MODULATOR

NIR-MX-LN series

1000 nm band Intensity Modulators

The NIR-MX-LN series are an intensity modulator especially designed for operation in the 1000 nm wavelength band.

This Mach-Zehnder modulator offers engineers working in the 1000 nm the intrinsic and unparalleled benefits of $LiNbO_3$ external modulation: high bandwidth, high contrast up to 30 dB and beyond, low insertion loss, high polarization extinction ratio, ease of use.



Like all Exail Near InfraRed (NIR) modulators, the NIR-MX series use a proton exchanged based waveguide process that confers them an unparalleled stability even when operating at high optical power up to 25 dBm.
The NIR-MX amplitude modulators come with high PER and Low IL options.

Features

- Optical Input Power capabiliy: 25 dBm
- Superior Extinction ratio > 30 dB
- X-cut for high stability
- Low drive voltage
- Low insertion loss

Applications

- Pulse generation / picking
- Carrier suppression
- Fiber optics sensors
- Pulse applications
- Analog transmission

Options

- Low insertion loss
- High polarization extinction ratio

Related Equipments

- RF amplifiers
- MBC-DG Automatic Bias Controllers
- Modbox-FE, PS, PG

NIR-MX-LN-10 Performance Highlights

Parameter	Min	Typ	Max	Unit
Operating wavelength	980	-	1150	nm
Insertion loss	-	3.5	-	dB
Insertion loss (with low IL option)	-	3	3.5	dB
Extinction ratio	-	30	-	dB
Electro-optical bandwidth	-	12	-	GHz
Vπ RF @10 GHz	-	4.5	-	V

Specifications given at 25 °C, 1060 nm

NIR-MX-LN-20 Performance Highlights

Parameter	Min	Typ	Max	Unit
Operating wavelength	980	-	1150	nm
Insertion loss	-	3.5	-	dB
Insertion loss (with low IL option)	-	3	3.5	dB
Extinction ratio	-	30	-	dB
Electro-optical bandwidth	-	18	-	GHz
Vπ RF @20 GHz	-	6	-	V

Specifications given at 25 °C, 1060 nm

NIR-MX-LN-40 Performance Highlights

Parameter	Min	Typ	Max	Unit
Operating wavelength	980	-	1150	nm
Insertion loss	-	3.5	4.5	dB
Extinction ratio	-	30	-	dB
Electro-optical bandwidth	-	30	-	GHz
Vπ RF @50 kHz	-	5	-	V

Specifications given at 25 °C, 1060 nm

NIR-MX-LN-10

12 GHz Intensity Modulator

Electrical Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Electro-optical bandwidth	S_{21}	RF electrodes, from 2 GHz	10	12	-	GHz
Rise time / Fall time	t_r / t_f	10 % - 90 % (1)	-	35 / 35		ps
Ripple S_{21}	ΔS_{21}	RF electrodes	-	0.5	1	dB
Electrical return loss	S_{11}	RF electrodes, f < 10 GHz	-	-12	-10	dB
Vπ RF @50 kHz	$V\pi_{RF\ 50\ kHz}$	RF electrodes	-	3.5	4.5	V
Vπ RF @10 GHz	$V\pi_{RF\ 10\ GHz}$	RF electrodes	-	4.5	5.5	V
Vπ DC electrodes	$V\pi_{DC}$	DC electrodes	-	4.5	5	V
RF input impedance	Z_{in-RF}	-	-	50	-	Ω
DC input impedance	Z_{in-DC}	-	-	1	-	MΩ

(1) Optical response to a perfect square shape electrical signal

Optical Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Crystal	-	-	Lithium Niobate X-Cut Y-Prop			
Operating wavelength	λ	-	980	1060	1150	nm
Insertion loss	IL	Standard, without connectors (3)	-	3.5	4.5	dB
Insertion loss (with low IL option)	LIL	Option, without connectors (3)	-	3	3.5	dB
DC extinction ratio	ER > 20	Measured @ 1060 nm by default, for other lambda (2) please contact us	20	-	-	dB
	ER > 25		25	-	-	dB
	ER > 30		30	-	-	dB
Polarization Extinction ratio	PER	Standard, without connectors (3)	20	-	-	dB
High Polarization Extinction ratio	HPER	Option, without connectors (3)	25	30	-	dB
Optical return loss	ORL	-	-40	-45	-	dB
Chirp	α	-	-0.1	0	0.1	-

