



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

RELATED EQUIPMENTS

- RF amplifiers
- MBC-DG Automatic Bias Controllers
- ModBox-CBand-NRZ
- ModBox-CBand-PAM4
- ModBox-VNA-CBand

The MX-LN series are lithium niobate (LiNbO₃) intensity modulators designed for optical communications at data rates up to 44 Gb/s.

The X-cut design of these Mach-Zehnder modulators confer them an unmatched stability in a wide range of operational conditions, as well as a zero chirp performance. IXblue 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 44 Gb/s optical transmission with NRZ, RZ, DPSK, Duo Binary modulation formats and are key device for a large variety of high bandwidth applications.

MX-LN-10 Performance Highlights

| Parameter | Min | Typ | Max | Unit |
|-------------------------------------|------|-----|------|------|
| Operating wavelength | 1530 | - | 1625 | nm |
| Insertion loss | - | 3.5 | - | dB |
| Insertion loss (with low IL option) | - | 2.7 | 3 | dB |
| Electro-optical bandwidth | 10 | 12 | - | GHz |

Specifications given at 25 °C, 1550 nm

MX-LN-20 Performance Highlights

| Parameter | Min | Typ | Max | Unit |
|---------------------------|------|-----|------|------|
| Operating wavelength | 1530 | - | 1625 | nm |
| Insertion loss | - | 3.5 | - | dB |
| Electro-optical bandwidth | 20 | 25 | - | GHz |
| V _π RF @50 kHz | - | 5 | - | V |

Specifications given at 25 °C, 1550 nm

MX-LN-40 Performance Highlights

| Parameter | Min | Typ | Max | Unit |
|---------------------------|------|-----|------|------|
| Operating wavelength | 1530 | - | 1625 | nm |
| Insertion loss | - | 3.5 | - | dB |
| Electro-optical bandwidth | 28 | 30 | - | GHz |
| V _π RF @50 kHz | - | 5 | - | V |

Specifications given at 25 °C, 1550 nm

MX-LN-10

10 GHz Intensity modulator

Electrical Characteristics

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|----------------------------|-------------------------------|-----------------------------|-----|-----|-----|------------|
| Electro-optic bandwidth | S_{21} | RF electrodes, from 2 GHz | 10 | 12 | - | GHz |
| Ripple S_{21} | ΔS_{21} | RF electrodes, $f < 12$ GHz | - | 0.5 | 1 | dB |
| Electrical return loss | S_{11} | RF electrodes | - | -12 | -10 | dB |
| V_{π} RF @50 kHz | $V_{\pi RF_{50\text{ kHz}}}$ | RF electrodes, @1550 nm | - | 5.5 | 6.5 | V |
| V_{π} RF @10 Gb/s PRBS | $V_{\pi RF_{10\text{ Gb/s}}}$ | RF electrodes, @1550 nm | - | 6.5 | 7 | V |
| V_{π} DC electrodes | $V_{\pi DC}$ | DC electrodes | - | 6.5 | 7 | V |
| RF input impedance | Z_{in-RF} | - | - | 50 | - | Ω |
| DC input impedance | Z_{in-DC} | - | - | 1 | - | M Ω |

50 Ω RF input

Optical Characteristics

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|-------------------------------------|-----------|---|------------------------------|------|------|------|
| Crystal | - | - | Lithium Niobate X-Cut Y-Prop | | | |
| Operating wavelength | λ | - | 1530 | 1550 | 1625 | nm |
| Insertion loss | IL | Without connectors | - | 3.5 | - | dB |
| Insertion loss (with low IL option) | LIL | 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 | - |

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

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 | 20 | 25 | - | GHz |
| Ripple S_{21} | ΔS_{21} | RF electrodes, $f < 20$ GHz | - | 0.5 | 1 | dB |
| Electrical return loss | S_{11} | RF electrodes | - | -12 | -10 | dB |
| $V\pi$ RF @50 kHz | $V\pi_{RF_{50\text{ kHz}}}$ | RF electrodes, @1550 nm | - | 5 | 5.5 | V |
| $V\pi$ RF @20 Gb/s PRBS | $V\pi_{RF_{20\text{ Gb/s}}}$ | RF electrodes, @1550 nm | - | 5.5 | 6 | V |
| $V\pi$ DC electrodes | $V\pi_{DC}$ | DC electrodes | - | 6.5 | 7 | V |
| RF input impedance | Z_{in-RF} | - | - | 50 | - | Ω |
| DC input impedance | Z_{in-DC} | - | - | 1 | - | M Ω |

50 Ω RF input

Optical Characteristics

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|----------------------|-----------|---|------------------------------|------|------|------|
| Crystal | - | - | Lithium Niobate X-Cut Y-Prop | | | |
| Operating wavelength | λ | - | 1530 | 1550 | 1625 | nm |
| Insertion loss | IL | Without connectors | - | 3.5 | 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 | - |

