field upgradable
- Multiple control modes (APC and ACC)
- Comprehensive reporting
- Digital interface with RS-232
- Low Noise Figure (NF)
- Optimized as a pre-amp

Applications

- Single-channel or narrow-band amplification
- Metropolitan and access networks
- Amplet for long haul networks
- Optical cross-connect
- Switch matrix
- Optical add/drop module
- Signal loss compensation in optical modules
- Digital CATV

Full Function Pin Assignment

Pin	Function	Pin	Function
1	+ 3.3V	2	+ 3.3V
3	NC	4	NC
5	GND	6	GND
7	RS-232 Rx	8	RS-232 Tx
9	GND	10	GND
11	NC	12	RESET input, (active Low)
13	Amplifier disable input, (active high)	14	Output power mute input,(active high)
15	Case temperature alarm, (active high)	16	Common alarm, (active Low)
17	Pump temperature alarm, (active high)	18	Pump bias alarm, (active high)
19	Loss of input alarm, (active high)	20	Loss of output alarm, (active high)
21	Input power monitor ground	22	Output power monitor ground
23	Input power monitor	24	Output power monitor
25	GND	26	GND
27	NC	28	NC
29	+ 3.3V	30	+ 3.3V

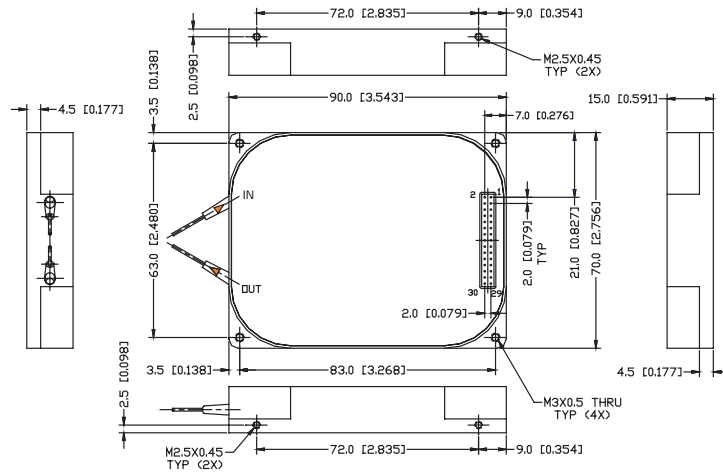
Electrical connection is made via a female 30 PIN connector (2 rows of 15, pin pitch 2.0mm, 0.5x0.5mm), Samtec SMM-115-01-S-D or equivalent.

Safety Information

ESD Protection

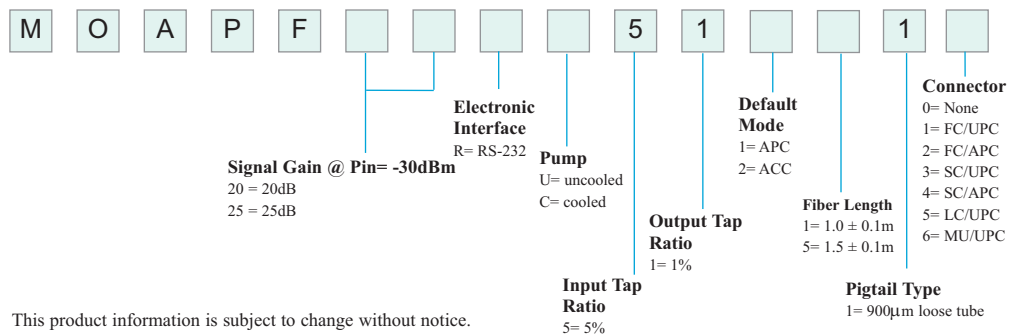
The laser diodes and photodiodes in the module can be easily destroyed by electrostatic discharge. Use wrist straps, grounded work surfaces, and anti-static techniques when operating this module. When not in use, the module shall be kept in a static-free environment.

Dimensions



Unit: mm (inch)

Ordering Information



This product information is subject to change without notice.

Compact ASE Source



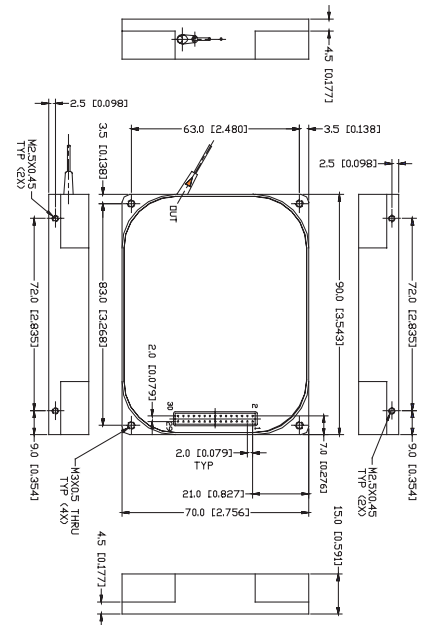
Features/Benefits

- Compact size (70 x 90 x 15mm)
- Low cost
- Standard electronic interface
- Option for flattened spectrum

Applications

- Fiber optic component testing
- Fiber sensor systems
- Fiber gyroscope

Dimensions



Unit: mm(inch)

Optical Specifications

Parameters	Unit	Min.	Typ.	Max.
Operating Wavelength Range	nm	1528	-	1562
Total Output Power	dBm	13 / 15 / 17	-	-
Output Stability ¹	dB	-	-	± 0.05 ³
Lasting Stability ²	dB	-	-	± 0.15 ³
Spectrum Flatness	dB	-	-	10
Optical Return Loss	dB	40	-	-
Power Supply	V	3.1	3.3	3.5
Power Consumption	uncooled	W	-	3
	cooled	W	-	6
Operating Temperature	°C	- 5	-	70
Storage Temperature	°C	- 40	-	85
Fiber Pigtail	-	SMF-28, 900µm buffered		
Dimensions	mm	70 x 90 x 15		

¹ After 30 minute warm-up, within 15 minutes at content temperature.

² After 30 minute warm-up, within 1 hour at content temperature.

³ High stability models are also available upon request.

Electrical PIN Assignment

Pin	Function	Pin	Function
1	+ 3.3V	2	+ 3.3V
3	NC	4	NC
5	GND	6	GND
7	RS-232 Rx	8	RS-232 Tx
9	GND	10	GND
11	NC	12	Reset input, (active low)
13	ASE disable input, (active high)	14	Output power mute input, (active high)
15	Case temperature alarm, (active high)	16	Common alarm, (active low)
17	Pump temperature alarm, (active high)	18	Pump bias alarm, (active high)
19	NC	20	Loss of output alarm, (active high)
21	NC	22	Output power monitor ground
23	NC	24	Output power monitor
25	GND	26	GND
27	NC	28	NC
29	+ 3.3V	30	+ 3.3V

Electrical connection is made via a female 30 PIN connector (2 rows of 15, pin pitch 2.0mm, 0.5x0.5mm), Samtec SMM-115-01-S-D or equivalent.

Ordering Information

E	A	S	E	N				M		0	0		1	
					Output Power		Electronic Interface		Pump		Fiber Length		Connector	
					13 = 13dBm 15 = 15dBm 17 = 17dBm		R= RS-232		U= uncooled C= cooled		1= 1.0 ± 0.1m 5= 1.5 ± 0.1m		0= None 1= FC/UPC 2= FC/APC 3= SC/UPC 4= SC/APC 5= LC/UPC 6= MU/UPC	

This product information is subject to change without notice.



High Band Isolation 1310 / 1550nm Wideband Wavelength Division Multiplexer / Demultiplexer

Features/Benefits

- Low thermal drift spectrum
- Wide passband
- High isolation at transmission and reflection
- Low insertion loss
- Epoxy-free optical path
- Totally passive

Applications

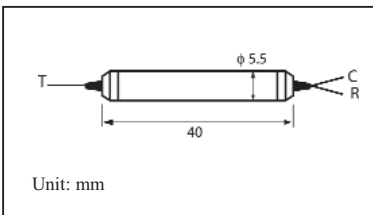
- CWDM networks
- Metro, access, enterprise and PON networks
- CATV fiber optic system

Specifications

Parameters	Unit	Performance
1550 Band Wavelength Range	nm	1464 ~ 1618
1310 Band Wavelength Range	nm	1270 ~ 1350
Insertion Loss of Passband*	dB	≤ 1.0
Insertion Loss of Reflection*	dB	≤ 1.0
Transmission Isolation**	dB	≥ 45
Reflection Isolation***	dB	≥ 45
PDL (all ports)	dB	≤ 0.1
Directivity	dB	≥ 55
Optical Return Loss (all ports)	dB	≥ 45

