



## FEATURES

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

## APPLICATIONS

- 12.5 Gp/s digital communications
- General purpose intensity modulation
- Test and measurement

## OPTIONS

- 20 Gbps & 40 Gbps versions
- 1300 nm, 1060 nm band versions
- Hermetic sealing

## RELATED EQUIPMENTS

- Choice of RF drivers
- MBC-DG Automatic Bias Controllers
- D-type Flip-Flop

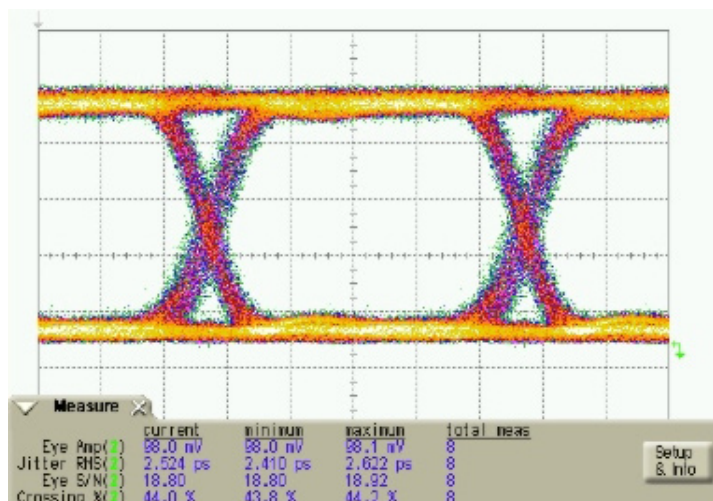
The MX-LN-10 is a lithium niobate ( $\text{LiNbO}_3$ ) intensity modulator designed for optical communications at data rates up to 12.5 Gb/s.

The X-cut design of this Mach-Zehnder modulator confers it 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. Thanks to its low  $V_\pi$ , the MX-LN-10 is ideally suited for 10-12.5 Gb/s optical transmission with NRZ, RZ, DPSK, Duo Binary modulation formats and is also a key device for a large variety of applications.

## Performance Highlights

Parameter	Min	Typ	Max	Unit
Operating wavelength	1530	-	1580	nm
Insertion loss	-	2.7	-	dB
Electro-optical bandwidth	-	12	-	GHz
$V_\pi$ RF @50 kHz	-	4	-	V

Specifications given at 25 °C, 50  $\Omega$ , 1550 nm



## Electrical Characteristics 50 $\Omega$ 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	$\Delta S_{21}$	RF electrodes, $f < 12\text{GHz}$	-	0.5	1	dB
Electrical return loss	$ES_{11}$	RF electrodes	-	-12	-10	dB
$V_{\pi}$ RF @50 kHz	$V_{\pi RF_{50\text{ kHz}}}$	RF electrodes	-	4	5	V
$V_{\pi}$ RF @10 GHz PRBS	$V_{\pi RF_{10\text{ GHz}}}$	RF electrodes	-	4.7	5.7	V
$V_{\pi}$ DC electrodes	$V_{\pi DC}$	DC electrodes	-	4	5	V
RF input impedance	$Z_{in-RF}$	-	-	40	-	$\Omega$
DC input impedance	$Z_{in-DC}$	-	-	1	-	M $\Omega$

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

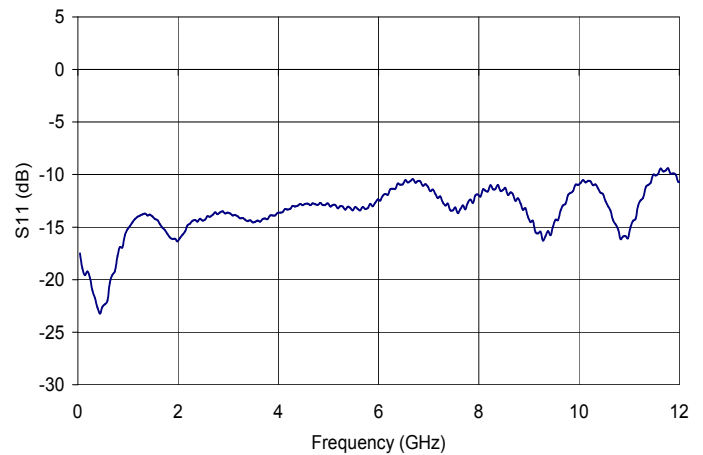
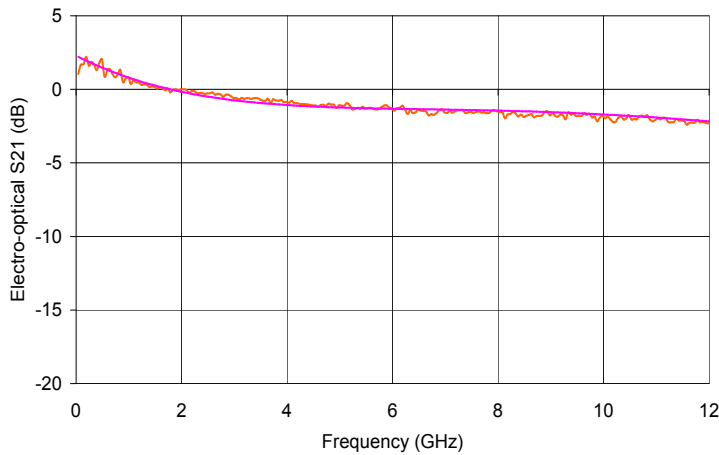
Parameter	Symbol	Condition	Min	Typ	Max	Unit
Crystal	-	-	Lithium Niobate X-Cut Y-Prop			
Operating wavelength	$\lambda$	-	1530	1550	1580	nm
Insertion loss	IL	Without connectors	-	3.5	5	dB
		Option Low IL, without connectors	-	2.7	3	dB
DC extinction ratio	ER	Measured with narrow source linewidth $< 200\text{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