(2) Exail can provide high extincion ratio modulator at 1030 nm, 1053 nm, 1060 nm and 1064 nm
(3) Consider an extra-loss up to 0.4 dB for each FC/APC optical connector

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}	-	25	dBm
Operating temperature	OT	0	+70	°C
Storage temperature	ST	-40	+85	°C

NIR-MX-LN-20

20 GHz Intensity Modulator

Electrical Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Electro-optical bandwidth	S_{21}	RF electrodes, from 2 GHz	16	18	-	GHz
Rise time / Fall time	t_r / t_f	10 % - 90 % (1)	-	20 / 20		ps
Ripple S_{21}	ΔS_{21}	RF electrodes	-	0.5	1	dB
Electrical return loss	S_{11}	RF electrodes, f < 18 GHz	-	-12	-10	dB
Vπ RF @50 kHz	$V\pi_{RF\ 50\ kHz}$	RF electrodes	-	3.5	4.5	V
Vπ RF @20 GHz	$V\pi_{RF\ 20\ GHz}$	RF electrodes	-	6	7	V
Vπ DC electrodes	$V\pi_{DC}$	DC electrodes	-	4.5	5	V
RF input impedance	Z_{in-RF}	-	-	50	-	Ω
DC input impedance	Z_{in-DC}	-	-	1	-	MΩ

(1) Optical response to a perfect square shape electrical signal

Optical Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Crystal	-	-	Lithium Niobate X-Cut Y-Prop			
Operating wavelength	λ	-	980	1060	1150	nm
Insertion loss	IL	Standard, without connectors (3)	-	3.5	4.5	dB
Insertion loss (with low IL option)	LIL	Option, without connectors (3)	-	3	3.5	dB
DC extinction ratio	ER > 20	Measured @ 1060 nm by default, for other lambda (2) please contact us	20	-	-	dB
	ER > 25		25	-	-	dB
	ER > 30		30	-	-	dB
Polarization Extinction ratio	PER	Standard, without connectors (3)	20	-	-	dB
High Polarization Extinction ratio	HPER	Option, without connectors (3)	25	30	-	dB
Optical return loss	ORL	-	-40	-45	-	dB
Chirp	α	-	-0.1	0	0.1	-

(2) Exail can provide high extincion ratio modulator at 1030 nm, 1053 nm, 1060 nm and 1064 nm
(3) Consider an extra-loss up to 0.4 dB for each FC/APC optical connector

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}	-	25	dBm
Operating temperature	OT	0	+70	°C
Storage temperature	ST	-40	+85	°C

NIR-MX-LN-40

40 GHz Intensity Modulator

Electrical Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Electro-optical bandwidth	S_{21}	RF electrodes, from 2 GHz	25	30	-	GHz
Rise time / Fall time	t_r / t_f	10 % - 90 % (1)	-	10 / 10		ps
Ripple S_{21}	ΔS_{21}	RF electrodes	-	0.5	1	dB
Electrical return loss	S_{11}	RF electrodes, f < 25 GHz	-	-15	-10	dB
Vπ RF @50 kHz	$V\pi_{RF\ 50\ kHz}$	RF electrodes	-	5	5.5	V
Vπ DC electrodes	$V\pi_{DC}$	DC electrodes	-	5	5.5	V
RF input impedance	Z_{in-RF}	-	-	50	-	Ω
DC input impedance	Z_{in-DC}	-	1	-	-	MΩ

(1) Optical response to a perfect square shape electrical signal

Optical Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Crystal	-	-	Lithium Niobate X-Cut Y-Prop, specific substrate			
Operating wavelength	λ	-	980	1060	1150	nm
Insertion loss	IL	Standard, without connectors (3)	-	3.5	4.5	dB
DC extinction ratio	ER > 20	Measured @ 1060 nm by default, for other lambda (2) please contact us	20	23	-	dB
	ER > 25		25	27	-	dB
	ER > 30		30	35	-	dB
Polarization Extinction ratio	PER	Standard, without connectors (3)	20	-	-	dB
High Polarization Extinction ratio	HPER	Option, without connectors (3)	25	30	-	dB
Optical return loss	ORL	-	-40	-45	-	dB
Chirp	α	-	-0.1	-	+0.1	-