* w/o connector
 ** @ 1350nm
 *** @ 1464nm

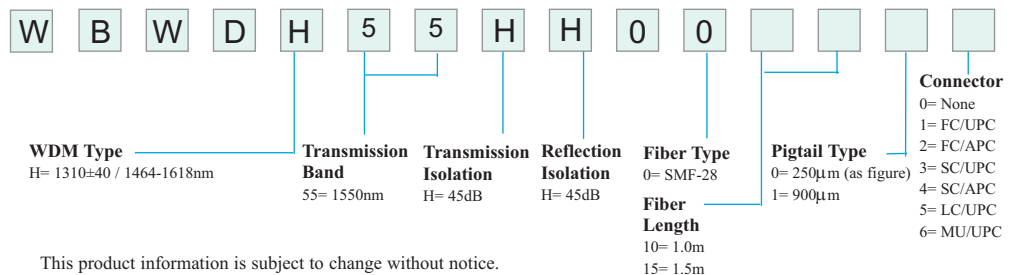
Dimensions

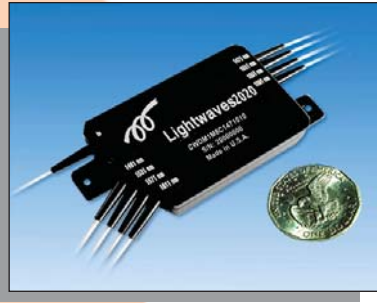


Absolute Maximum Rating

Parameters	Unit	Specification
Maximum Optical Power	dBm	25
Operation Temperature	°C	-5 ~ +70
Storage Temperature	°C	-40 ~ +85
Tensile Load	N	5

Ordering Information





Compact 8-Channel Coarse Wavelength Division Multiplexer / Demultiplexer Module

Features/Benefits

- Ultra wide passband
- Compact size
- Extreme low insertion loss and link loss
- Wide operating temperature range
- Excellent thermal stability

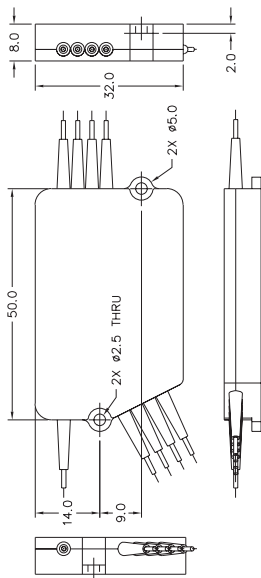
Applications

- Metro, access and enterprise networks
- CATV
- 3G wireless telephony
- PON and FTTx networks

Parameters	Unit	Mux	Demux	Mux	Demux	
Channel Number	-	-	8			
Center Wavelength	-	nm	1471, 1491, 1511, 1531, 1551, 1571, 1591, 1611			
Channel Passband	-	nm	± 6.5	± 6.5	± 7.5**	± 7.5**
Insertion Loss	Max.	dB	1.2	1.2	1.4	1.4
Passband Flatness	Max.	dB	0.3	0.3	0.3	0.3
Channel Isolation (adjacent)	Min.	dB	N/A	30	N/A	30
Channel Isolation (non-adjacent)	Min.	dB	N/A	45	N/A	45
PDL	Max.	dB	0.2		0.2	
PMD	Max.	ps	0.1		0.1	
Return Loss	Min.	dB	45		45	
Directivity	Min.	dB	50		50	
Dimension	-	mm	50 x 32 x 8			

** This product is available upon request
Note : insertion loss and return loss values are without connectors.

Dimensions

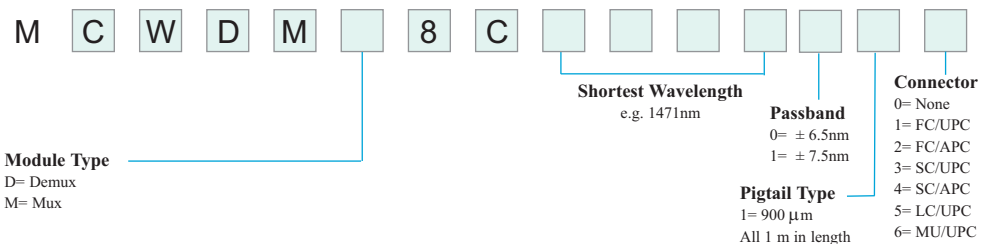


Unit: mm

Absolute Maximum Rating

Parameters	Unit	Specification
Maximum Optical Power	dBm	25
Operation Temperature	°C	-20 ~ +70
Storage Temperature	°C	-30 ~ +85
Tensile Load	N	5

Ordering Information



This product information is subject to change without notice.

Miniature 1x2 Single-Mode Optomechanical Switch



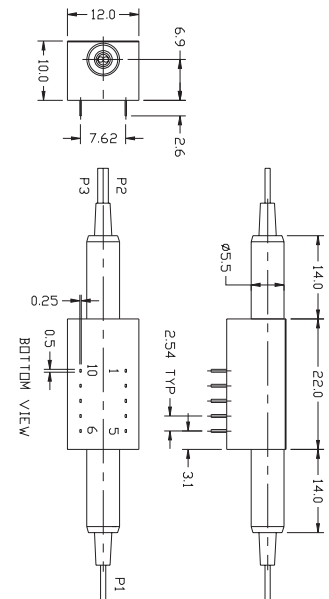
Features/Benefits

- Small size
- Low insertion loss
- Wide wavelength range
- Latch or non-latching options

Applications

- Network switching
- Network protection and restoration
- Testing instrumentation
- Configurable optical add/drop

Dimensions



Unit: mm

Optical Specifications			
Parameters	Unit	Specifications	
Wavelength Range	nm	1260~1360 or 1510~1610	1260~1360 and 1510~1610
Insertion Loss	dB	<0.5 (P grade), <0.7 (A grade)	<0.8 (P grade), <1.0 (A grade)
WDL	dB	< 0.2	< 0.3
PDL	dB	< 0.05	
Return Loss	dB	> 55	
Cross Talk	dB	> 60	
Repeatability	dB	< ±0.02	
Optical Power Handling	mW	500	
Switching Time	ms	< 3.0 (1.0 typical)	
Durability	cycles	> 10 million	
Switching Voltage	V	4.5 ~ 5.0	
Operating Temperature	° C	-5 ~ 70	
Storage Temperature	° C	-40 ~ 85	
Packaging Dimensions	mm	22 (L) x 12 (W) x 10(H)	

Note: preliminary specifications may change without notice. Insertion loss and return loss are specified without connectors

Electrical Configuration

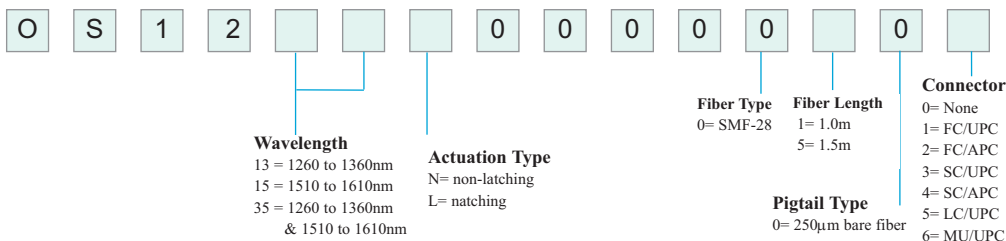
Latching Type

Optical Path	Electric Control				Status Sensor			
	Pin 1	Pin 5	Pin 6	Pin 10	Pin 2-3	Pin 3-4	Pin 7-8	Pin 8-9
P1 - P2	V+	GND	-	-	open	close	close	open
P1 - P3	-	-	GND	V+	close	open	open	close

Non-Latching Type

Optical Path	Electric Control			Status Sensor		
	Pin 1	Pin 10	Pin 2-3	Pin 3-4	Pin 7-8	Pin 8-9
P1 - P2	V+	GND	open	close	close	open
P1 - P3	-	-	close	open	open	close

Ordering Information



This product information is subject to change without notice.



Tunable Optical Filter

Features / Benefits

- 40nm wavelength tuning range
- Operating wavelength: C, L or S band
- Low insertion loss
- Low PDL
- Cost-effective
- Tuning with micrometer or stepper motor

Applications

- Tuning components for tunable laser and white light source
- Optical testing
- Sensor source
- Channel selection in WDM network

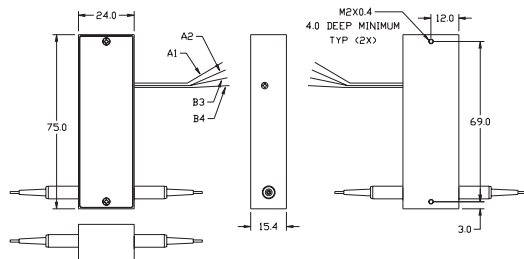
Specifications

Parameters	Unit	C-band	L-band	S-band
Nominal Wavelength	nm	1520 - 1565	1570 - 1610	1485 - 1520
Maximum Insertion Loss	dB	< 2.7		
PDL*	dB	< 0.1		
Optical Return Loss	dB	> 50		
Bandwidth*	-	<1.2nm @ 3dB down, 10nm @ 20dB down		
Tuning Resolution*	-	continuously tunable for manual type 0.01 nm for stepper motor		
Operating Temperature	°C	0 to 70		
Storage Temperature	°C	-40 to 85		
Dimension	mm	24 x 50 x 15 (manual type) 24 x 75 x 15.4 (stepper motor)		

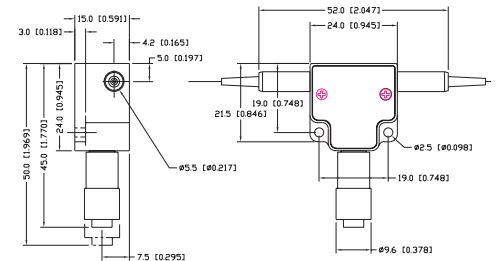
Note: All specification referenced without connectors
* Measured at the wavelength of 1550 nm

Dimensions

Stepper motor



Manual type

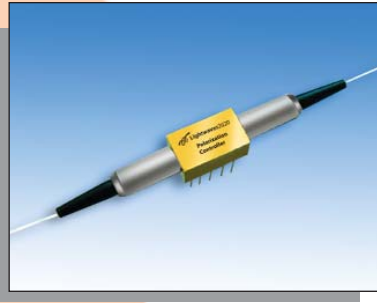


Units: mm (inch)

Ordering Information

T	O	T	F			0	1	2	0	0	0			
				Type	Wavelength		Fiber Type			Fiber Length		Connector		
				M= manual S= stepper motor	C = C-band L = L-band S = S-band		0= SMF-28			1= 1.0m 5= 1.5m		0= None 1= FC/UPC 2= FC/APC 3= SC/UPC 4= SC/APC 5= LC/UPC 6= MU/UPC		
						Pigtail Type								
						0= 250µm bare fiber 1= 900µm loose tube								

This product information is subject to change without notice.



