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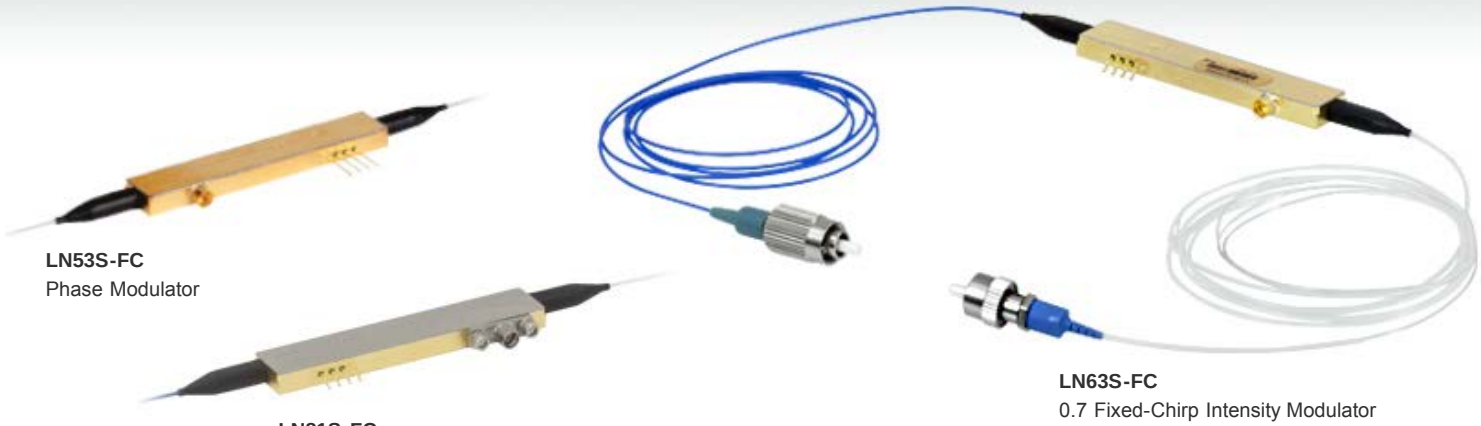
THORLABS

LN56S-FC - March 16, 2015

Item # LN56S-FC was discontinued on March 16, 2015. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

LITHIUM NIOBATE MODULATORS

- 10 GHz Intensity Modulators, X- and Z-Cut $LiNbO_3$
- 10 GHz Phase Modulators, Z-Cut $LiNbO_3$



LN53S-FC
Phase Modulator

LN81S-FC
Zero-Chirp Intensity Modulator

LN63S-FC
0.7 Fixed-Chirp Intensity Modulator

Hide 0.7 Fixed Chirp Intensity Modulators

0.7 Fixed Chirp Intensity Modulators

Hide Overview

OVERVIEW

Features

- C- and L-Band Operation Range
- 300-Pin MSA Transponder Compatible Footprint
- Titanium Indiffused Z-Cut Lithium Niobate
- Low Drive Voltage
- Long-Term Bias Stability
- Telcordia GR-468 Compliant
- Integrated Photodetector

Parameter	Value
Operating Range[a]	1525 - 1605 nm
PRBS[b] Optical Extinction Ratio	13 dB
Bit Rate Frequency	9.953 Gb/s
Electrooptic Bandwidth (-3 dB)	10 GHz

a. See note below.
b. Pseudo Random Binary Sequence

The LN63S-FC and LN82S-FC are 0.7 fixed-chirp $LiNbO_3$ intensity modulators that are designed to be integrated into 300 pin MSA compatible transponders. They feature integrated photodiodes. Fixed-Chirp modulators are fabricated from Titanium Indiffused Z-Cut $LiNb0_3$, which creates in an inequality in the push-pull phase shift between the two arms of the Mach-Zehnder interferometer. This results in a phase/frequency shift (chirp) in the output in addition to the intensity modulation. These fixed chirp modulators down-chirp the pulse, which can be useful when the optical fiber in the network has a positive dispersion coefficient. The down-chirped pulse traveling through an optical fiber with a positive dispersion coefficient will be compressed until a minimum is reached. Beyond that point the dispersion term will dominate. Since chirping the pulse increases the spectral width of the pulse, the chirped pulse will eventually be broader than an unchirped pulse traveling through the same optical fiber. These fixed chirp intensity modulators are ideal for applications requiring improved power penalty (less than two dB for +1600 ps/nm) performance over zero-chirp devices. The integrated photodetector can be used for optical power

monitoring and modulator bias control, which eliminates the need for an external fiber tap.

