

## MODULATOR

# MPX and MPZ series

## Low frequencies to 40 GHz Phase Modulators

The MPX-LN and MPZ-LN series make up the most comprehensive range of electro-optic phase modulators available on the market for the 1550 nm wavelength band.

- The MPZ-LN series are ideally suited for wide bandwidth operation to 40 GHz. Dedicated modulators bandwidths are proposed for an efficient electrical to optical conversion.
- The MPX-LN-0.1 has a high impedance input optimized for modulation frequencies up to 300 MHz.

Designed using state-of-the-art and proven lithium niobate technology, MPX-LN and MPZ-LN phase modulators are easy to operate and to integrate. These modulators come with a comprehensive range of options (DC Coupled, Low  $V_{\pi}$ , Low Insertion Loss, Embedded POLarizer, High Electrical Power) to offer the highest performance for a wide range of applications from laboratory experiments to demanding industrial systems.



### Features

- Low to very wide EO bandwidth
- C & L bands
- Low  $V_{\pi}$
- Low insertion loss

### Applications

- Side bands generation
- Spectral Beam Combining (SBC)
- Coherent Beam Combining (CBC)
- Optical Frequency Combs
- Interferometric sensing
- Frequency shifting / broadening
- Quantum Key Distribution (QKD)
- Pound-Drever-Hall locking (PDH)
- High data rate telecommunications

### Options

- DC coupled
- Low residual modulation
- Low IL, High PER, Low  $V_{\pi}$  (LVP)
- High electrical input power (HEP)

### Related Equipments

- Matched RF amplifiers
- Coherent Beam Combining ModBox

### Low and Medium Bandwidth Phase Modulators Highlights <sup>(1)</sup>

Parameter	MPX-LN-0.1	MPZ-LN-01
Operating wavelength	1530 nm - 1625 nm	
Usable Electro-optical bandwidth	300 MHz	3 GHz
$V_{\pi}$ RF @50 kHz	3.5 V	3 V
Insertion loss	2.7 dB	2.5 dB

<sup>(1)</sup> Specifications given at 25 °C, 1550 nm

### Wide Bandwidth Low $V_{\pi}$ Phase Modulators Highlights <sup>(1)</sup>

Parameter	MPZ-LN-10	MPZ-LN-10-LVP
Operating wavelength	1530 nm - 1625 nm	1530 nm - 1580 nm
Usable electro-optical bandwidth	16 GHz	20 GHz
$V_{\pi}$ RF @50 kHz	4 V	3 V
Insertion loss	2.5 dB	3 dB

<sup>(1)</sup> Specifications given at 25 °C, 1550 nm

### Wide Bandwidth Phase Modulators Highlights <sup>(1)</sup>

Parameter	MPZ-LN-20	MPZ-LN-40
Operating wavelength	1530 nm - 1625 nm	
Usable electro-optical bandwidth	30 GHz	40 GHz
$V_{\pi}$ RF @50 kHz	4.5 V	6 V
Insertion loss	2.5 dB	2.5 dB

<sup>(1)</sup> Specifications given at 25 °C, 1550 nm

#### Ordering Information:

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Email orders to: [sales@xsoptix.com](mailto:sales@xsoptix.com)  
Fax orders to: 800-878-7282

# MPX-LN-0.1

Up to 300 MHz Phase Modulator

## Electrical Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Electro-optical bandwidth	$S_{21}$	-	-	150	-	MHz
Usabe electro-optical bandwidth	$S_{21}$	-	-	300	-	MHz
$V_{\pi}$ RF @50 kHz	$V_{\pi_{RF\ 50\ kHz}}$	-	-	3.5	4	V
RF Input Impedance	$Z_{in-RF}$	-	-	10 000	-	$\Omega$

## Optical Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Crystal	-	-	Lithium Niobate X-Cut Y-Prop			
Waveguide process	-	-	Ti diffusion			
Operating wavelength	$\lambda$	-	1530	1550	1625	nm
Insertion loss	IL	Without optical connectors <sup>(1)</sup>	-	2.7	3.5	dB
Optical return loss	ORL	-	-40	-45	-	dB

