Photline TECHNOLOGIES

Delivering Modulation Solutions

MX-LN series
1550 nm band Intensity Modulators

Modulator

The MX-LN series are lithium niobate ($LiNb0_3$) intensity modulators designed for optical communications at data rates up to 40 Gb/s.

The X-cut design of this Mach-Zehnder modulators confer them an unmatched stability in a wide range of operational conditions, as well as a zero chirp performance. Photline Technologies proprietary waveguide design offers a low insertion loss combined with a high contrast. The MX-LN series are ideally suited for 10 Gb/s up to 40 Gb/s optical transmission with NRZ, RZ, DPSK, Duo Binary modulation formats and are key device for a large variety of high bandwidth applications.

FEATURES

- High Bandwidth
- X-cut for high stability
- Low drive voltage
- Low insertion loss

APPLICATIONS

- Digital communications
- General purpose intensity modulation
- Test and measurement

OPTIONS

- High extinction ratio versions
- 2000 nm, 1300 nm, 1060 nm, 850 nm
- Hermetic sealing

RELATED EQUIPMENTS

- RF amplifiers
- MBC-DG Automatic Bias Controllers
- ModBox-1550nm-44Gb/s

MX-LN-10 Performance Highlights

Parameter	Min	Typ	Max	Unit
Operating wavelength	1530	-	1580	nm
Insertion loss (low loss option)	-	2.7	-	dB
Electro-optical bandwidth	-	12	-	GHz
Vπ RF @50 kHz	-	4	-	V

Specifications given at 25 °C, 1550 nm

MX-LN-20 Performance Highlights

Parameter	Min	Typ	Max	Unit
Operating wavelength	1530	-	1580	nm
Insertion loss (low loss option)	-	2.7	-	dB
Electro-optical bandwidth	-	20	-	GHz
Vπ RF @50 kHz	-	5.5	-	V

Specifications given at 25 °C, 1550 nm

MX-LN-40 Performance Highlights

Parameter	Min	Typ	Max	Unit
Operating wavelength	1530	-	1580	nm
Insertion loss	-	4	-	dB
Electro-optical bandwidth	-	30	-	GHz
Vπ RF @50 kHz	-	6.4	-	V

Specifications given at 25 °C, 1550 nm

MX-LN-10
10 GHz Intensity modulator

Electrical Characteristics 50 Ω RF input

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Electro-optic bandwidth	S_{21}	RF electrodes, -3dB from 2 GHz	10	12	-	GHz
Ripple S21	ΔS21	RF electrodes, f < 12GHz	-	0.5	1	dB
Electrical return loss	ES_{11}	RF electrodes	-	-12	-10	dB
Vπ RF @50 kHz	$V\pi RF_{50\ kHz}$	RF electrodes	-	4	5	V
Vπ RF @10 GHz PRBS	$V\pi RF_{10\ GHz}$	RF electrodes	-	4.7	5.7	V
Vπ DC electrodes	VπDC	DC electrodes	-	4	5	V
RF input impedance	$Z_{in\text{-}RF}$	-	-	40	-	Ω
DC input impedance	$Z_{in\text{-}DC}$	-	-	1	-	MΩ

A DC block may be required at the RF input to isolate driving electronics from the DC bias voltage

Optical Characteristics All specifications given at 25°C, 1550 nm, unless differently specified

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Crystal	-	-	Lithium Niobate X-Cut Y-Prop			
Operating wavelength	λ	-	1530	1550	1580	nm
Insertion loss	IL	Without connectors	-	3.5	5	dB
		Option Low IL, without connectors	-	2.7	3	dB
DC extinction ratio	ER	Measured with narrow source linewidth < 200 MHz	20	22	-	dB
Optical return loss	ORL	-	-40	-45	-	dB
Chirp	α	-	-0.1	0	0.1	–

Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of the data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect device reliability.