The 0.7 fixed-chirp Z-Cut LiNbO3 intensity modulators are 10 GHz devices with a PM input fiber pigtail and an SM output pigtail. Both are FC/PC-terminated. The PM fiber is slow-axis aligned. The RF input on the LN82S-FC has a field-replaceable GPO connector, which is considered physically compatible with SMP. For adapting to an SMA connector type, we recommend either a short SMP to SMA cable or a GPO to K adapter, both of which we have available for purchase upon request. Please be advised that because of the compact modulator package, the modulator may not sit flat on a table after attaching a GPO to K adapter, but will sit flat when using the SMP to SMA cable. These specific adapters have been verified to fit the GPO or SMP connector on the package, and have been used in house for testing purposes. Other third party SMP adapters are available from various electronics component suppliers, but the fit may vary and compatibility is not guaranteed. For more information on custom configurations (i.e., fiber type, connectorization, etc.) and quotes, please contact Technical Support.

Note: The modulator is designed for use in the 1550 nm window. Using the modulator at another wavelength (e.g., visible light) may cause a temporary increase in loss that is not covered under warranty. For instance, the increase in loss caused by shorter wavelengths can be reversed by heating the modulator to 50 °C for an hour.

Hide Specs

SPECS

Parameter	Min	Typical	Max	Parameter	Min	Typical	Max
Operating Wavelength[a]	1525 nm	-	1605 nm	**Operating Case Temperature**	0 °C	-	70 °C
DC Optical On/Off Extinction Ratio	20 dB	-	-	**Optical Insertion Loss (Connectorized)**	-	4.0 dB	5.0 dB
PRBS[b] Optical Extinction Ratio	13 dB	-	-	**EOL[d] Insertion Loss Variation**	-0.5 dB	-	0.5 dB
Bit Rate Frequency	9.953 Gb/s	-	-	**Modulator Chirp Parameter**	0.6	-	0.8
E/O Bandwidth (-3 dB)	10 GHz	-	-	**Optical Return Loss**	40 dB	-	-
S11 (DC to 10 GHz)	-	-12 dB	-10 dB	**PD Responsivity**	0.1 mA/mW	-	0.5 mA/mW
RF Drive Voltage (PRBS)	-	5.5 V	6 V	**Output Optical Power Monitoring Range**	-5 dBm	-	10 dBm
V_{π} Bias Port[c]	-	3 V	8 V	**Output Monitor Variation**	-0.5 dB	-	0.5 dB
EOL[d] DC Bias Voltage Range	-8 V	-	8 V	**Monitor Photodiode Reverse Bias Voltage**	-5.5 V	-	-3.0 V

a. The modulator is designed for use in the 1550 nm window. Using the modulator at another wavelength (e.g., visible light) may cause a temporary increase in loss that is not covered under warranty. For instance, the increase in loss caused by shorter wavelengths can be reversed by heating the modulator to 50 °C for an hour.
b. Pseudo Random Binary Sequence
c. Half-Wave Retardation DC Voltage
d. End of Life

Pin Label (Number)	Description
C (1)	Photodetector Cathode
A (2)	Photodetector Anode
B (3)	Modulator DC Bias
G (4)	Modulator Bias Ground

RF Modulation Input: SMP RF Connector

Part Number	Description	Price	Availability
LN63S-FC	**Fixed-Chirp, 10 GHz Intensity Modulator, Integrated PD, FC/PC**	**$1,500.00**	**Today**
LN82S-FC	**Fixed-Chirp, 10 GHz Intensity Mod., Integrated PD and Replaceable GPO Connector, FC/PC**	**$1,500.00**	**Today**

0.7 Fixed Chirp Intensity Modulator with Variable Optical Attenuator

OVERVIEW

Features

- C- and L-Band Operation Range
- 300-Pin MSA Transponder Compatible Footprint
- Titanium Indiffused Z-Cut Lithium Niobate
- Low Drive Voltage
- Long-Term Bias Stability
- Telcordia GR-468 Compliant
- Variable Optical Attenuator with 18 dB Attenuation Range

Parameter	Value
Operating Range[a]	1525 - 1605 nm
VOA[b] Attenuation	18 dB
PRBS[c] Optical Extinction Ratio	13 dB
Bit Rate Frequency	9.953 Gb/s
Electrooptic Bandwidth (-3 dB)	10 GHz

[a] See note below.