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

<sup>(1)</sup> Consider an extra-loss up to 0.25 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
Modulation voltage range	$EV_{in}$	-20	20	V
Optical input power	$OP_{in}$	-	20	dBm
Operating temperature	OT	0	+70	°C
Storage temperature	ST	-40	+85	°C

# MPZ-LN-01

Up to 3 GHz Phase Modulator

## Electrical Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Electro-optical bandwidth	$S_{21}$	-	1	1.5	-	GHz
Usable electro-optical bandwidth	$S_{21}$	-	-	3	-	GHz
Ripple $S_{21}$	$\Delta S_{21}$	-	-	0.5	-	dB
Electrical return loss	$S_{11}$	-	-	-15	-12	dB
V $\pi$ RF @50 kHz	$V_{\pi_{RF\ 50\ kHz}}$	-	-	3	3.5	V
V $\pi$ RF @1 GHz / 3 GHz	$V_{\pi_{RF\ 1\ GHz}}$	-	-	3.1 / 4.5	-	V
RF port impedance matching	$Z_{in-RF}$	-	-	50	-	$\Omega$
V $\pi$ DC electrodes	$V_{\pi_{DC}}$	DCC option, housing #B	-	3	6	V
DC port impedance matching	$Z_{in-DC}$	DCC option, housing #B	1	-	-	M $\Omega$

## Optical Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Crystal	-	-	Lithium Niobate Z-Cut X-Prop			
Waveguide process	-	-	Ti diffusion			
Operating wavelength	$\lambda$	-	1530	1550	1625	nm
Insertion loss	IL	Without optical connectors <sup>(1)</sup>	-	2.5	3.5	dB
Optical return loss	ORL	-	-40	-45	-	dB

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

<sup>(1)</sup> Consider an extra-loss up to 0.25 dB for each FC/APC optical connector.

## Absolute Maximum Ratings

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Parameter	Symbol	Condition	Min	Max	Unit
RF input power	$EP_{in}$	-	-	33	dBm
Optical input power	$OP_{in}$	-	-	20	dBm
Bias voltage	$V_{DCC}$	DCC option, housing #B	-15	+15	V
Operating temperature	OT	-	0	+70	°C
Storage temperature	ST	-	-40	+85	°C

# MPZ-LN-10

Up to 16 GHz Phase Modulator

## Electrical Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Electro-optical bandwidth	$S_{21}$	-	10	12	-	GHz
Usable electro-optical bandwidth	$S_{21}$	-	-	16	-	GHz
Ripple $S_{21}$	$\Delta S_{21}$	-	-	0.5	1	dB
Electrical return loss	$S_{11}$	-	-	-17	-14	dB
		HEP option	-	-14	-10	dB
$V_{\pi}$ RF @50 kHz	$V_{\pi_{RF\ 50\ kHz}}$	-	-	4	5	V
$V_{\pi}$ RF @10 GHz / 16 GHz	$V_{\pi_{RF\ 10\ GHz / 16\ GHz}}$	-	-	6 / 9	-	V
RF impedance matching	$Z_{in-RF}$	-	-	50	-	$\Omega$
$V_{\pi}$ DC electrodes	$V_{\pi_{DC}}$	DCC option, housing #B	-	4	7	V
DC port impedance matching	$Z_{in-DC}$	DCC option, housing #B	1	-	-	M $\Omega$

## Optical Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Crystal	-	-	Lithium Niobate Z-Cut Y-Prop			
Waveguide process	-	-	Ti diffusion			
Operating wavelength	$\lambda$	-	1530	1550	1625	nm
Insertion loss	IL	Without optical connectors <sup>(1)</sup>	-	2.5	3.5	dB
Low insertion loss option	LIL	Without optical connectors <sup>(1)</sup>	-	2	2.5	dB
Optical return loss	ORL	-	-40	-45	-	dB

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

<sup>(1)</sup> Consider an extra-loss up to 0.25 dB for each FC/APC optical connector

## Absolute Maximum Ratings

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Parameter	Symbol	Condition	Min	Max	Unit
RF input power	$EP_{in}$	-	-	28	dBm
High electrical input power option	$HEP_{in}$	HEP option	-	33	dBm
Optical input power	$OP_{in}$	-	-	20	dBm
Bias voltage	$V_{DCC}$	DCC option, housing #B	-15	+15	V
Operating temperature	OT	-	0	+70	°C
Storage temperature	ST	-	-40	+85	°C