Liquid Crystal Based Polarization Controller

Features/Benefits

- No-moving parts
- Wide operating wavelength range
- High extinction ratio
- Low insertion loss
- Low PDL
- Low PMD
- Low power consumption

Applications

- PMD compensators
- Polarization generators
- Polarization multiplexers
- Polarization scramblers
- Polarization instrumentation

Pin Layout

Pin No#	Description
1 & 10	R _{TD} (optional)
2 & 9	Cell 1 0°
3 & 8	Cell 2 45°
4 & 7	Cell 3 0°
5 & 6	Cell 4 45°

Specifications

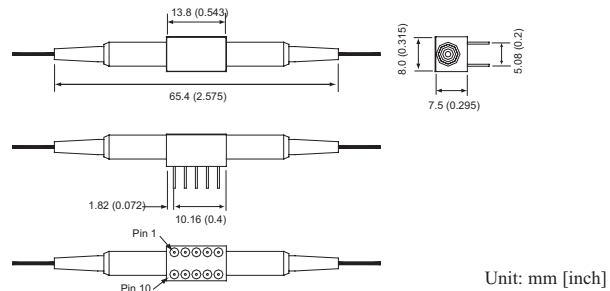
Parameters	Unit	3-Cell Option	4-Cell
Operating Wavelength Range	nm	1525 ~ 1615	
Insertion Loss (w/o connector)	dB	≤ 1.2	≤ 1.5
Wavelength Dependent Loss	dB	≤ 0.5	≤ 0.5
Extinction Ratio	dB	≥ 30	≥ 30
Response Speed @ 23°C	ms	Typ. 100	Typ.100
Polarization Mode Dispersion	ps	≤ 0.1	≤ 0.1
Optical Return Loss (w/o connector)	dB	≥ 50	≥ 50
Activation Loss **	dB	≤ 0.1	≤ 0.1
Driving Voltage (w/o driver)	V	0 ~ 20 Peak to Peak, 10 KHz Square Wave	
Driving Voltage (w/ driver)	V	0 ~ 5VDC	
Operating Temperature	°C	0 ~ 65	
Storage Temperature	°C	-40 ~ 85	
Operating Humidity	%RH	0 ~ 95	

** Defined to be the maximum variation in insertion loss as the polarization controller is adjusted to cover all polarization states.

Absolute Maximum Ratings

Parameters	Unit	Specification
Optical Input Power	dBm	≥ 23
Power Consumption	mW	1 per cell

Dimensions



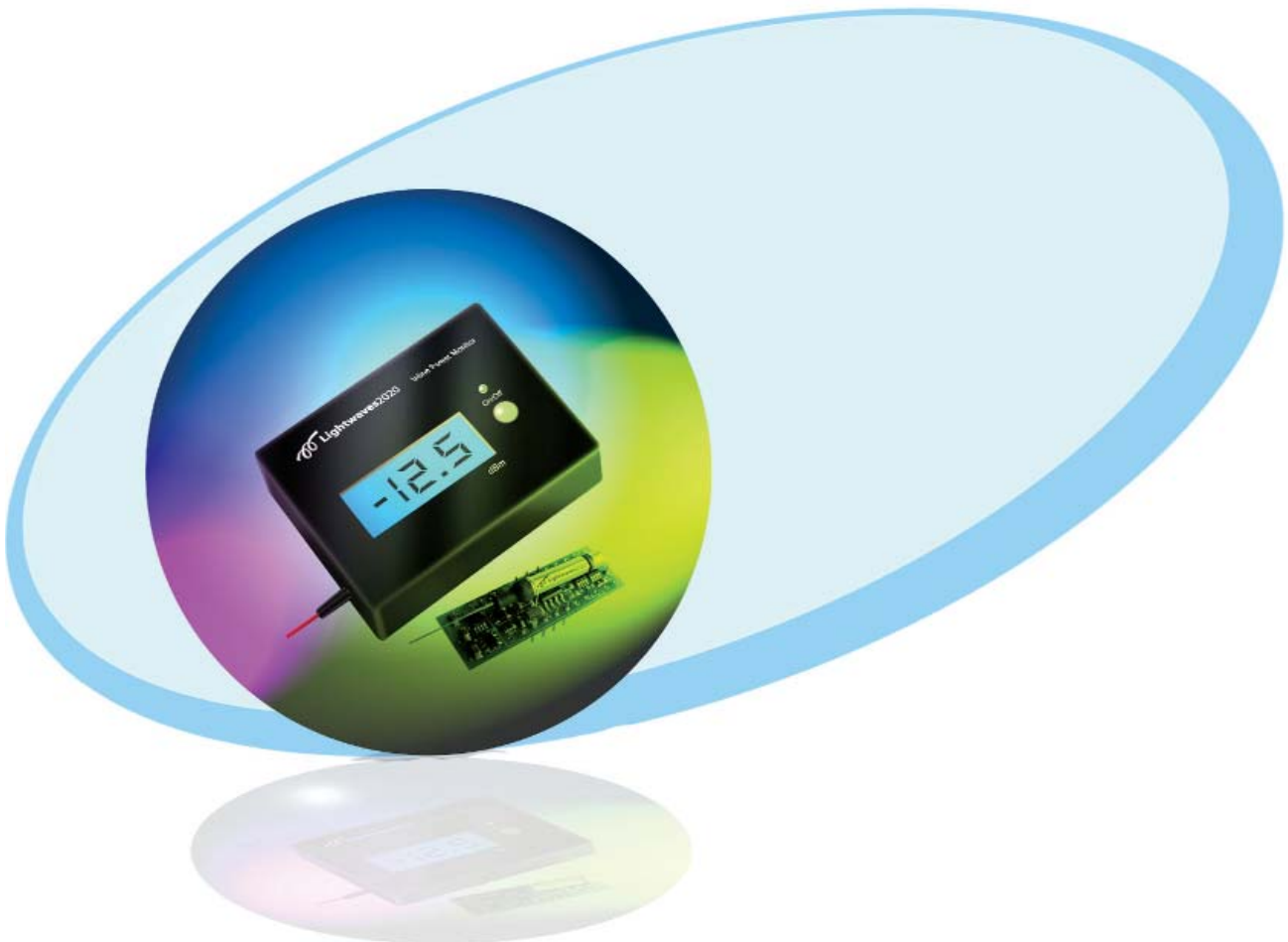
Ordering Information

P	C		0	1	2			0	0	0				0	
Platform 3= 3-cell LC 4= 4-cell LC				Thermal Sensor Option 0= w/o R _{TD} 1= w R _{TD}			Driver D= no driver I= w /driver			Pigtail Type of Input 0= 250 μm 1= 900 μm All 1 m in length		Fiber Type of Output 0= SMF-28 1= PM		Pigtail Type of Output 0= 250 μm 1= 900 μm 2= 400 μm All 1 m in length	Connector 0= None 1= FC/UPC 2= FC/APC 3= SC/UPC 4= SC/APC 5= LC/UPC 6= MU/UPC

This product information is subject to change without notice.

INLINE MONITORING

- Inline Wavelength and Power Monitor 42
- Inline Optical Power Monitor 43
- Inline Optical Power Monitor with Display 44
- Optical Channel Monitor 45





Compact Inline Optical Wavelength and Power Monitor

Features / Benefits

- Real time wavelength and power monitoring
- Precise wavelength measurement
- Wide dynamic range
- Inline and network ready
- Remote data storage/reporting
- 10/100 base Ethernet interface
- Compact and rugged design
- Integrated USB interface

Applications

- On-site services
- Network system installation
- Network segment monitoring
- CATV
- FTTx
- Manufacturing
- Maintenance

Specifications

Optical

Parameters	Unit	Specification
Wavelength Range	nm	1260 to 1610
Tap Ratio	%	3
Insertion Loss	dB	< 0.4
Wavelength Accuracy	nm	+/- 0.1**
Optical Power Range for Wavelength	dBm	-15 to +23
Power Range	dBm	-40 to +23
Optical Power Accuracy	dB	+/- 0.1**
Maximum Input Optical Power	dBm	23

** : The accuracy is at 1310nm and 1550nm, at 23°C.

Environmental & Physical

Item	Unit	Specification
Operating Temperature	°C	0 to 50
Storage Temperature	°C	-20 to 70
Relative Humidity (non-condensing)	%RH	10 to 90
Fiber Pigtail	-	SMF-28e, 250µm bare fiber or 900µm loose tube
Power Supply (DC)	V	+ 5

* Example: *Optical network line tracking and troubleshooting*

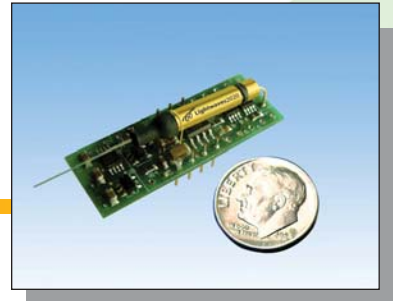
Network engineer can connect the CIOM to a network line to keep track on the changes in optical wavelength and power. The CIOM can be configured to report alarms to a remote management station, through 802.3 Ethernet or GSM / GPRS wireless interface (optional), when a user-predefined alarm threshold is exceeded.