[b] Variable Optical Attenuator

[c] Pseudo Random Binary Sequence

The LN83S-FC is a 0.7 fixed-chirp $LiNbO_3$ intensity modulator with a variable optical attenuator (VOA) that is designed to be integrated into 300 pin MSA compatible transponders. Fixed-Chirp modulators are fabricated from Titanium Indiffused Z-Cut $LiNb0_3$, which creates in an inequality in the push-pull phase shift between the two arms of the Mach-Zehnder interferometer. This results in a phase/frequency shift (chirp) in the output in addition to the intensity modulation. These fixed chirp modulators down-chirp the pulse, which can be useful when the optical fiber in the network has a positive dispersion coefficient. The down-chirped pulse traveling through an optical fiber with a positive dispersion coefficient will be compressed until a minimum is reached. Beyond that point the dispersion term will dominate. Since chirping the pulse increases the spectral width of the pulse, the chirped pulse will eventually be broader than an unchirped pulse traveling through the same optical fiber. These fixed chirp intensity modulators are ideal for applications requiring improved power penalty (less than two dB for +1600 ps/nm) performance over zero-chirp devices.

The LN383S-FC modulator has an integrated VOA that allows for active attenuation of the optical output power over an 18 dB range. This can be useful when efficient management of network imbalances in DWDM optical links is needed, or in other applications.

The LN83S-FC 10GHz $LiNbO_3$ waveguide modulator comes with a SMP connector, which is considered physically compatible with GPO. For adapting to an SMA connector type, we recommend either a short SMP to SMA cable or a GPO to K adapter, both of which we have available for purchase upon request. Please be advised that because of the compact modulator package, the modulator may not sit flat on a table after attaching a GPO to K adapter, but will sit flat when using the SMP to SMA cable. These specific adapters have been verified to fit the GPO or SMP connector on the package, and have been used in house for testing purposes. Other third party SMP adapters are available from various electronics component suppliers, but the fit may vary and compatibility is not guaranteed. For more information on custom configurations (i.e., fiber type, connectorization, etc.) and quotes, please contact Technical Support.

Note: The modulator is designed for use in the 1550 nm window. Using the modulator at another wavelength (e.g., visible light) may cause a temporary increase in loss that is not covered under warranty. For instance, the increase in loss caused by shorter wavelengths can be reversed by heating the modulator to 50 °C for an hour.

Hide Specs

SPECS

Parameter	Min	Typical	Max	Parameter	Min	Typical	Max
Operating Wavelength[a]	1525 nm	-	1605 nm	**Operating Case Temperature**	0 °C	-	70 °C
DC Optical On/Off Extinction Ratio	20 dB	-	-	**Optical Insertion Loss (Connectorized)**	-	4.0 dB	5.5 dB
PRBS[b] Optical Extinction Ratio	13 dB	-	-	**EOL[d] Insertion Loss Variation**	-0.5 dB	-	0.5 dB
Bit Rate Frequency	9.953 Gb/s	-	-	**Modulator Chirp Parameter**	0.6	-	0.8
E/O Bandwidth (-3 dB)	10 GHz	-	-	**Optical Return Loss**	40 dB	-	-
S11 (DC to 10 GHz)	-	-12 dB	-10 dB	**VOA Attenuation Range**	15 dB	-	-
RF Drive Voltage (PRBS)	-	6.5 V	7 V	**VOA V_π at DC**	-	-	18 V
V_π Bias Port[c]	-	3	8 V	**Min to Max VOA Transmission Voltage Range**	-16 V	-	16 V
EOL[d] DC Bias Voltage Range	-10 V	-	10 V	**VOA 3 dB Bandwidth**	-	100 MHz	-

[a] The modulator is designed for use in the 1550 nm window. Using the modulator at another wavelength (e.g., visible light) may cause a temporary increase in loss that is not covered under warranty. For instance, the increase in loss caused by shorter wavelengths can be reversed by heating the modulator to 50

°C for an hour.

[b] Pseudo Random Binary Sequence

[c] Half-Wave Retardation DC Voltage

[d] End of Life

Pin Label (Number)	Description
C (1)	Not Connected
A (2)	VOA Control Voltage
B (3)	DC Bias
G (4)	Case Ground

RF Modulation Input: SMP RF Connector

Part Number	Description	Price	Availability
LN83S-FC	**Fixed-Chirp, 10 GHz Intensity Mod., Integrated Variable Optical Attenuator, FC/PC**	**$1,750.00**	**Today**

Hide Zero-Chirp Intensity Modulators

Zero-Chirp Intensity Modulators

Hide Overview

OVERVIEW

Features

- C- and L-Band Operation Range
- 300-Pin MSA Transponder Compatible Footprint
- Titanium Indiffused X-Cut Lithium Niobate
- Low Drive Voltage
- Long-Term Bias Stability
- Telcordia GR-468 Compliant
- Integrated Photodetector