## Absolute Maximum Ratings

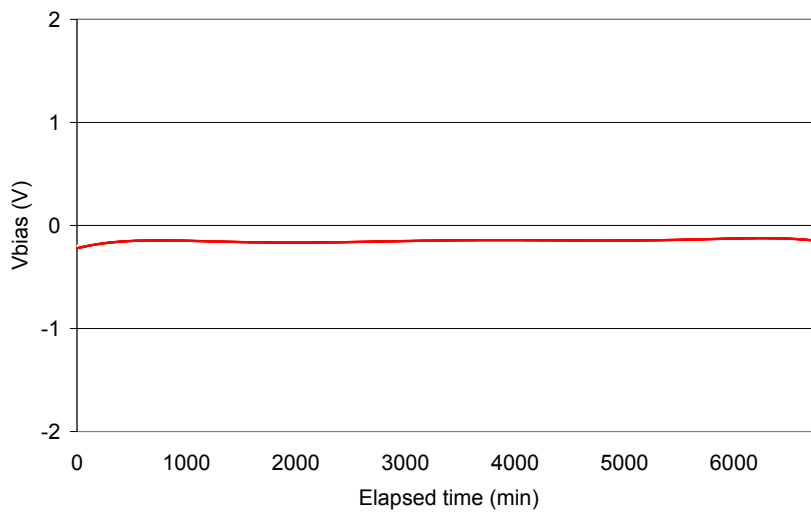
Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of the data sheet. Exposure to absolute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

