10 GHz Intensity Modulators (Page 1 of 2)

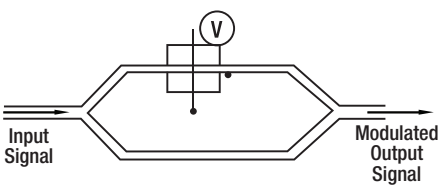
LN63S
10 GHz Phase Modulator

Thorlabs' 10 Gb/s Intensity Modulators are made from Titanium-Indiffused Lithium Niobate Modulators from Covega, Thorlabs Quantum Electronics. All of these high-performance optical modulators are designed for simple system integration to benefit customers developing high-speed modulation systems. These high-performance 10 GHz (10 Gb/s) modulators, which have an extremely small footprint and profile, feature a single-ended drive configuration with separate DC bias pins.

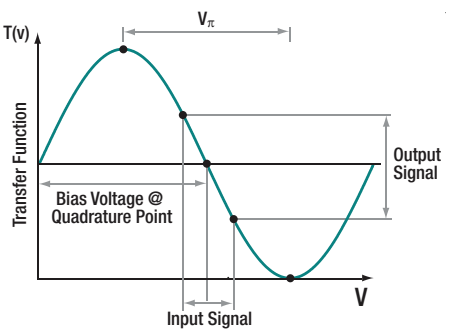
All modulators are based on a Titanium-indiffused $LiNbO_3$ structure and packaged in a hermetic housing with PM fiber and SM fiber pigtails on the device input and output, respectively. The pigtails are connectorized with FC/PC and SC/PC connectors. Please note that polarization-maintaining fiber and a full range of connectorization options are available for all Lithium Niobate Modulators; contact our Technical Support Team for assistance and details. Within the set of Intensity Modulators, Fixed-Chirp and Zero-Chirp devices are offered for dispersion control.

Mach-Zehnder Modulator Operation

Applying a voltage across one arm of the Mach-Zehnder modulator shifts the phase of the signal through that arm by an amount proportional to the voltage applied. If the phase shift equates to an integral number of wavelengths, the two beams will combine constructively and the intensity of the output power will be at its maximum. If the phase shift is a half wavelength out of phase, the two beams will combine destructively and the output power will be at its minimum.



Schematic Diagram of a Mach-Zehnder Modulator



Transfer Function of a Mach-Zehnder Modulator

Fixed-Chirp Modulators

Thorlabs offers two types of Z-Cut, Fixed-Chirp Modulators for signal control: LN63S and LN82S have an integrated photodetector, while LN83S has an integrated Variable Optical Attenuator. The LN63S and LN82S Intensity Modulators are equipped with SMP and GPO connectors, respectively.

The photodetectors integrated into LN63S and LN82S have a sensitivity range of at least 15 dB and enable optical power monitoring and modulator bias control, thereby eliminating the need for an external fiber tap and splicing. The Variable Optical Attenuator integrated into LN83S has an active attenuation range in excess of 15 dB; the attenuator enables dynamic channel equalization by active attenuation of optical output power. These features and levels of integration give designers of NRZ and RZ data format modulation systems an ideal set of components and tools to create modulation systems.

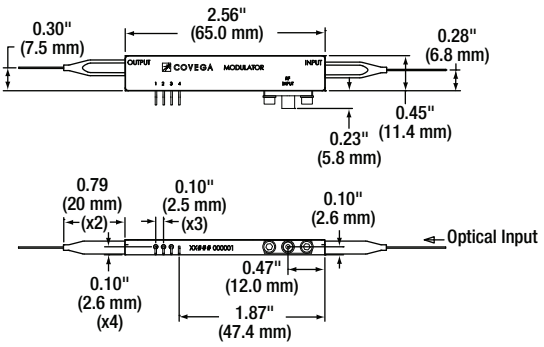
ITEM#		LN63S / LN82S / LN83S		
Parameter	**Symbol**	**Min**	**Typ**	**Max**
E/O Bandwidth (-3 dB)	$f_{c\text{-}3dB}$	10.0 GHz	–	–
Bit Rate Frequency	f_{BR}	9.953 Gbs	–	12.5 Gbs
Optical On/Off Extinction Ratio	E.R.	20 dB	–	–
Optical Extinction Ratio (PRBS)	E.R.	13 dB	–	–
Chirp Parameter (Fixed / Zero Chirp)	|α|	0.6 / -0.1 GHz	–	0.8 / 0.1 GHz
Optical Insertion Loss (Connectorized)	I.L.	–	4.0 dB	5.0 dB
Insertion Loss Variation (EOL)	ΔI.L.	-0.5 dB	–	0.5 dB
Optical Return Loss		40 dB	–	–
Operating Wavelength	λ	1525 nm	–	1605 nm
S11 (DC to 10 GHz)		–	-12 dB	-10 dB
RF Drive Voltage (PRBS)	V_{PRBS}	–	5.5 V	6.0 V
V_π @ DC		–	3.0 V	8.0 V
DC Bias Voltage Range (EOL)	V_{BIAS}	-8.0 V	–	8.0 V
PD Responsitivity (Ref. to Output Power)		0.1 A/W	–	0.5 A/W
Output Optical Power Monitoring		-5 dBm	–	10 dBm
Output Monitor Variation		-0.5 dB	–	0.5 dB
Monitor Photodiode Reverse Bias Voltage		-5.5 V	–	-3.0 V
Vp Attenuator Port (@DC)		0.1 V	–	0.5 V
VOA Control Voltage Range (EOL)		-5 V	–	10 V
Attenuation Range		-0.5 dB	–	0.5 dB

10 GHz Intensity Modulators (Page 2 of 2)

Zero-Chirp Modulators

Covega, Thorlabs Quantum Electronics, offers two Zero-Chirp 10 Gb/s Intensity Modulators. These modulators have a Mach-Zehnder interferometric architecture and offer a large bandwidth with an industry-leading low RF drive voltage, supporting data rates up to 12.5 Gb/s. The LN56S and LN81S are X-cut Zero-Chirp modulators with an integrated photodetector. The LN81S has a GPO connector, while the LN56S has an SMP connector. The integrated photodetector, which has a sensitivity range of at least 15 dB, enables optical power monitoring and modulator bias control, eliminating the need for an external fiber tap and splicing. The modulators were designed for implementing NRZ and RZ data format modulation systems.