Parameter	Symbol	Min	Max	Unit
RF input power	EP_{in}	-	28	dBm
Bias voltage	V_{bias}	-20	+20	V
Optical input power	OP_{in}	-	20	dBm
Operating temperature	OT	0	+70	°C
Storage temperature	ST	-40	+85	°C

MX-LN-20
20 GHz Intensity modulator

Electrical Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Electro-optic bandwidth	S_{21}	RF electrodes, from 2 GHz	18	20	-	GHz
Ripple S21	ΔS21	RF electrodes, f < 20 GHz	-	0.5	1	dB
Electrical return loss	ES_{11}	RF electrodes	-	-12	-10	dB
Vπ RF @50 kHz	$V\pi RF_{50\ kHz}$	RF electrodes	-	5.5	6	V
Vπ RF @10 GHz PRBS	$V\pi RF_{10\ GHz}$	RF electrodes	-	6.5	7	V
Vπ DC electrodes	VπDC	DC electrodes	-	6.5	7	V
RF input impedance	$Z_{in\text{-}RF}$	-	-	40	-	Ω
DC input impedance	$Z_{in\text{-}DC}$	-	-	1	-	MΩ

Optical Characteristics
All specifications given at 25 °C, 1550 nm, unless different specified

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Crystal	-	-	Lithium Niobate X-Cut Y-Prop			
Operating wavelength	λ	-	1530	1550	1580	nm
Insertion loss	IL	Without connectors	-	4	5	dB
		Option Low IL, without connectors	-	2.7	3	dB
DC extinction ratio	ER	Measured with narrow source linewidth < 200 MHz	20	22	-	dB
Optical return loss	ORL	-	-40	-45	-	dB
Chirp	α	-	-0.1	0	0.1	–

Absolute Maximum Ratings
Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of the data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect device reliability.

Parameter	Symbol	Min	Max	Unit
RF input power	EP_{in}	-	28	dBm
Bias voltage	V_{bias}	-20	+20	V
Optical input power	OP_{in}	-	20	dBm
Operating temperature	OT	0	+70	°C
Storage temperature	ST	-40	+85	°C

MX-LN-40
40 GHz Intensity modulator

Electrical Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Electro-optic bandwidth	S_{21}	RF electrodes, from 2 GHz	28	30	-	GHz
Ripple S21	ΔS21	RF electrodes, f < 30 GHz	-	0.5	1	dB
Electrical return loss	ES_{11}	RF electrodes	-	-12	-10	dB
Vπ RF @50 kHz	$V\pi RF_{50\ kHz}$	RF electrodes	-	6.4	6.7	V
Vπ DC electrodes	VπDC	DC electrodes	-	6.5	7	V
RF input impedance	$Z_{in\text{-}RF}$	-	-	35	-	Ω
DC input impedance	$Z_{in\text{-}DC}$	-	1	-	-	MΩ

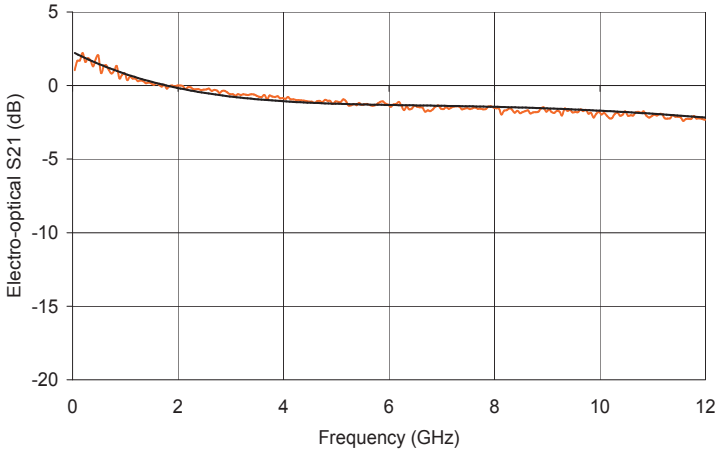
Optical Characteristics
All specifications given at 25 °C, 1550 nm, unless different specified