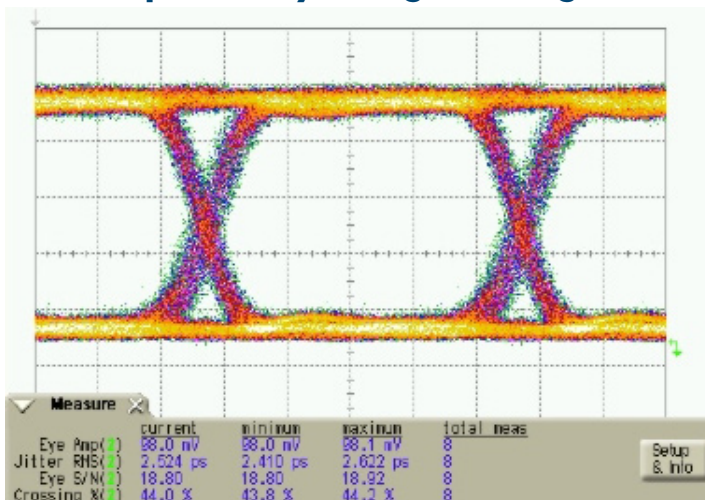
## Typical S21 & S11 Parameters Curves



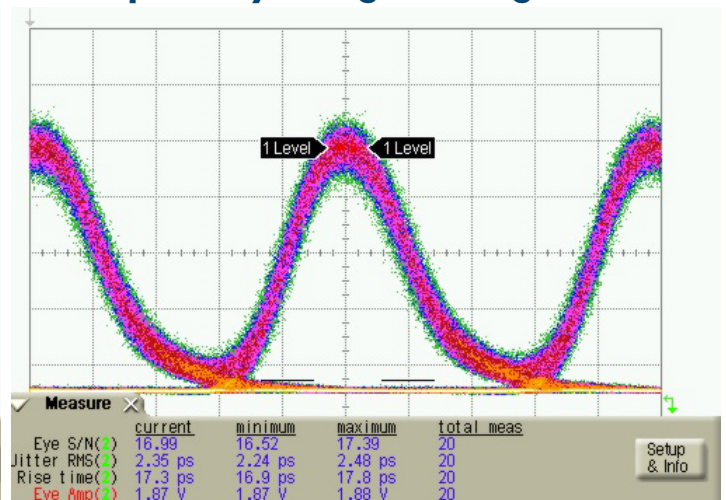
## Stability versus Time

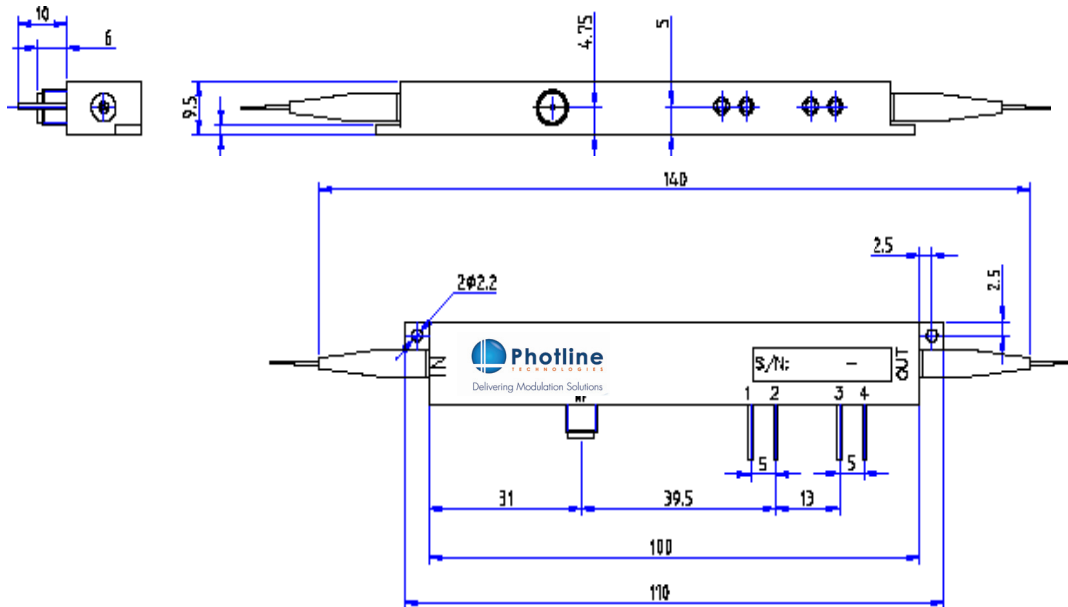


## 10 Gbps NRZ Eye Diagram diagram



## 10 Gbps RZ Eye Diagram diagram



**Mechanical Diagram and Pinout** All measurements in mm


Port	Function	Note
IN	Optical input port	1550 nm Polarization maintaining fiber, SM-15-P-8/125UV/UV400 length : 1.5 meter, buffer diameter : 900 um
OUT	Optical output port	1550 nm Polarization maintaining fiber, SM-15-P-8/125UV/UV400 length : 1.5 meter, buffer diameter : 900 um
RF	RF input port	Wilton 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

**Ordering information**
**MX-LN-10-XX-Y-Z-AB-CD**

BW = Bandwidth : 10 10 GHz

XX = Internal photodiode : 00 Not integrated PD PD Integrated

Y = Input fiber : P Polarisation maintaining S Standard single mode

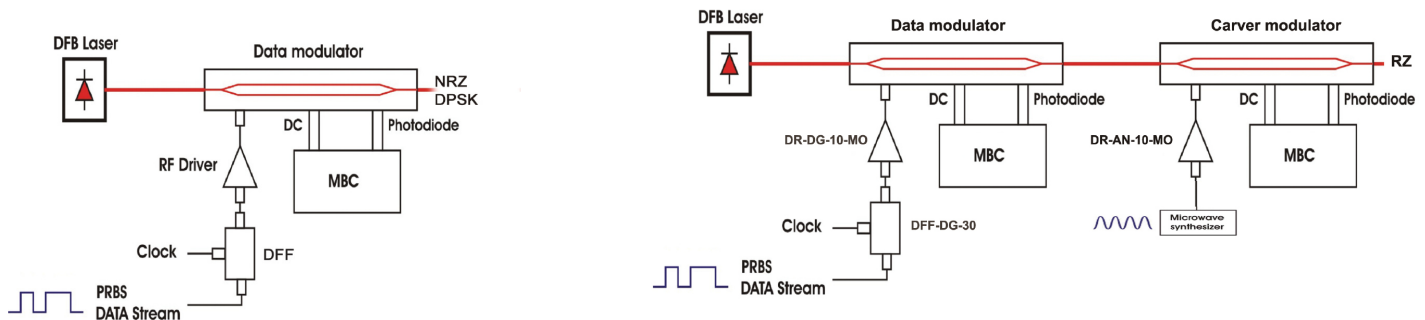
Z = Input fiber : P Polarisation maintaining S Standard single mode

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  $V_{\pi}$  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-DG-10-MO-RZ module is wideband RF amplifiers designed to drive optical modulators for RZ 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.



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

ModBoxes for 10 Gbps up to 40 Gb/s NRZ, RZ, DPSK, Stressed Eyes, Multi-channel, 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  $\text{LiNbO}_3$  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), RF drivers and modules, transmitters and modulation units.

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