Parameter	Value
Operating Range[a]	1525 - 1605 nm
PRBS[b] Optical Extinction Ratio	13 dB
Bit Rate Frequency	9.953 Gb/s
Electrooptic Bandwidth (-3 dB)	10 GHz

a. See note below.

b. Pseudo Random Binary Sequence

The LN81S-FC and LN56S-FC are zero-chirp $LiNbO_3$ intensity modulators with integrated photodiodes that are designed to be integrated into 300 pin MSA compatible transponders. Zero-Chirp modulators are fabricated from X-Cut Titanium Indiffused $LiNb0_3$, which allows for both arms of the Mach-Zehnder interferometer to be symmetric. This symmetry ensures that the modulated output of the intensity modulator is not also shifted in phase/frequency (chirped). A chirped signal will be spectrally broadened, which leads to greater chromatic dispersion and limits the WDM channel separation. Zero-Chirp intensity modulators are ideal for use in metro and long-haul DWDM applications requiring less than a 2 dB power penalty for ±1,200 ps/nm dispersion. The integrated photodetector can be used for optical power monitoring and modulator bias control, which eliminates the need for an external fiber tap.

The two X-Cut LiNbO3 intensity modulators available online are 10 GHz devices with a PM input fiber pigtail and an SM output fiber pigtail. Both are terminated with FC/PC connectors. The PM fiber is keyed to the slow-axis which is also aligned to the extraordinary mode.

Models of 10GHz $LiNbO_3$ waveguide modulators that come with a GPO connector, which is considered physically compatible with SMP, can be adapted to an SMA connector. To do so, we recommend either a short SMP to SMA cable or a GPO to K adapter, both of which we have available for purchase upon request. Please be advised that because of the compact modulator package, the modulator may not sit flat on a table after attaching a GPO to K adapter, but will sit flat when using the SMP to SMA cable. These specific adapters have been verified to fit the GPO or SMP connector on the package, and have been used in house for testing purposes. Other third party SMP adapters are available from various electronics component suppliers, but the fit may vary and compatibility is not guaranteed. For more information on custom configurations (i.e., fiber type, connectorization, etc.) and quotes, please contact Technical Support.

Note: The modulator is designed for use in the 1550 nm window. Using the modulator at another wavelength (e.g., visible light) may cause a temporary increase in loss that is not covered under warranty. For instance, the increase in loss caused by shorter wavelengths can be reversed by heating the modulator to 50 °C for an hour.

Hide Specs

SPECS

Parameter	Min	Typical	Max	Parameter	Min	Typical	Max
Operating Wavelength[a]	1525 nm	-	1605 nm	**Operating Case Temperature**	0 °C		70 °C
DC Optical On/Off Extinction Ratio	20 dB	-	-	**Optical Insertion Loss (Connectorized)**	-	4.0 dB	5.0 dB
PRBS[b] **Optical Extinction Ratio**	13 dB	-	-	**EOL**[d] **Insertion Loss Variation**	-0.5 dB	-	0.5 dB
Bit Rate Frequency	9.953 Gb/s	-	-	**Modulator Chirp Parameter**	-0.1	-	0.1
E/O Bandwidth (-3 dB)	10 GHz	-	-	**Optical Return Loss**	40 dB	-	-
S11 (DC to 10 GHz)	-	-12 dB	-10 dB	**PD Responsivity**	0.1 mA/mW	-	0.5 mA/mW
RF Drive Voltage (PRBS)	-	5.5 V	6 V	**Output Optical Power Monitoring Range**	-5 dBm	-	10 dBm
V_{π} Bias Port[c]	-	-	8 V	**Output Monitor Variation**	-0.5 dB	-	0.5 dB
EOL[d] **DC Bias Voltage Range**	-8 V	-	8 V	**Monitor Photodiode Reverse Bias Voltage**	-5.5 V	-	-3.0 V

a. The modulator is designed for use in the 1550 nm window. Using the modulator at another wavelength (e.g., visible light) may cause a temporary increase in loss that is not covered under warranty. For instance, the increase in loss caused by shorter wavelengths can be reversed by heating the modulator to 50 °C for an hour.
b. Pseudo Random Binary Sequence
c. Half-Wave Retardation DC Voltage
d. End of Life

Pin Label (Number)	Description
C (1)	Photodetector Cathode
A (2)	Photodetector Anode
B (3)	Modulator DC Bias
G (4)	Modulator Bias Ground