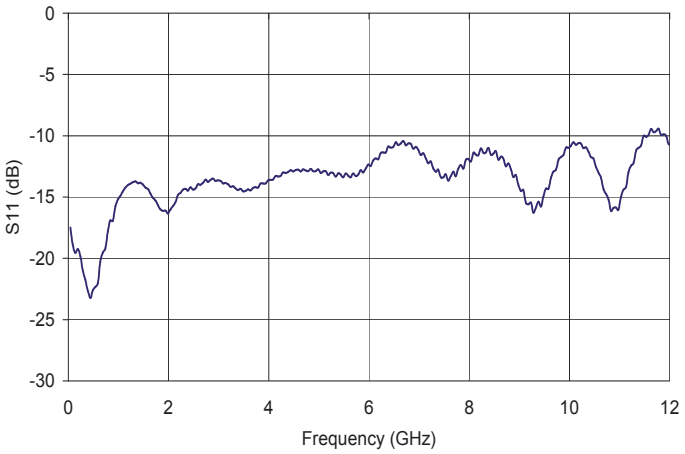
Parameter	Symbol	Condition	Min	Typ	Max	Unit
Crystal	-	-	Lithium Niobate X-Cut Y-Prop			
Operating wavelength	λ	-	1530	1550	1580	nm
Insertion loss	IL	Without connectors	-	4	5	dB
DC extinction ratio	ER	Measured with narrow source linewidth < 200 MHz	20	22	-	dB
Optical return loss	ORL	-	-40	-45	-	dB
Chirp	α	-	-0.1	0	0.1	–

Absolute Maximum Ratings
Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of the data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect device reliability.

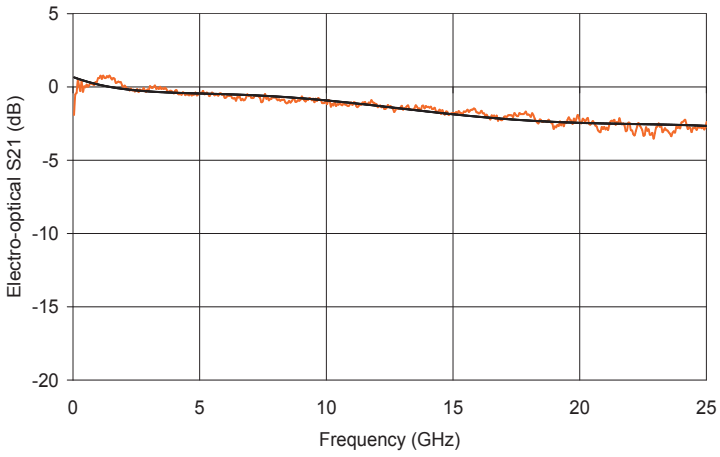
Parameter	Symbol	Min	Max	Unit
RF input power	EP_{in}	-	28	dBm
Bias voltage	V_{bias}	-20	+20	V
Optical input power	OP_{in}	-	20	dBm
Operating temperature	OT	0	+70	°C
Storage temperature	ST	-40	+85	°C

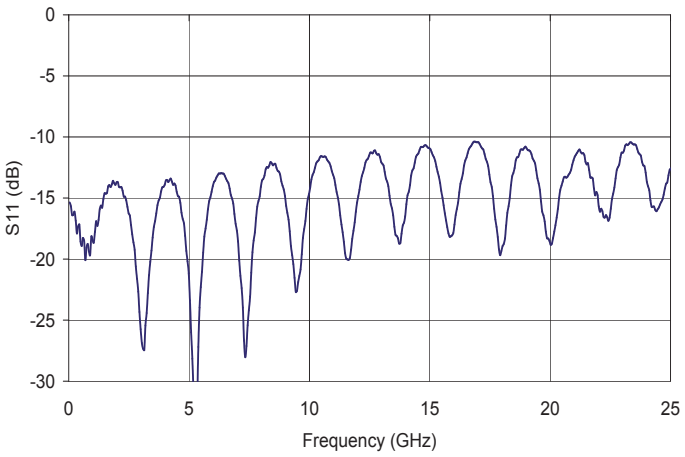
MX-LN-10 - Typical S21 & S11 Parameters Curves