Ordering Information

L	W	P	M	A	5	0	0	3	0	1	0				
								Tap Ratio	Fiber Type		Fiber Length		Connector		
								3= 3%	0= SMF-28e		1= 1.0m 5= 1.5m		0= None 1= FC/UPC 2= FC/APC 3= SC/UPC 4= SC/APC 5= LC/UPC 6= MU/UPC		
										Pigtail Type					
										0= 250µm bare fiber 1= 900µm loose tube					

This product information is subject to change without notice.

Miniature Inline Optical Power Monitor



Specifications

Parameter	Unit	Min.	Typ.	Max.	Notes
Operating Wavelength Range	nm	1525	-	1615	
Tap Ratio	%	1	3	5	
Insertion Loss	dB			0.4	1% tap ratio
				0.5	3% tap ratio
				0.6	5% tap ratio
Polarization Dependent Loss	dB		0.05	0.1	
Wavelength Dependent Loss	dB		0.05	0.15	
Polarization Mode Dispersion	ps			0.1	
Return Loss	dB	45		-	
Optical Input Power Range	dBm	- 45		23	
Optical Power Accuracy	dB		+/- 0.1		*
Optical Responsivity Flatness	dB			± 0.3	with respect to band center
Optical Polarization Dependent Responsivity	dB			0.1	
Frequency Response Bandwidth	MHz			10	

*: The accuracy is defined at 1550nm with input power > -30dBm, and at 23°C.

Physical & Environmental

Item	Unit	Range
Operating Temperature	°C	0 to 70
Storage Temperature	°C	-40 to 85
Relative Humidity (non-condensing)	%RH	10 to 90
Fiber Pigtail	-	SMF-28e, 250µm bare fiber or 900µm loose tube
Dimension (H x W x D)	mm	32.2 x 12.6 x 12
Power Supply	V	+ 5

Ordering Information

L	O	P	M	E	5	0	0		0	0	0				
				Wavelength E = 1525 to 1615nm					Tap Ratio 1= 1% 3= 3% 5= 5%	Fiber Type 0= SMF-28e	Fiber Length 1= 1.0m 5= 1.5m	Pigtail Type 0= 250µm bare fiber 1= 900µm loose tube	Connector 0= None 1= FC/UPC 2= FC/APC 3= SC/UPC 4= SC/APC 5= LC/UPC 6= MU/UPC		

This product information is subject to change without notice.

Features / Benefits

- Real time power monitoring
- Low insertion loss
- Wide dynamic range
- Compact design
- SMBus digital interface
- Analog monitoring voltage output
- 8-pin DIP electrical connector
- +5V supply

Applications

- Network monitoring
- Optical module
- FTTx testing
- Manufacturing
- Optical power measurement

Electrical Interface

1. Vcc (+ 5V)
2. SCL (SMBus clock signal)
3. SDO (SMBus data Signal)
4. Ground
5. Ground
6. Reset
7. Analog ground
8. Analog monitoring output (0 - 2V)



Miniature Inline Optical Power Monitor with LCD Display

Features / Benefits

- Real time power monitoring
- Low insertion loss
- Wide dynamic range
- Compact design
- RS232 interface
- Digital LCD display
- Analog monitoring voltage output
- Battery / +5V DC power supply

Applications

- Network monitoring
- Optical module
- FTTx testing
- Manufacturing
- Optical power measurement

Specifications

Parameter	Unit	Min.	Typ.	Max.	Notes
Operating Wavelength Range	nm	1525	-	1615	
Tap Ratio	%	1	3	5	
Insertion Loss	dB			0.4	1% tap ratio
				0.5	3% tap ratio
				0.6	5% tap ratio
Polarization Dependent Loss	dB		0.05	0.1	
Wavelength Dependent Loss	dB		0.05	0.15	
Polarization Mode Dispersion	ps			0.1	
Return Loss	dB	45		-	
Optical Input Power Range	dBm	- 45		23	
Optical Power Accuracy	dB		+/- 0.1		*
Optical Responsivity Flatness	dB			± 0.3	with respect to band center
Optical Polarization Dependent Responsivity	dB			0.1	
Frequency Response Bandwidth	MHz			10	

*: The accuracy is defined at 1550nm with input power > -30dBm, and at 23°C.

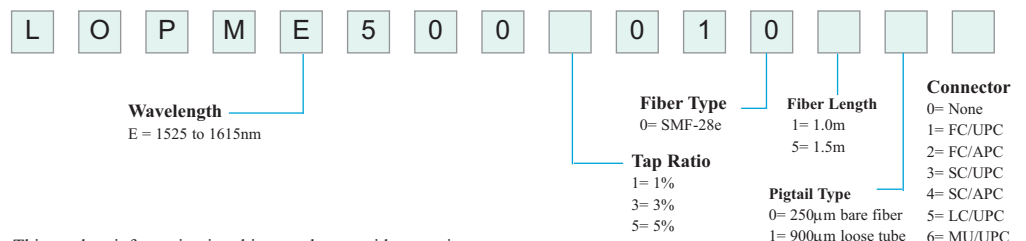
Electrical Interface

1. Vcc (+5V)
2. TX
3. RX
4. Ground
5. Ground
6. Reset
7. Analog ground
8. Analog monitoring output (0-2V)

Physical & Environmental

Item	Unit	Range
Operating Temperature	°C	0 to 50
Storage Temperature	°C	-40 to 85
Relative Humidity (non-condensing)	%RH	10 to 90
Fiber Pigtail	-	SMF-28e, 250µm bare fiber or 900µm loose tube
Dimension (H x W x D)	mm	80 x 50 x 20
Power Supply	-	Battery and +5V DC external

Ordering Information



This product information is subject to change without notice.

Optical Channel Monitor



Specifications

Parameters	Unit	Specification
Absolute Power Accuracy	dB	+/- 0.75
Relative Power Accuracy	dB	+/- 0.5
Absolute Wavelength Accuracy	pm	+/- 75
Power Repeatability	dB	+/- 0.1
Polarization Dependent Loss	dB	0.3
Optical Return Loss	dB	45
Response Time (per channel)	ms	100 (without OSNR), 500 (OSNR)
Interface	-	RS232
Power Consumption	W	< 5
OSNR	dB	20
OSNR Accuracy	dB	+/- 1.5
Input Wavelength Tolerance	nm	ITU +/- 0.1
Input Power Range	dBm	-40 to -10
Max. Adjacent Channel Power Imbalance	dB	15
Max. Non-Adjacent Channel Power Imbalance	dB	20
Mechanical Dimension	mm	125 x 70 x 16

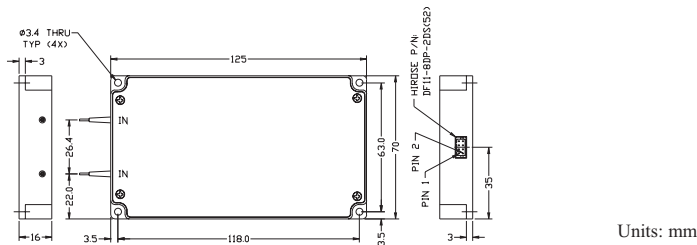
Features / Benefits

- 50GHz or 100GHz ITU grids, C-band, L-band or C+L bands
- High adjacent channel isolation
- Excellent temperature stability
- Single port or multiple (2 to 4) port monitoring
- High accuracy in power and wavelength measurements
- Large dynamic range in power monitoring

Applications

- Real-time optical performance or channel monitoring of DWDM networks
- Optical add/drop monitoring and diagnostics
- Optical power or OSNR monitoring for gain equalization in DWDM networks
- Real-time system error warning and alarming
- EDFA gain balancing

Dimensions



Ordering Information

L	O	C	M		5			0	0	0	0			
Wavelength		Port Number			OSNR			Fiber Type		Fiber Length		Connector		
C = C-band L = L-band		1 = one port 2 = two port			R = with OSNR N = w/o OSNR			0 = SMF-28e		1 = 1.0m 5 = 1.5m		0 = None 1 = FC/UPC 2 = FC/APC 3 = SC/UPC 4 = SC/APC 5 = LC/UPC 6 = MU/UPC		
								Pigtail Type						
								0 = 250µm bare fiber 1 = 900µm loose tube						

This product information is subject to change without notice.

Liquid Crystal – a novel approach to control light-waves

Lightwaves2020's liquid crystal based Variable Optical Attenuator (LC-VOA) is based on our proprietary liquid crystal (LC) technology and Laser welding package technology, which features AC voltage controlled, no-moving parts and low power consumption.

With laser welding process, the LC cell and optics are sealed in a compact coaxial package of $\phi 7.2\text{mm}$ in diameter, which makes this small footprint ideal for integration onto circuit board.