RF Modulation Input: SMP RF Connector

Part Number	Description	Price	Availability
LN56S-FC	**Zero-Chirp, 10 GHz Intensity Mod., Integrated PD, FC/PC**	**$1,500.00**	**Lead Time**
LN81S-FC	**Zero-Chirp, 10 GHz Intensity Mod., Integrated PD and Replaceable GPO Conn,, FC/PC**	**$1,500.00**	**Lead Time**

Hide 10 GHz Phase Modulator

10 GHz Phase Modulator

Hide Overview

OVERVIEW

Features

- C- and L-Band Operation Range
- 300-Pin MSA Transponder Compatible Footprint
- Titanium Indiffused Z-Cut Lithium Niobate
- Low Drive Voltage
- Telcordia GR-468 Compliant
- Optional Integrated Output Polarizer

Parameter	Value
Operating Range[a]	1525 - 1605 nm
Bit Rate Frequency	9.953 Gb/s
Electrooptic Bandwidth (-3 dB)	10 GHz

[a] See note below.

The LN53S-FC and LN65S-FC are Titanium Indiffused Z-Cut $LiNbO_3$ phase modulators that are designed to be integrated into 300 pin MSA compatible transponders. Phase modulators provide chirp control in high-speed data communications. The $LiNbO_3$ is also ideal for coherent communications, sensing, all-optical frequency-shifting, and data encryption applications.

The two Z-Cut $LiNbO_3$ phase modulators available online are 10 GHz devices with a PM input fiber pigtail and a SM output fiber pigtail. Both are terminated with FC/PC connectors. The LN65S-FC has an integrated optical polarizer positioned before the output port of the device. The integrated polarizer is not included with the LN53S-FC. With no polarizer, the device is capable of supporting both optical modes, ordinary and extraordinary. Each mode will have a different modulation efficiency; the modulation efficiency of the extraordinary mode will be approximately a factor of three greater than the ordinary mode. For those interested in supporting only the extraordinary mode, the internal polarizer would be desirable.

Models of 10GHz $LiNbO_3$ waveguide modulators that come with a GPO connector, which is considered physically compatible with SMP, can be adapted to an SMA connector type. To do so, we recommend either a short SMP to SMA cable or a GPO to K adapter, both of which we have available for purchase upon request. Please be advised that because of the compact modulator package, the modulator may not sit flat on a table after attaching a GPO to K adapter, but will sit flat when using the SMP to SMA cable. These specific adapters have been verified to fit the GPO or SMP connector on the package, and have been used in house for testing purposes. Other third party SMP adapters are available from various electronics component suppliers, but the fit may vary and compatibility is not guaranteed. For more information on custom configurations (i.e., fiber type, connectorization, etc.) and quotes, please contact Technical Support.

Note: The modulator is designed for use in the 1550 nm window. Using the modulator at another wavelength (e.g., visible light) may cause a temporary increase in loss that is not covered under warranty. For instance, the increase in loss caused by shorter wavelengths can be reversed by heating the modulator to 50 °C for an hour.

Hide Specs

SPECS

Parameter	Min	Typical	Max	Parameter	Min	Typical	Max
Operating Wavelength[a]	1525 nm	-	1605 nm	**Operating Case Temperature**	0 °C	-	70 °C
Bit Rate Frequency	9.953 Gb/s	-	-	**Optical Insertion Loss (Connectorized)**	-	3.5 dB	4.5 dB
E/O Bandwidth (-3 dB)	10 GHz	-	-	**EOL**[b] **Insertion Loss Variation**	-0.5 dB	-	0.5 dB
S11 (DC to 10 GHz)	-	-12 dB	-10 dB	**Optical Return Loss**	40 dB	-	-
RF Drive Voltage (PRBS)	-	4.5 V	5 V	**V_π at DC**[c]	-	3.5 V	4 V

[a] The modulator is designed for use in the 1550 nm window. Using the modulator at another wavelength (e.g., visible light) may cause a temporary increase in loss that is not covered under warranty. For instance, the increase in loss caused by shorter wavelengths can be reversed by heating the modulator to 50 °C for an hour.

[b] End of Life

[c] Half-Wave Retardation DC Voltage

Pin Label (Number)	Description
C (1)	Not Connected
A (2)	Not Connected
B (3)	Not Connected
G (4)	Not Connected

RF Modulation Input: SMP RF Connector

Part Number	Description	Price	Availability
LN53S-FC	**10 GHz Phase Modulator without Polarizer, FC/PC Connectors**	**$1,550.00**	**Today**
LN65S-FC	**10 GHz Phase Modulator with Polarizer, FC/PC Connectors**	**$1,550.00**	**Today**

Visit the *Lithium Niobate Modulators* page for pricing and availability information:
http://www.thorlabs.com/newgrouppage9.cfm?objectgroup_id=3918