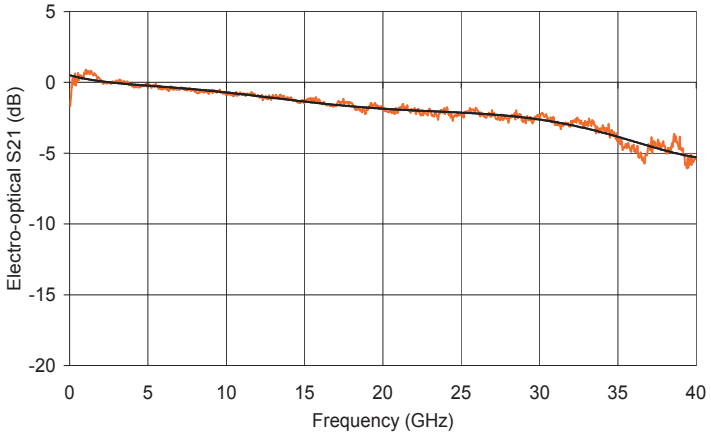


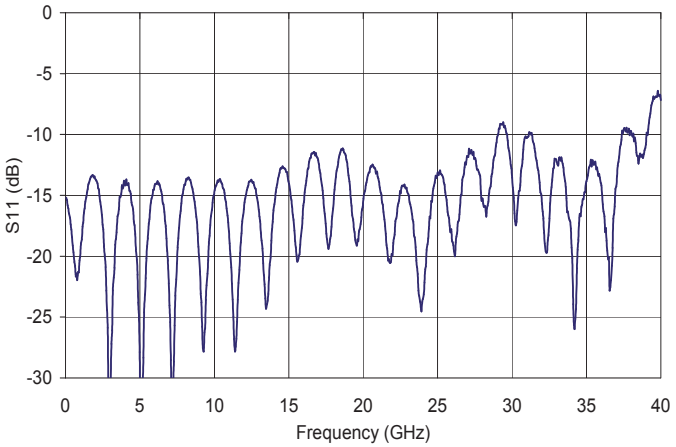
MX-LN-20 - Typical S21 & S11 Parameters Curves





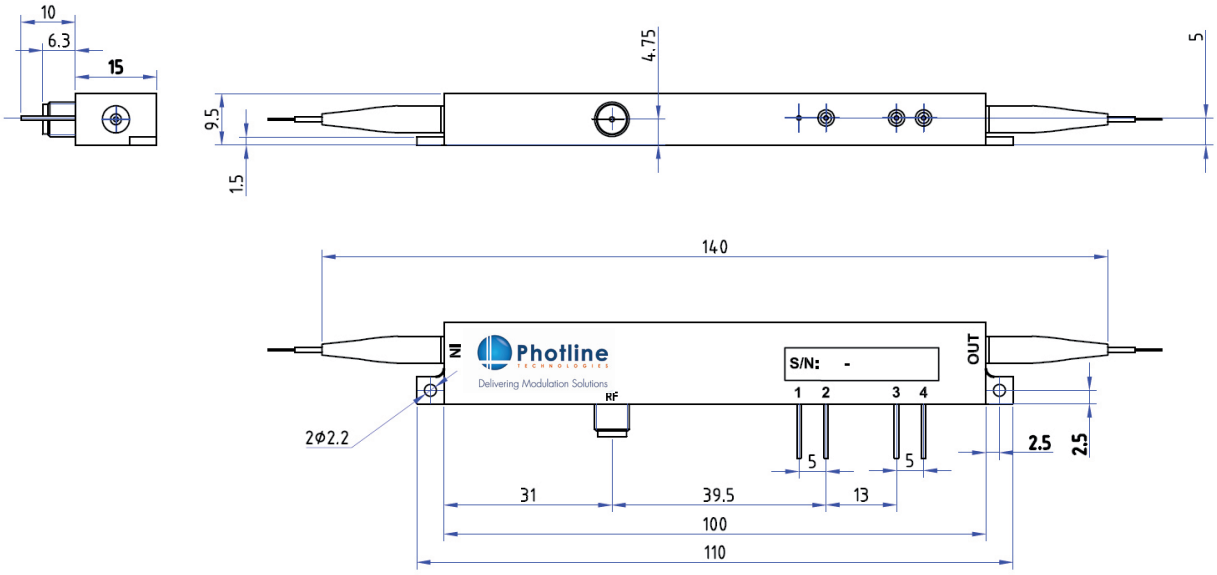
MX-LN-40 - Typical S21 & S11 Parameters Curves