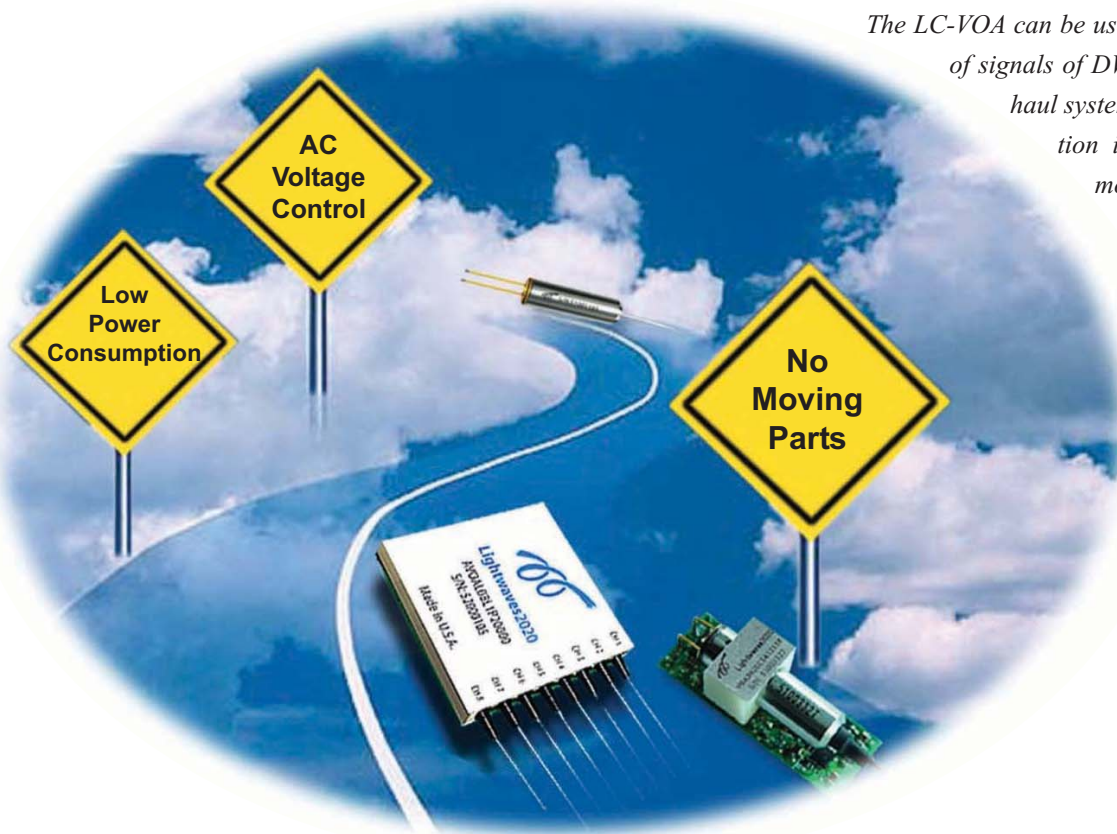
The LC cell, acting as a variable phase retarder, changes the phase of incoming optical wave while AC voltage is applied on the cell. This phase shift results in variation of optical coupling efficiency, which eventually causes optical attenuation. By the principle, the attenuation is just the result of optical phase shift other than movement of any mechanical parts.

The LC-VOA can sustain office vibration and mechanical shock.

The LC-VOA is driven by either a 0 ~ 30V peak to peak 10 KHz square wave or a 0 ~ 5V DC signal when using a Lightwaves2020's driver.

In addition, it offers the benefits of continuous attenuation control without backlash, high attenuation of more than 30 dB, low driving voltage, excellent PDL, low insertion loss, precision attenuation control without backlash, wide operating wavelength range covering S-, C- or L- band.

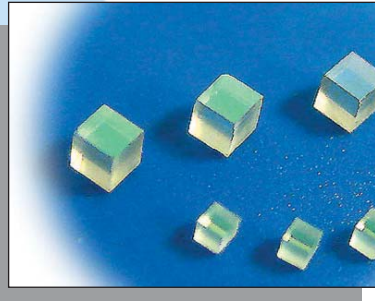
The LC-VOA can be used for pre-emphasis of signals of DWDM lasers in long haul systems, power equalization in optical add/drop modules and optical cross-connects, as well as gain-tilt adjustment in erbium-doped fiber amplifiers. The VOA is designed and built to meet Telcordia standard.



OPTICAL COATING

- Telecom Filters..... 48
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- Fluorescence Filters..... 51
- Laser Line Filters..... 52
- Custom Coating Services..... 53





Telecom Filters

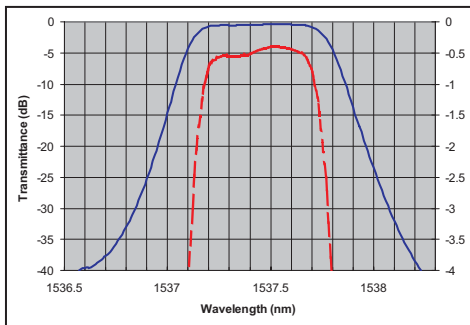
Features / Benefits

- Low insertion loss
- Small ripples
- High transmission isolation
- High reflection isolation
- Low polarization dependent loss (PDL)
- Low temperature dependent wavelength shift
- Telcordia compliant
- Dielectric hard coating and excellent environmental stability and reliability

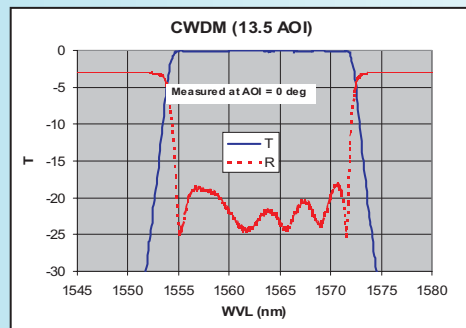
Product Family	Filter Types
DWDM	<ul style="list-style-type: none"> • 50 GHz DWDM • 100 GHz DWDM • Low CD 100 GHz DWDM • 200 GHz DWDM • 100 GHz 4 skip0 • Other customized DWDM filters
CWDM	<ul style="list-style-type: none"> • Standard CWDM (AOI = 1.8 deg) • CWDM with extended blocking (1250 – 1650nm) • 13.5 deg AOI CWDM • 13.5 deg AOI CWDM with extended blocking (1250 – 1650nm) • CWDM 4 skip0 • CWDM 8 skip0 • Other customized CWDM filters
GFF	<ul style="list-style-type: none"> • Any customized gain flattening filters
Edge Filters	<ul style="list-style-type: none"> • Long pass filters • Short pass filters
Grin Lens and Fiber Tip Coating	<ul style="list-style-type: none"> • Tap filters on grin lens • Filters on fiber tip

Sample Spectra

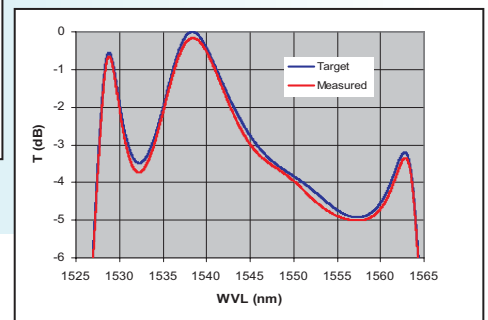
1) 100 GHz DWDM filters



2) 13.5 degree AOI CWDM filters



3) GFFs



Raman Filters

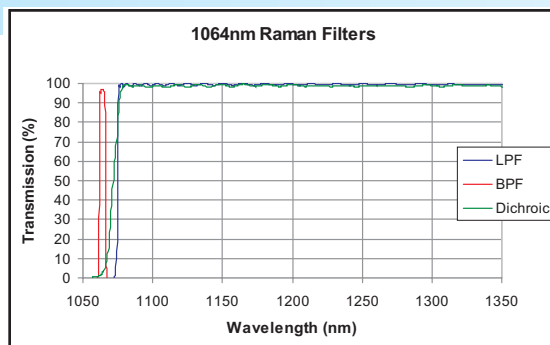
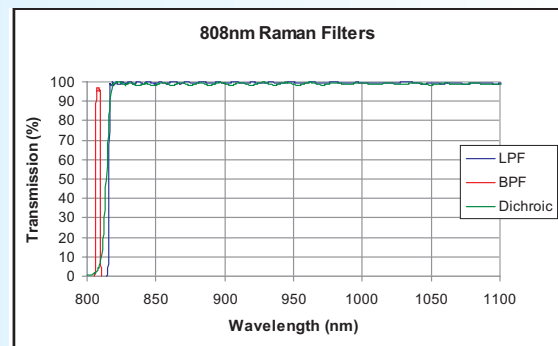
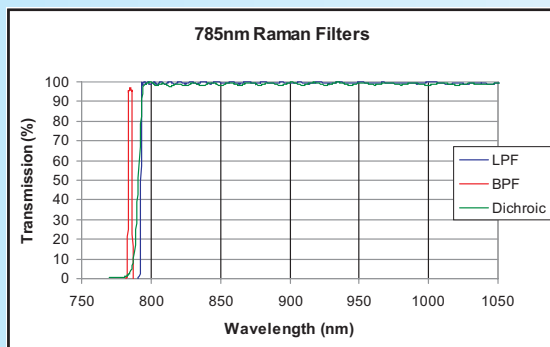
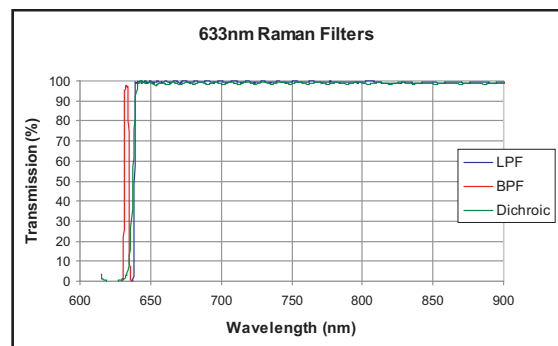
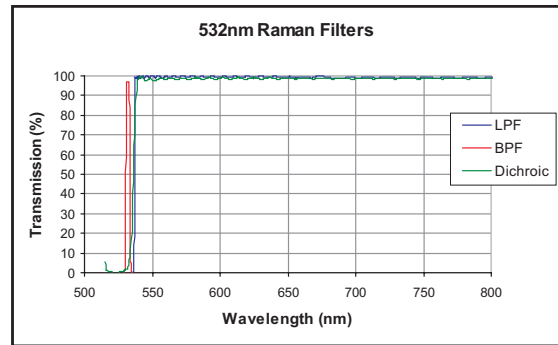