(2) Exail can provide high extincion ratio modulator at 1030 nm, 1053 nm, 1060 nm and 1064 nm
(3) Consider an extra-loss up to 0.4 dB for each FC/APC optical connector

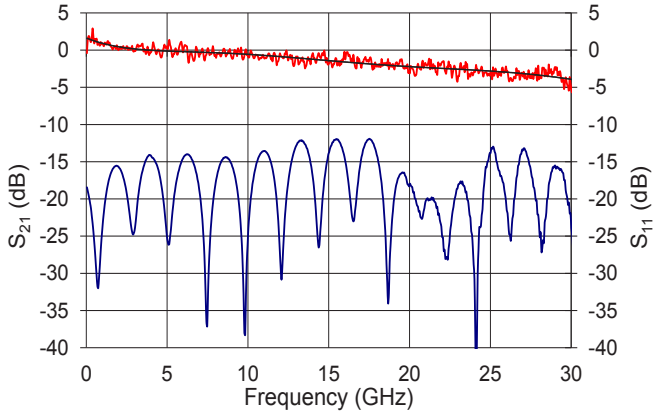
Absolute Maximum Ratings

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

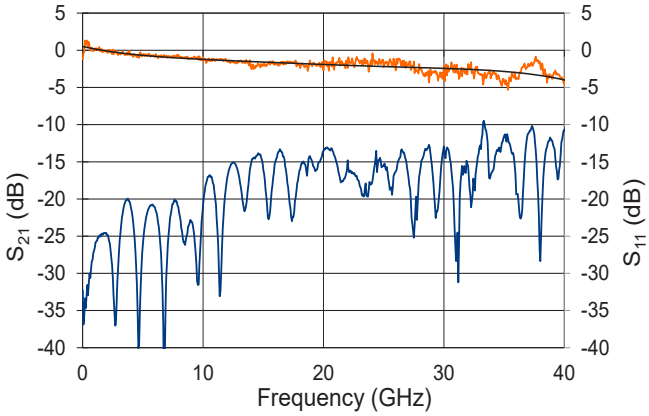
Parameter	Symbol	Min	Max	Unit
RF input power	EP_{in}	-	28	dBm
Bias Voltage	V_{bias}	-20	+20	V
Optical input power	OP_{in}	-	25	dBm
Operating temperature	OT	0	+70	°C
Storage temperature	ST	-40	+85	°C

NIR-MX-LN-10, 20 & 40

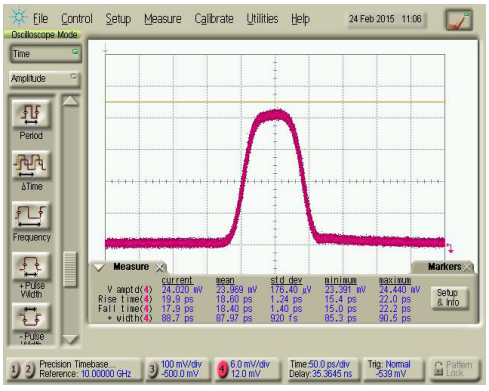
NIR-MX-LN-10 and NIR-MX-LN-20
S_{21} & S_{11} Parameter Curves



NIR-MX-LN-40
S_{21} & S_{11} Parameter Curves



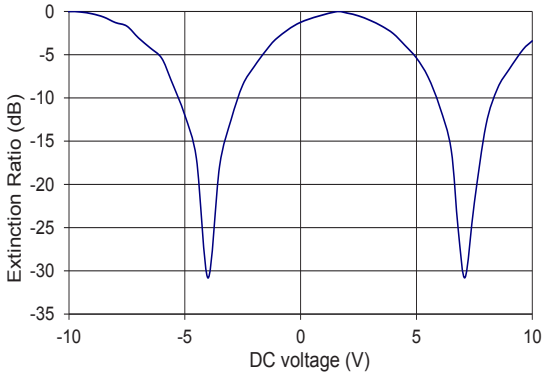
NIR-MX-LN-10 + DR-VE-10-MO: 100 ps Square Pulse generated