MX-LN-10 & MX-LN-20 Mechanical Diagram and Pinout

All measurements in mm



Port	Function	Note
IN	Optical input port	Polarization maintaining fiber, Corning PM 98-U25A, Length 1.5 meter. Buffer diameter 900 µm
OUT	Optical output port	Polarization maintaining fiber, Corning PM 98-U25A, Length 1.5 meter. Buffer diameter 900 µm
RF	RF input port	Wiltron female K (SMA compatible)
1	Ground	Pin feed through diameter 1.0 mm
2	DC	Pin feed through diameter 1.0 mm
3	Photodiode cathode	Pin feed through diameter 1.0 mm
4	Photodiode anode	Pin feed through diameter 1.0 mm

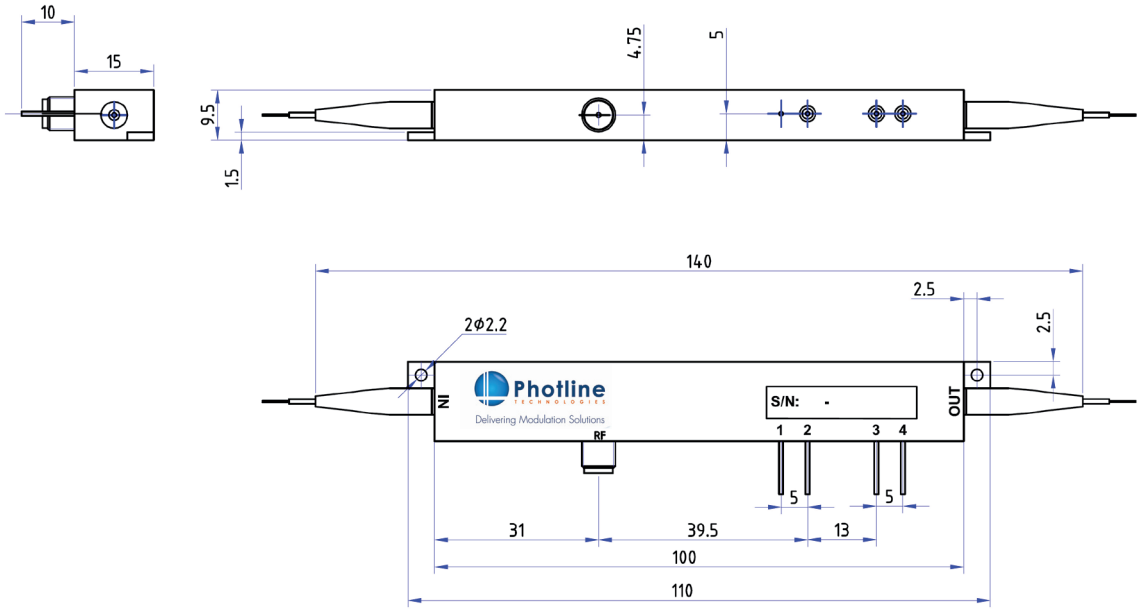
Ordering information

MX-LN-BW-XX-Y-Z-AB-CD

BW = Bandwidth : 10 10 GHz 20 20 GHz 40 40 GHz
XX = Internal photodiode : 00 Not integrated PD PD Integrated
Y = Input fiber : P Polarisation maintaining S Standard single mode
Z = Input fiber : P Polarisation maintaining S Standard single mode
AB = Output connector : 00 bare fiber FA FC/APC FC FC/SPC
CD = Output connector : 00 bare fiber FA FC/APC FC FC/SPC
Note : optical connectors are Seikoh-Giken with narrow key or equivalent