Laser Line WVL (nm)	BPF (AOI = 0deg)			
	FWHM nm	Slope (50%T to 6 OD) nm	Peak Transmittance	PN (Ø25mm)
325.0	2.0	< 7	> 80%	RB01-325-25
355.0	2.0	< 7	> 80%	RB01-355-25
363.8	2.0	< 7	> 80%	RB01-363-25
405.4	2.5	< 7.5	> 90%	RB01-405-25
425.4	2.5	< 7.5	> 90%	RB01-425-25
441.6	2.5	< 7.5	> 90%	RB01-441-25
457.9	2.5	< 7.5	> 90%	RB01-457-25
473.0	2.5	< 7.5	> 90%	RB01-473-25
488.0	2.5	< 7.5	> 90%	RB01-488-25
491.0	2.5	< 7.5	> 90%	RB01-491-25
514.5	2.5	< 8.0	> 90%	RB01-514-25
532.0	3.0	< 8.0	> 90%	RB01-532-25
568.2	3.0	< 8.0	> 90%	RB01-568-25
632.8	3.0	< 8.5	> 90%	RB01-632-25
647.1	3.0	< 8.5	> 90%	RB01-647-25
658.0	3.0	< 8.5	> 90%	RB01-658-25
664.0	3.0	< 8.5	> 90%	RB01-664-25
780.0	3.5	< 9.0	> 90%	RB01-780-25
785.0	3.5	< 9.0	> 90%	RB01-785-25
808.0	3.5	< 10	> 90%	RB01-808-25
830.0	3.5	< 10	> 90%	RB01-830-25
980.0	4.0	< 12	> 90%	RB01-980-25

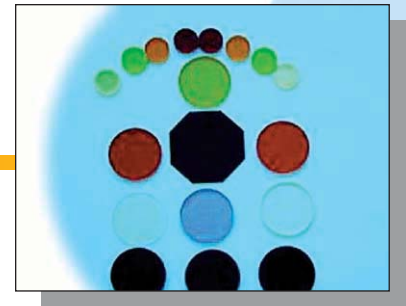
- Using high purity optical substrates with low Raman effect (data available upon request)
- High OD laser-line blocking for maximum laser rejection (> 6 OD)
- Steep slopes to enable measuring the small Raman shifts (5 OD slope: BPF: < 4nm; LPF < 10nm; 45 deg dichroic: < 10nm)
- High transmittance in the pass band (> 90%)
- Typical 6 OD Blocking Range: $0.85\lambda_0 \sim 1.15\lambda_0$
- High laser damage threshold (> 20J/cm² @ 532nm)
- Superior environmental reliability

Laser Line WVL (nm)	LPF (AOI = 0deg)			PN (Ø25mm)
	Blocking @ Laser Line OD	Pass Band Range nm		
			T%	
325.0	> 6	329.2 - 450	> 90%	RL01-325-25
355.0	> 6	359.6 - 850	> 90%	RL01-355-25
363.8	> 6	368.5 - 850	> 90%	RL01-363-25
405.4	> 6	410.5 - 850	> 90%	RL01-405-25
425.4	> 6	430.8 - 850	> 90%	RL01-425-25
441.6	> 6	447.3 - 1000	> 90%	RL01-441-25
457.9	> 6	463.9 - 1000	> 90%	RL01-457-25
473.0	> 6	479.1 - 1000	> 90%	RL01-473-25
488.0	> 6	494.3 - 1100	> 90%	RL01-488-25
491.0	> 6	497.5 - 1100	> 90%	RL01-491-25
514.5	> 6	521.2 - 1200	> 90%	RL01-514-25
532.0	> 6	538.9 - 1200	> 90%	RL01-532-25
568.2	> 6	575.6 - 1200	> 90%	RL01-568-25
632.8	> 6	641.0 - 1200	> 90%	RL01-632-25
647.1	> 6	655.5 - 1200	> 90%	RL01-647-25
658.0	> 6	666.5 - 1200	> 90%	RL01-658-25
664.0	> 6	672.6 - 1200	> 90%	RL01-664-25
780.0	> 6	790.1 - 1200	> 90%	RL01-780-25
785.0	> 6	795.2 - 1200	> 90%	RL01-785-25
808.0	> 6	818.5 - 1200	> 90%	RL01-808-25
830.0	> 6	840.8 - 1200	> 90%	RL01-830-25
980.0	> 6	992.7 - 1200	> 90%	RL01-980-25
1064.0	> 6	1077.8 - 1700	> 90%	RL01-1064-25

Laser Line WVL	Dichroic (AOI = 45deg)			PN (Ø25mm)
	Reflection @Laser Line	Pass Band		
(nm)	R%	Range	T%	
325.0	> 95%	329.2 - 450	> 90%	RD01-325-25
355.0	> 95%	359.6 - 850	> 90%	RD01-355-25
363.8	> 95%	368.5 - 850	> 90%	RD01-363-25
405.4	> 95%	410.5 - 850	> 90%	RD01-405-25
425.4	> 95%	430.8 - 850	> 90%	RD01-425-25
441.6	> 95%	447.3 - 1000	> 90%	RD01-441-25
457.9	> 95%	463.9 - 1000	> 90%	RD01-457-25
473.0	> 95%	479.1 -1000	> 90%	RD01-473-25
488.0	> 95%	494.3 - 1100	> 90%	RD01-488-25
491.0	> 95%	497.5 - 1100	> 90%	RD01-491-25
514.5	> 95%	521.2 - 1200	> 90%	RD01-514-25
532.0	> 95%	538.9 - 1200	> 90%	RD01-532-25
568.2	> 95%	575.6 - 1200	> 90%	RD01-568-25
632.8	> 95%	641.0 - 1200	> 90%	RD01-632-25
647.1	> 95%	655.5 - 1200	> 90%	RD01-647-25
658.0	> 95%	666.5 - 1200	> 90%	RD01-658-25
664.0	> 95%	672.6 - 1200	> 90%	RD01-664-25
780.0	> 95%	790.1 - 1200	> 90%	RD01-780-25
785.0	> 95%	795.2 - 1200	> 90%	RD01-785-25
808.0	> 95%	818.5 - 1200	> 90%	RD01-808-25
830.0	> 95%	840.8 - 1200	> 90%	RD01-830-25
980.0	> 95%	992.7 - 1200	> 90%	RD01-980-25
1064.0	> 95%	1077.8 - 1700	> 90%	RD01-1064-25



Fluorescence Filters



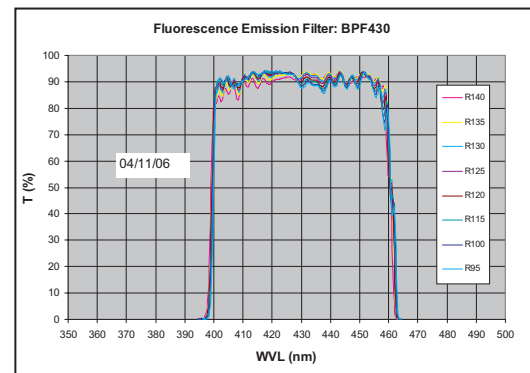
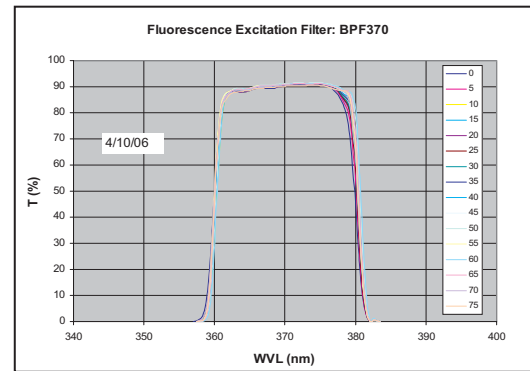
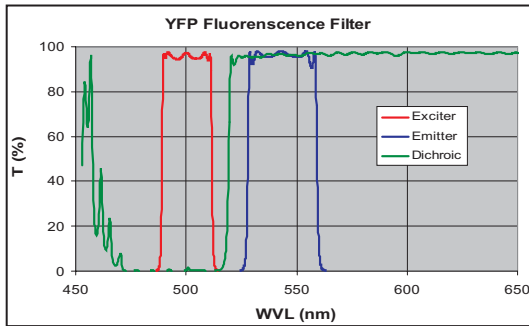
Typical Fluorescence Filter Sets

Fluorophore (nm)	Exciter		Emitter		Dichroic
	CWL (nm)	BW (nm)	CWL (nm)	BW (nm)	Reflection
CFP	438	20	483	30	426 - 450
CY3	531	30	593	75	499 - 555
CY5	628	60	692	70	594 - 651
DAPI	377	50	447	50	344 - 404
FITC	482	30	536	40	446 - 500
GFP	472	40	520	50	442 - 488
Texas Red	562	40	624	60	530 - 585
TRITC	543	50	593	55	499 - 555
YFP	500	20	542	30	488 - 513

Features:

- High transmission: > 90%
- High reflection (dichroic beam splitter): > 98%
- Steep slope
- Hard dielectric coating with superior environmental reliability and durability

Sample Spectrum



Excellent Uniformity

As shown at the right, we are able to make those fluorescence filters with very good uniformity. For instance, the center wavelength variation over a 3" x 3" wafer is less than 0.5 nm.