# MPZ-LN-10-LVP

Up to 20 GHz Phase Modulator

## Electrical Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Electro-optical bandwidth	$S_{21}$	-	10	12	-	GHz
Usable electro-optical bandwidth	$S_{21}$	-	-	20	-	GHz
Ripple $S_{21}$	$\Delta S_{21}$	-	-	0.5	1	dB
Electrical return loss	$S_{11}$	-	-	-14	-10	dB
$V_{\pi}$ RF @50 kHz	$V_{\pi_{RF\ 50\ kHz}}$	LVP option, housing #C	-	3	4	V
$V_{\pi}$ RF @10 GHz	$V_{\pi_{RF\ 10\ GHz}}$	LVP option, housing #C	-	5	-	V
RF impedance matching	$Z_{in-RF}$	-	-	50	-	$\Omega$

## Optical Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Crystal	-	-	Lithium Niobate Z-Cut X-Prop			
Waveguide process	-	-	Ti diffusion			
Operating wavelength	$\lambda$	-	1530	1550	1580	nm
Insertion loss	IL	Without optical connector <sup>(1)</sup>	-	3	4	dB
Optical return loss	ORL	-	-40	-45	-	dB

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

<sup>(1)</sup> Consider an extra-loss up to 0.25 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	Condition	Min	Max	Unit
RF input power	$EP_{in}$	-	-	33	dBm
Optical input power	$OP_{in}$	-	-	20	dBm
Operating temperature	OT	-	0	+70	°C
Storage temperature	ST	-	-40	+85	°C

# MPZ-LN-20

Up to 30 GHz Phase Modulator

## Electrical Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Electro-optical bandwidth	$S_{21}$	RF electrodes, from 2 GHz	20	25	-	GHz
Usable electro-optical bandwidth	$S_{21}$	RF electrodes, from 2 GHz	-	30	-	GHz
Ripple $S_{21}$	$\Delta S_{21}$	-	-	0.5	1	dB
Electrical return loss	$S_{11}$	-	-	-12	-10	dB
$V_{\pi}$ RF @50 kHz	$V_{\pi_{RF\ 50\ kHz}}$	-	-	4.5	5.5	V
$V_{\pi}$ RF @20 GHz / 30 GHz	$V_{\pi_{RF\ 20\ GHz / 30\ GHz}}$	-	-	6.5 / 10	-	V
Impedance matching	$Z_{in-RF}$	-	-	50	-	$\Omega$

## Optical Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Crystal	-	-	Lithium Niobate Z-Cut Y-Prop			
Waveguide process	-	-	Ti diffusion			
Operating wavelength	$\lambda$	-	1530	1550	1625	nm
Insertion loss	IL	Without optical connectors <sup>(1)</sup>	-	2.5	3	dB
Optical return loss	ORL	-	-40	-45	-	dB

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

<sup>(1)</sup> Consider an extra-loss up to 0.25 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
Optical input power	$OP_{in}$	-	20	dBm
Operating temperature	OT	0	+70	°C
Storage temperature	ST	-40	+85	°C

# MPZ-LN-40

Up to 40 GHz Phase Modulator

## Electrical Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Electro-optical bandwidth	$S_{21}$	RF electrodes, from 2 GHz	30	33	-	GHz
Usable electro-optical bandwidth	$S_{21}$	RF electrodes, from 2 GHz	-	40	-	GHz
Ripple $S_{21}$	$\Delta S_{21}$	-	-	0.5	1	dB
Electrical return loss	$S_{11}$	-	-	-12	-9	dB
$V_{\pi}$ RF @50 kHz	$V_{\pi_{RF\ 50\ kHz}}$	-	-	6	7	V
$V_{\pi}$ RF @30 GHz	$V_{\pi_{RF\ 30\ GHz}}$	-	-	8.5	-	V
Impedance matching	$Z_{in-RF}$	-	-	50	-	$\Omega$

## Optical Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Crystal	-	-	Lithium Niobate Z-Cut Y-Prop			
Waveguide process	-	-	Ti diffusion			
Operating wavelength	$\lambda$	-	1530	1550	1625	nm
Insertion loss	IL	Without optical connectors <sup>(1)</sup>	-	2.5	3	dB
Optical return loss	ORL	-	-40	-45	-	dB