ITEM#		LN56S / LN81S		
Parameter	**Symbol**	**Min**	**Typ**	**Max**
E/O Bandwidth (-3 dBe)	$f_{c\text{-}3dB}$	10.0 GHz	–	–
Bit Rate Frequency	f_{BR}	9.953 GHz	–	12.5 GHz
Optical On/Off Extinction Ratio	E.R.	20 dB	–	–
Optical Extinction Ratio (PRBS)	E.R.	13 dB	–	–
Chirp Parameter (Fixed / Zero Chirp)	|α|	0.6 / -0.1 GHz	–	0.8 / 0.1 GHz
Optical Insertion Loss (Connectorized)	I.L.	–	4.0 dB	5.0 dB
Insertion Loss Variation (EOL)	ΔI.L.	-0.5 dB	–	0.5 dB
Optical Return Loss		40 dB	–	–
Operating Wavelength	λ	1525 nm	–	1605 nm
S11 (DC to 10 GHz)		–	-12 dB	-10 dB
RF Drive Voltage (PRBS)	V_{PRBS}	–	5.5 V	6.0 V
Vπ @ DC		–	5.5 V	8.0 V
DC Bias Voltage Range (EOL)	V_{BIAS}	-8.0 V	–	8.0 V
PD Responsitivity (ref. to output power)		0.1 A/W	–	0.5 A/W
Output Optical Power Monitoring		-5 dBm	–	10 dBm
Output Monitor Variation		-0.5 dB	–	0.5 dB
Monitor Photodiode Reverse Bias Voltage		-5.5 V	–	-3.0 V



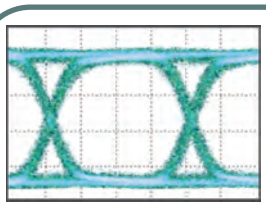
10 GHz Modulator Package Drawing

	LN56S / LN63S LN83S	LN81S / LN82S
RF Input	GPO Connector	SMP Connector
Pin 1	Detector Cathode	Detector Cathode
Pin 2	Detector Anode	Detector Anode
Pin 3	DC Bias Voltage	DC Bias Voltage
Pin 4	Case Ground	Case Ground

OPTICAL PORTS

Input : PM Fiber
Output : SM Fiber

Please refer to our website for complete models and drawings.



The display of a receiver "Eye Pattern" is a convenient graphical method to indicate the data signal quality produced by the communications channel. As one of the first elements in the communication channel, the modulators from Covega, Thorlabs Quantum Electronics, have been Telcordia GR-468-CORE qualified for use in communication systems.

The image is an example "Eye Pattern" produced by a Covega Modulators, showing the oscilloscope trace at the receiver of a two-level modulation scheme such as an "On-Off-Keying" (OOK) signal.

Other connector styles are available, contact Thorlabs

ITEM#	$	£	€	RMB	DESCRIPTION
LN56S-FC	$ 1,275.00	£ 883.90	€ 1.132,00	¥ 10,767.00	Zero-Chirp, 10 GHz Intensity Modulator, Integrated PD, FC/PC Connectors
LN56S-SC	$ 1,275.00	£ 883.90	€ 1.132,00	¥ 10,767.00	Zero-Chirp, 10 GHz Intensity Modulator, Integrated PD, SC/PC Connectors
LN63S-FC	$ 1,350.00	£ 935.90	€ 1.198,60	¥ 11,400.00	Fixed-Chirp, 10 GHz Intensity Modulator, Integrated PD, FC/PC Connectors
LN63S-SC	$ 1,350.00	£ 935.90	€ 1.198,60	¥ 11,400.00	Fixed-Chirp, 10 GHz Intensity Modulator, Integrated PD, SC/PC Connectors
LN81S-FC	$ 1,275.00	£ 883.90	€ 1.132,00	¥ 10,767.00	Zero-Chirp, 10 GHz Intensity Modulator, Integrated PD and Replaceable GPO Connector, FC/PC Connectors
LN81S-SC	$ 1,275.00	£ 883.90	€ 1.132,00	¥ 10,767.00	Zero-Chirp, 10 GHz Intensity Modulator, Integrated PD and Replaceable GPO Connector, SC/PC Connectors
LN82S-FC	$ 1,350.00	£ 935.90	€ 1.198,60	¥ 11,400.00	Fixed-Chirp, 10 GHz Intensity Modulator, Integrated PD and Replaceable GPO Connector, FC/PC Connectors
LN82S-SC	$ 1,350.00	£ 935.90	€ 1.198,60	¥ 11,400.00	Fixed-Chirp, 10 GHz Intensity Modulator, and Replaceable GPO Connector, SC/PC Connectors
LN83S-FC	$ 1,750.00	£ 1,213.00	€ 1.553,50	¥ 14,778.00	Fixed-Chirp, 10 GHz Intensity Modulator, Integrated Variable Optical Attenuator, FC/PC Connectors
LN83S-SC	$ 1,750.00	£ 1,213.00	€ 1.553,50	¥ 14,778.00	Fixed-Chirp, 10 GHz Intensity Modulator, Integrated Variable Optical Attenuator, SC/PC Connectors