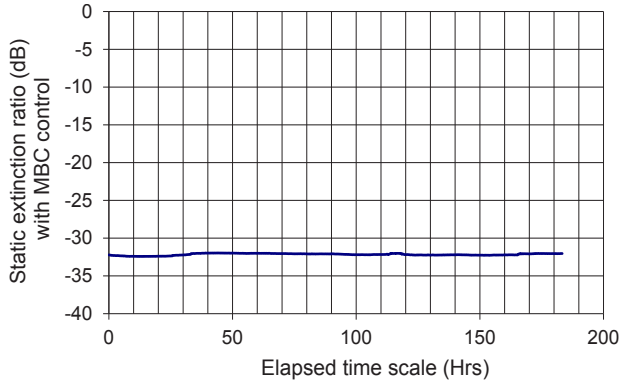
NIR-MX-LN-40 + DR-PL-20-MO: 30 ps Pulse generated



Extinction Ratio

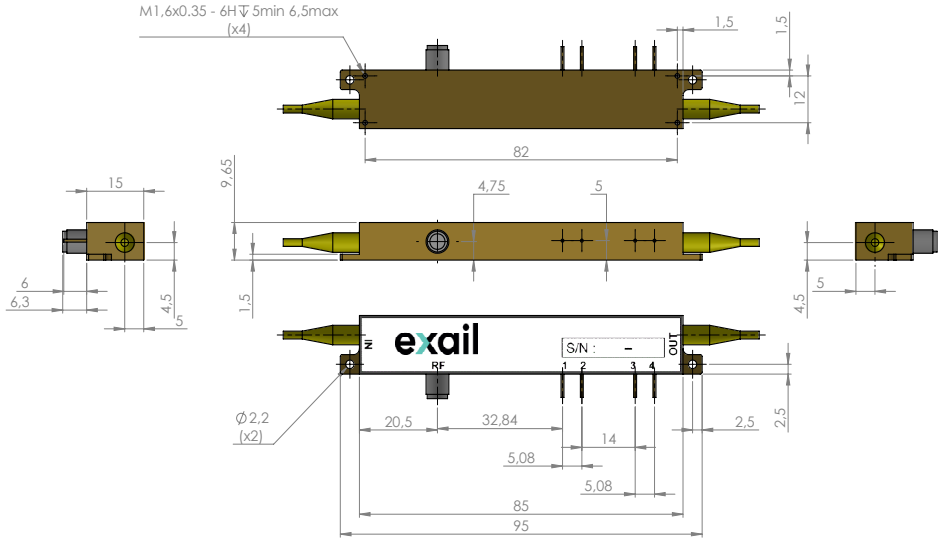


Stability with Time and Temperature
NIR-MX and MBC-DG-A3



Mechanical Diagram and Pinout

All measurements in mm



Port	Function	Note
IN	Optical input port	Polarization maintaining fiber Corning PM 98-U25D Length: 1.5 meter, buffer diameter: 900 µm
OUT	Optical output port	Polarization maintaining fiber Corning PM98-U25D Length: 1.5 meter, buffer diameter: 900 µm
RF	RF input port	Female K
1	Ground	Pin feed through diameter 1.0 mm
2	DC	Pin feed through diameter 1.0 mm
3, 4	Photodiode cathode, anode	Pin feed through diameter 1.0 mm

Ordering information

NIR-MX-LN -□-□-□-□-□-□-□-□

- Bandwidth : **10** (10 GHz), **20** (20 GHz), **40** (40 GHz)
- Internal photodiode: "PD": integrated, "00": not integrated (by default)
- Input fiber: P Polarization maintaining
- Output fiber: P Polarization maintaining
- Input connector: **00** (bare fiber), **FA** (FC/APC)
- Output connector: **00** (bare fiber), **FA** (FC/APC)
- Extinction ratio: **20** (20 dB), **25** (25 dB), **30** (30 dB)
- PER: High Polarization Extinction Ratio option
  LIL: Low Insertion Loss option (for **10** and **20** GHz)

09_2023_ED7 / 00023418-A / 00023624-A / 00023643-B