# Liquid Crystal Based Normal-Off Variable Optical Attenuator (VOA)

### **Features/Benefits**

- Normal-off at zero voltage for channel blocking & system protection
- Dual liquid crystal based wave plates for thermal effect compensation
- Monotonous attenuation change with voltage
- No moving parts
- Low driving voltage
- Low wavelength dependent loss
- Low polarization dependent loss
- Analog or digital driver
- Low Cost

## Applications

- Channel blocking & system protection in dynamic optical networks
- Power equalization in optical add/drop modules and optical cross-connects
- Power adjustment before receivers
- Gain adjustment in EDFA
- Vmux & transmitter power adjustment



Lightwaves2020's new Normal-Off Liquid Crystal (LC)-Based VOA is a voltage controlled device that offers channel blocking and automatic system turn-on protection by providing high attenuation when no driving voltage is applied. The device has a dynamic range of 21 dB attenuation and operates in the C- or L-band.

Sealed in a compact coaxial package ( $\emptyset$ 7.2 x 23.5mm), the VOA's small footprint makes it ideal for integration onto circuit boards. In addition, it offers the benefits of no moving parts, precision attenuation control without backlash, low driving voltage (< 1mW), low power consumption, excellent PDL performance, low WDL, good modulation performance (< -28dB), low insertion loss and low cost. The VOA is driven by either a 0 - 20 V peak to peak 10 KHz square wave or by a 0 - 5V DC voltage using Lightwaves2020's easy-to-plug driver board.

The Normal-Off VOA can be used for pre-emphasis of DWDM laser signals 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. In addition, the driver provided by Lightwaves2020 enables customers to immediately integrate it into next-generation dynamically adjustable intelligent networks. As with all Lightwaves2020's products, the Normal-On VOA conforms to Telcordia requirements.

The driver is shipped with either an analog or a digital interface.



## LC Based Normal-Off Variable Optical Attenuator (VOA)

Specifications			
Parameter	Unit	A grade	B grade
Operating Wavelength Range	nm	C- / L- / C- & L-band	
Maximum Attenuation	dB	≥ 21	≥ 21
Insertion Loss (w/o connector)	dB	≤ 1.5	≤ 1.8
Polarization Dependent Loss	dB	≤ 0.5p-p	≤ 0.5p-p
Controlled Attenuation Range <sup>1</sup>	dB	21	21
Attenuation Resolution	dB/mV	≤ 0.1	≤ 0.1
Shut-off Attenuation	dB	≥ 21	≥ 21
Attenuation Temperature	dB	≤ 0.4p-p	≤ 0.4p-p
Dependence (TDL) <sup>2</sup>			
Polarization Mode Dispersion	ps	≤ 0.1	≤ 0.1
(PMD)			
Optical Return Loss (w/o connector)	dB	$\geq 40$	≥ 40
Response Time, Tresp, 10 % to 90 % <sup>3</sup>	ms	≤ 85	≤ 85
Optical Power Modulation Index (MI) <sup>4</sup>	dB	≤ -28	≤ -28

Note 1: at minimum applied voltage, at which a monotonic attenuation is guaranteed.

Note 2: for 0 dB attenuation (at min. IL) Note 3: response time includes contributions from electrically driving circuits; measured between 10 % and 90 % of maximum attenuation.

Note 4: MI= 10 log (Vac/Vdc/2); Vac and Vdc are defined as follows:

Vac is the peak-to-peak AC voltage due to parasite modulation of the output light from DUT monitored by the O/E converting equipment; Vdc is DC signal level due to output light from DUT monitored by the O/E converting equipment

#### **VOA Dimensions**



Unit: mm

#### **Absolute Maximum Ratings**

Parameters	Unit	Condition	Specification
Operating Condition	°C	Temperature	-5 to 70
	%RH	Humidity	0 to 90
Storage Condition	°C	Temperature	-40 to 85
	%RH	Humidity	0 to 90
Maximum Optical Power	mW	-	300
ESD	kV	-	-4 to +4

#### **Ordering Information**



This product information is subject to change without notice.



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All 1 m in length

#### **Driver Characteristics**

Parameter	Unit	Specification
Power Supply	v	$+5 \pm 10\%$
Driving Voltage	v	0~5
Dimension	Inch	1.97 x 0.5 x 0.063
(excluding electric pin)		
Electric Pin Dimension	Inch	Ø0.02 x 0.19
Electric Pin Pitch	Inch	0.1

#### VOA + Driver Assembly Diagram



Unit: mm (inch)