This will result in much better image, especially in a system with large NA and a large beam size.

High Transmission

Our fluorescence filters have high transmission, with transmittance higher than 85% in UV, and larger than 90% in visible.

(See spectra at the right, measured at wafer level before AR is applied on the back).



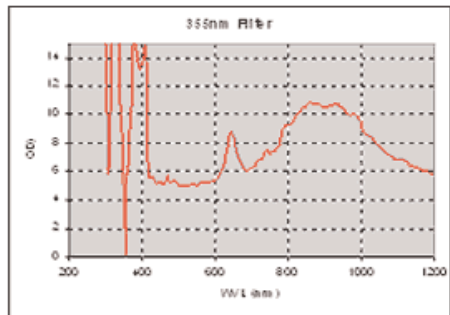
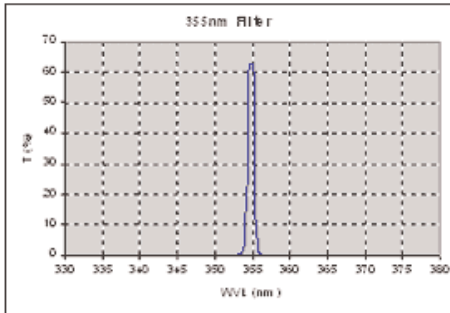
Laser Line Filters

Features / Benefits

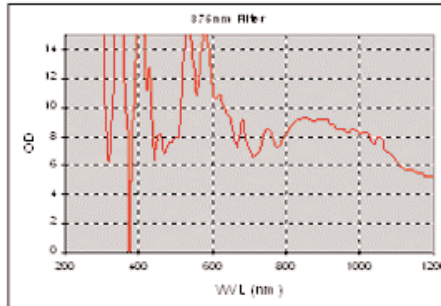
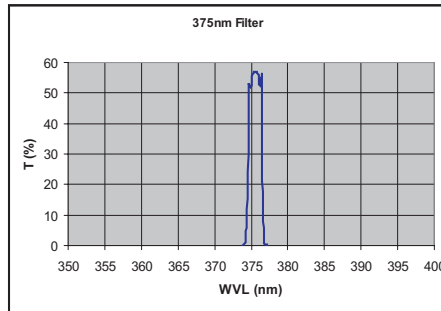
- High transmission: > 90%
- Steep slope (roll-off to 5 OD): < 1% of laser wavelength
- Wide blocking range (customer application specific)
- Negligible temperature dependence of laser wavelength
- Hard dielectric coating with superior environmental reliability and durability (for telecom application, meeting Telecordia standards)

Sample Spectrum

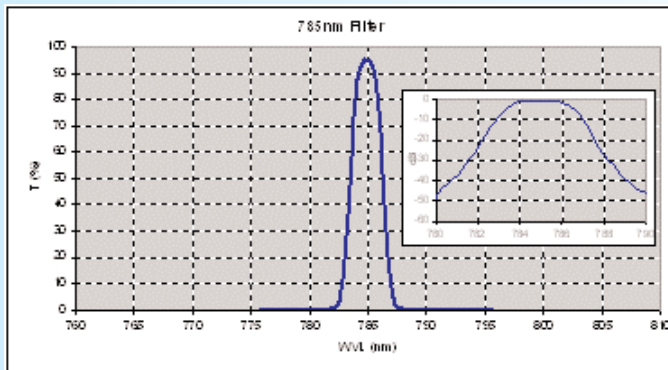
355 nm filter with 5 OD blocking from 200 - 1200nm



375 nm filter with 5 OD blocking from 200 - 1200nm



785 nm Filter



Wavelength	Tpeak (%)*	FWHM (nm)
325.0	> 80	2.0
355.0	> 80	2.0
375.0	> 85	2.0
387.0	> 90	2.0
473.0	> 90	2.5
488.0	> 90	2.5
491.0	> 90	2.5
532.0	> 90	3.0
561.0	> 90	3.0
632.8	> 90	3.0
647.1	> 90	3.0
670.0	> 90	3.0
780.0	> 90	3.0
785.0	> 90	3.0
808.0	> 90	3.0
830.0	> 90	3.0
976.0	> 90	3.5
980.0	> 90	3.5
1047.1	> 80	2.0
1064.0	> 90	4.0

* Note: Typical values. For very wide range blocking, contact Lightwaves2020 for detailed specs.

Custom Coating Service



Lightwaves2020's optical coating division develops optical thin film filters and related optical components for various high end applications, from medical imaging, spectroscopic instrumentation, raman lasers, high power lasers, optical sensing, aerospace, and military & defense as well as telecommunications.

Equipped with state-of-the-art optical coating systems and its industry-leading and proprietary optical thin film technology, Lightwaves2020 manufactures and supplies cutting-edge optical thin film products for demanding applications in wavelength range from 200nm to 2500nm. Lightwaves2020 always works closely with its customers in the design-in for new product development.

In conjunction with Lightwaves2020's other technologies in liquid crystal, fiber optics, test and measurement, system integration, and automation, we are able to provide a complete and cost effective optical solution for various applications.

Applications

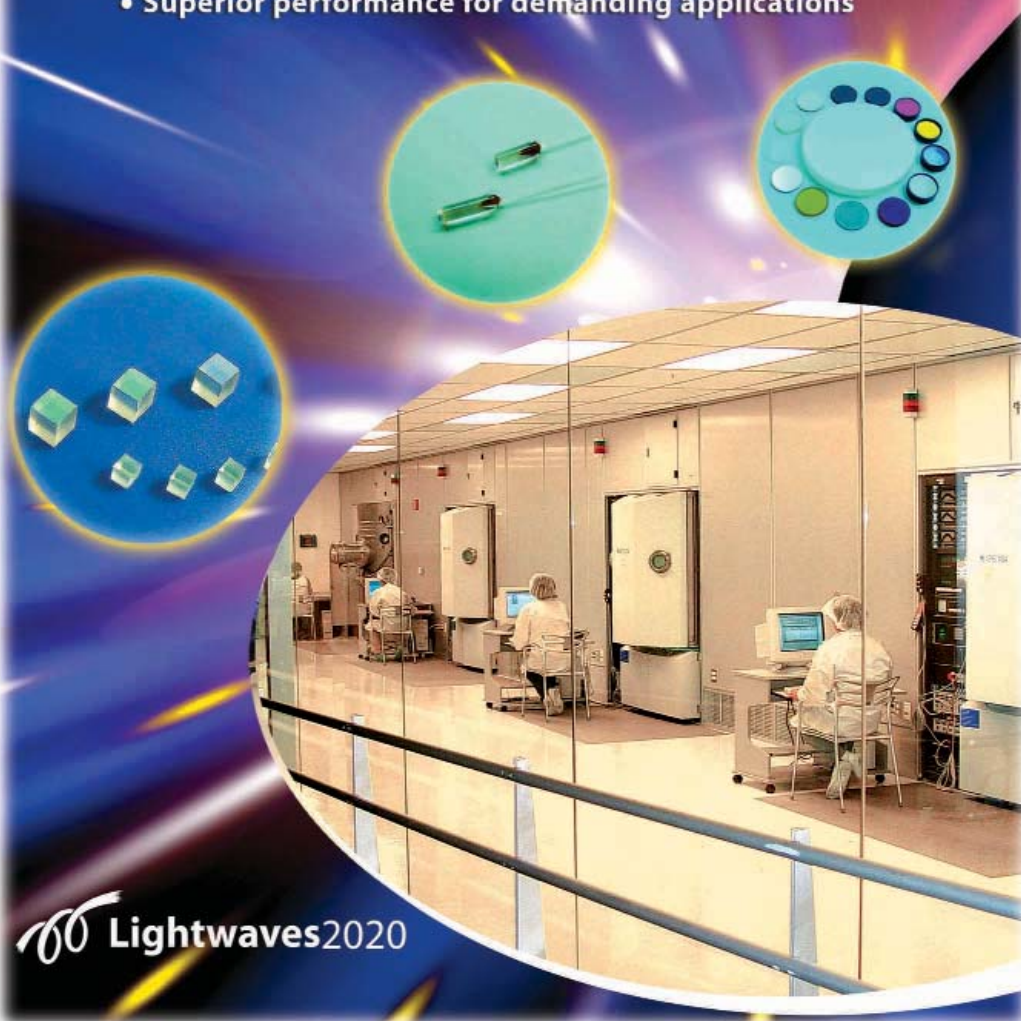
- Aerospace
- Biomedical optics
- Displays
- Fiber optics (telecommunications)
- High power lasers
- Military and defense
- Optical sensing
- Optical spectroscopic instrumentations
- Raman lasers
- Scientific instrumentations
- UV optics