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

<sup>(1)</sup> Consider an extra-loss up to 0.25 dB for each FC/APC optical connector

## Absolute Maximum Ratings

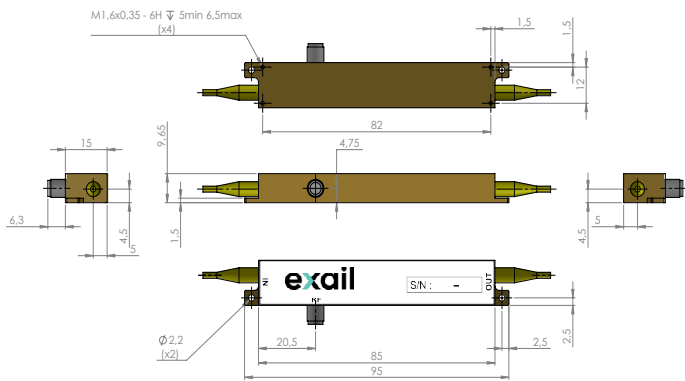
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Parameter	Symbol	Min	Max	Unit
RF input power	$EP_{in}$	-	28	dBm
Optical input power	$OP_{in}$	-	20	dBm
Operating temperature	OT	0	+70	°C
Storage temperature	ST	-40	+85	°C

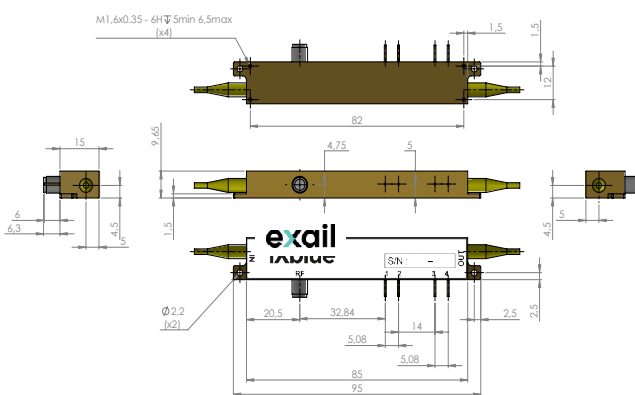
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## Mechanical Diagram and Pinout

All measurements in mm



Housing #A: Standard Modulator housing



Housing #B: Modulator housing with DCC



Housing #C: Modulator housing for the MPZ-LN-10-LVP

Port	Function	Note
IN	Optical input port	Polarization maintaining fiber 1550 nm Corning PM 15-U25D Length: 1.5 meter, buffer diameter: 900 μm
OUT	Optical output port	Polarization maintaining fiber 1550 nm, Corning PM 15-U25D Length: 1.5 meter, buffer diameter: 900 μm
RF	RF input port	Female K (SMA compatible) MPZ-LN-40: female 2.4 mm, compatible to mate with V / 1.85 mm
PINS 1 / 2	Ground / DC	Pin feed through diameter 1.0 mm - For DCC option with housing #B
PINS 3 / 4	Not connected / Not connected	Pin feed through diameter 1.0 mm - For DCC option with housing #B

## Ordering Information

MPX/MPZ-LN--00-----

- Bandwidth: **X-cut: 0.1** (150 MHz),  
**Z-cut: 01** (1 GHz), **10** (10 GHz), **20** (20 GHz), **40** (40 GHz)
- Input fiber: **P**olarisation maintaining Fiber
- Output fiber: **P**olarisation maintaining Fiber
- Input connector: **00** (bare fiber), **FA** (FC/APC)
- Output connector: **00** (bare fiber), **FA** (FC/APC)
- Embedded in-line POLarizer: **POL**
- High Electrical Power: **HEP** (for MPZ-LN-10)
- Low Insertion Loss: **LIL** (for MPZ-LN-10 only)
- DC Coupled: **DCC** (for MPZ-LN-01 and MPZ-LN-10 only)
- Low V<sub>π</sub> option: **LVP** (for MPZ-LN-10 only)

Exail reserves the right to change, at any time and without notice, the specifications, design, function or form of its products described herein.

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