MX-LN-40 Mechanical Diagram and Pinout

All measurements in mm



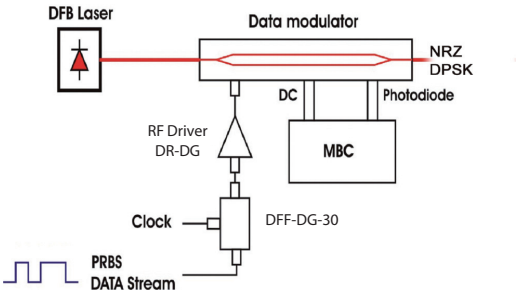
Port	Function	Note
IN	Optical input port	Polarization maintaining fiber, Corning PM 98-U25A, Length 1.5 meter. Buffer diameter 900 µm
OUT	Optical output port	Polarization maintaining fiber, Corning PM 98-U25A, Length 1.5 meter. Buffer diameter 900 µm
RF	RF input port	Wiltron female V
1	Ground	Pin feed through diameter 1.0 mm
2	DC	Pin feed through diameter 1.0 mm
3	Photodiode cathode	Pin feed through diameter 1.0 mm
4	Photodiode anode	Pin feed through diameter 1.0 mm

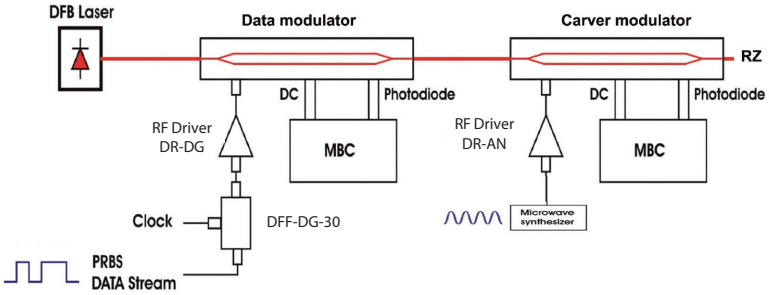
Ordering information

MX-LN-40-XX-Y-Z-AB-CD

BW = Bandwidth : 10 10 GHz 20 20 GHz 40 40 GHz
XX = Internal photodiode : 00 Not integrated PD PD Integrated
Y = Input fiber : P Polarisation maintaining S Standard single mode
Z = Input fiber : P Polarisation maintaining S Standard single mode
AB = Output connector : 00 bare fiber FA FC/APC FC FC/SPC
CD = Output connector : 00 bare fiber FA FC/APC FC FC/SPC
Note : optical connectors are Seikoh-Giken with narrow key or equivalent

Related equipments & Examples of application





OOK-NRZ, DPSK transmission

DR-DG series amplifiers are designed to drive MX-LN at one and two times Vπ for NRZ and DPSK modulation scheme.

MBC-DG-BT is an automatic bias controller that locks the operating point of the MX-LN modulators.

DFF-DG-30 is a D-type Flip Flop module intended for NRZ retiming and reshaping PRBS data-stream.

OOK-RZ transmission

DR-AN module is wideband RF amplifiers designed to drive optical modulators for analog modulation scheme.

MBC-DG-BT is continuously tunable : it can lock on any point of the modulator transfer curve, Quadrature and Min points for instance.

Modbxes are a family of turnkey optical transmitters and external benchtop units for telecommunication applications.

ModBoxes for 10 Gb/s up to 44 Gb/s NRZ, RZ, DPSK, Stressed Eyes, Multi-channel, Analog Optical Modulation Units are designed to generate high performances transmission and reception system.

About us

Photline Technologies is a provider of Fiber Optics Modulation Solutions based on the company $LiNb0_3$ modulators and high-speed electronics modules. Photline Technologies offers high speed and high data rate modulation solutions for the telecommunication industry and the defense, aerospace, instruments and sensors markets. The products offered by the company include : comprehensive range of intensity and phase modulators (800 nm, 1060 nm, 1300 nm, 1550 nm, 2000 nm), RF drivers and modules, transmitters and modulation units.

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