Products

- Band Pass Filters
- Beam Splitters
- Biomedical Spectroscopy Imaging Filters
- CWDM Filters
- Dichroic Filters
- DWDM Filters
- Edge Filters
- Fluorescence Filters
- Gain Flattening Filters
- Laser Line Filters
- Near IR Spectroscopy Band Pass Filters
- Other Telecom Filters
- Raman Filters
- UV Filters

Optical Filters for The Future

- Cutting-edge designs and manufacturing
- Superior performance for demanding applications



 Lightwaves2020

INSTRUMENTATION

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Handheld Network Link Tester

Features / Benefits

- Handheld, lightweight design
- High power capability
- Highly accurate, low wavelength sensitivity
- Cost-effective, efficient, portable, and reliable
- Built-in standard USB 2.0 interface
- Sleek, stylish design via rugged, durable housing
- Brilliant 3.5" color TFT display
- Bluetooth™ ready
- One CF type II card expansion slot
- One SD / MMC card expansion slot
- Built-in data storage management
- Touch screen and user friendly GUI

Applications

- Manufacturing
- Maintenance
- Administration (local or on-site)
- R&D / laboratory
- Quality assurance

Specifications

Parameters	Variable	Input	Output
	Optical Attenuator	Power Meter	Power Controller
Wavelength Range	1520 to 1610nm	1520 to 1610nm	1520 to 1610nm
Calibration Wavelengths	1550 nm	1550 nm	1550 nm
Attenuation Range	3.0 to 60dB	-	-
Input Power Range	-	+23 to -50dBm	-
Output Power Range ²	-	-	+20 to -50 dBm
Insertion Loss ¹	2.5 dB typical	2.5 dB typical	2.5 dB typical
	3.0 dB maximum	3.0 dB maximum	3.0 dB maximum
Repeatability	± 0.02dB typical	± 0.02dB typical	± 0.02 dB typical
	± 0.05dB maximum	± 0.05dB maximum	± 0.05dB maximum
Linearity	± 0.15dB	± 0.15dB	± 0.15dB
Resolution	0.05dB	0.05dB	0.05dB
Thermal Stability	± 0.5dB	± 0.5dB	± 0.5dB
Measurement Accuracy ¹	± 0.5dB	± 0.3dB	± 0.3dB
Response Time	< 2s	-	< 2s

General Performances

Operating Temperature	0 to 40°C
Storage Temperature	-20 to 60°C
Relative Humidity (non-condensing)	10 to 90%RH
Maximum Input Optical Power	23 dBm
Size (H x W x D)	88 x 192 x 35
Weight	~ 1.5lb
Optical Connector	SC / UPC
Electric Power Supply	Batteries or AC
Communication	RS-232
Tone Detection	Continuous, 270Hz, 1KHz, 2KHz

NOTE: 1. At room temperature and without connector.

2. Input optical power must be 3dBm higher than required output optical power.

Ordering Information

L W 1 0 1 2 a

This product information is subject to change without notice.

Handheld Wavelength and Power Meter



Specifications

Optical

Parameters	Unit	Specification
Wavelength Range	nm	1260 to 1620
Wavelength Accuracy	nm	+/- 0.1*
Wavelength Display Resolution	nm	0.01
Optical Power Range in Wavelength Measurement	dBm	-35 to +15
Power Range	dBm	-60 to +15
Optical Power Accuracy	dB	+/- 0.1*
Optical Power Resolution	dB	0.01
Maximum Input Optical Power	dBm	20
Optical Connector	-	SC / UPC

*: The accuracy is at 1310 nm and 1550 nm, at 23 °C.

Environmental & Physical

Item	Unit	Specification
Operating Temperature	°C	0 to 40
Storage Temperature	°C	- 20 to 70
Relative Humidity (Non-Condensing)	%RH	10 to 90
Size (H x W x D)	mm	88 x 192 x 35
Weight With Jacket	lb	1.2
Power Supply	VDC	9, batteries or adapter

Ordering Information

L W 1 0 4 1 a

This product information is subject to change without notice.

Features / Benefits

- Handheld, lightweight design
- Quickly and accurately measures wavelengths and power
- Cost-effective, efficient, portable, and reliable
- Easy and convenient for on-site applications
- Built-in standard USB 2.0 interface
- Sleek, stylish design via rugged, durable housing
- Brilliant 3.5" color TFT display
- Bluetooth™ ready
- One CF type II expansion slot
- One SD / MMC expansion slot
- Built-in data storage management
- Touch screen and user-friendly GUI

Applications

- Manufacturing
- Maintenance
- Administration (local and on-site)
- Network installation and monitoring
- CATV
- FTTx
- R & D / laboratory



Handheld Polarization Synthesizer

Features / Benefits

- Handheld, lightweight design
- Track and lock polarization (SOP)
- Insensitive to small fluctuation of input SOP
- Wide-range wavelength detection and measurement
- Low insertion loss
- Real-time display of Poincaré sphere
- Cost-effective, efficient, portable, and reliable
- Built-in standard USB 2.0 interface
- Sleek, stylish design via rugged, durable housing
- Brilliant 3.5" color TFT display
- Bluetooth™ ready
- One CF type II expansion slot
- One SD / MMC expansion slot
- Built-in data storage management
- Touch screen and user-friendly GUI

Applications

- Manufacturing
- Maintenance
- Administration
- R& D / laboratory

Specifications

Optical

Parameters	Unit	Specification
Wavelength Range	nm	1520 to 1610*
Input Power Range	dBm	-20 to 10
Insertion Loss	dB	< 1.5
Return Loss	dB	> 50
PMD	ps	< 0.1
SOP Tracking Accuracy	°	< 2
SOP Resolution	-	± 0.02
SOP Settling Time	second	< 3.0
Optical Connector	-	SC / UPC

*: Other ranges available

Environmental & Physical

Item	Unit	Specification
Operating Temperature	°C	0 to 40
Storage Temperature	°C	-20 to 70
Relative Humidity (Non-Condensing)	%RH	10 to 90
Size (H x W x D)	mm	88 x 192 x 35
Weight With Jacket	lb	1.2
Power Supply	VDC	9, batteries or adapter

Ordering Information

L W 1 0 3 2 a

This product information is subject to change without notice.

Handheld Polarimeter



Specifications

Optical

Parameters	Unit	Specification
Wavelength Range	nm	1520 to 1610
Input Power Range	dBm	-35 to +5
SOP Accuracy	degree	< 2.0
DOP Accuracy	degree	< +/- 5.0%, (+/- 2.0% typical)
Return Loss	dB	> 50
Optical Connector	-	SC / UPC

Environmental & Physical

Item	Unit	Specification
Operating Temperature	°C	0 to 40
Storage Temperature	°C	-20 to 70
Relative Humidity (non-condensing)	%RH	10 to 90
Size (H x W x D)	mm	88 x 192 x 35
Weight With Jacket	lb	1.2
Power Supply	VDC	9, batteries or adapter

Ordering Information

L W 1 0 2 2 a

This product information is subject to change without notice.

Features / Benefits

- Handheld, lightweight design
- Large, dynamic range of measurement
- No moving parts and unlimited data logging
- Customized calibration options
- Precise, real-time display of SOP and Poincare sphere
- Cost-effective, efficient, portable, and reliable
- Built-in standard USB 2.0 interface
- Sleek, stylish design via rugged, durable housing
- Brilliant 3.5" color TFT display
- Bluetooth™ ready
- One CF type II expansion slot
- One SD / MMC expansion slot
- Built-in data storage management
- Touch screen and user-friendly interface

Applications

- Manufacturing
- Maintenance
- Administration (local or on-site)
- R&D / laboratory
- Quality assurance



High Power Tunable Laser Source

Features / Benefits

- High output power
- High side-mode suppression ratio
- Narrow line width
- High degree of polarization
- Very stable and repeatable
- Free of hop
- Digital display
- RS232 interface

Applications

- Optical components testing
- In-site optical monitoring in thin film coating
- Fiber sensing

Specifications

Parameters	Unit	Specifications
Operating Wavelength Range	nm	1525 - 1565
Nominal Output Power	dBm	17
Output Power Stability	dB/hr	< 0.01
Degree of Polarization	%	100
Side-Mode Suppression Ratio	dB	> 60
Line Width	nm	< 0.05
Wavelength Accuracy	nm	< 0.01
Tuning Resolution	nm	0.01
Driving Voltage (AC)	V	90 to 240
Driving Current	A	< 0.5
Operating Temperature	°C	-5 to 50
Storage Temperature	°C	-20 to 85
Relative Humidity	%RH	5 to 90
Optical Connector	-	FC/APC mating sleeve
Dimensions	mm	257 x 103 x 313

Ordering Information

L W 2 0 2 3 a

This product information is subject to change without notice.