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

Absolute Maximum Ratings

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| 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 S_{21} | ΔS_{21} | RF electrodes, $f < 30$ GHz | - | 0.5 | 1 | dB |
| Electrical return loss | S_{11} | RF electrodes | - | -12 | -10 | dB |
| $V\pi$ RF @50 kHz | $V\pi_{RF_{50\text{ kHz}}}$ | RF electrodes, @1550 nm | - | 5 | 6 | V |
| $V\pi$ DC electrodes | $V\pi_{DC}$ | DC electrodes, @1550 nm | - | 6.5 | 7 | V |
| RF input impedance | Z_{in-RF} | - | - | 50 | - | Ω |
| DC input impedance | Z_{in-DC} | - | 1 | - | - | M Ω |

50 Ω RF input

Optical Characteristics

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|----------------------|-----------|---|------------------------------|------|------|------|
| Crystal | - | - | Lithium Niobate X-Cut Y-Prop | | | |
| Operating wavelength | λ | - | 1530 | 1550 | 1625 | nm |
| Insertion loss | IL | Without connectors | - | 3.5 | 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 | - |

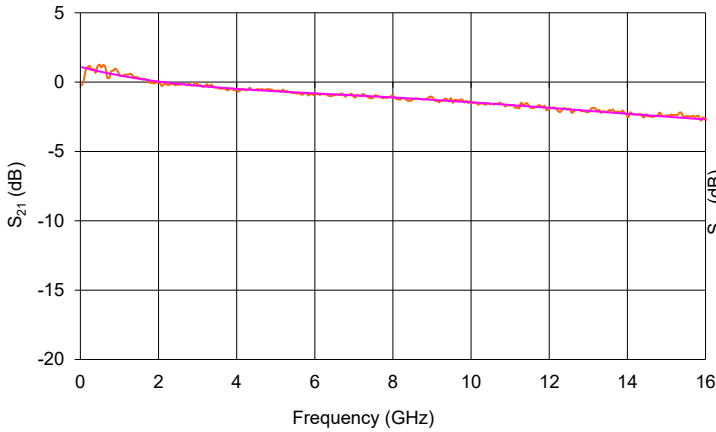
All specifications given at 25 °C, 1550 nm, unless different specified

Absolute Maximum Ratings

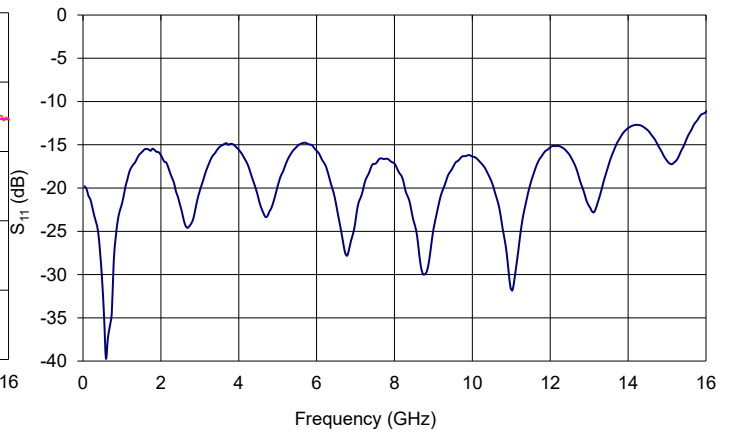
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| Parameter | Symbol | Min | Max | Unit |
|-----------------------|------------|-----|-----|------|
| RF input power | EP_{in} | - | 28 | dBm |
| Bias voltage | V_{bias} | -20 | +20 | V |
| Optical input power | OP_{in} | - | 20 | dBm |
| Operating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

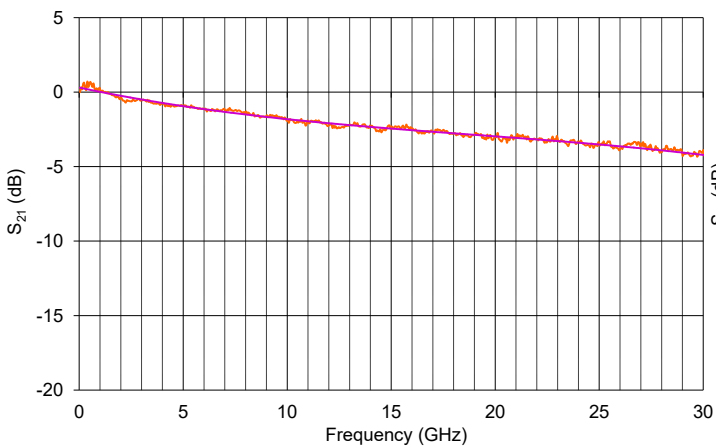
MX-LN-10 Typical S_{21} Curve



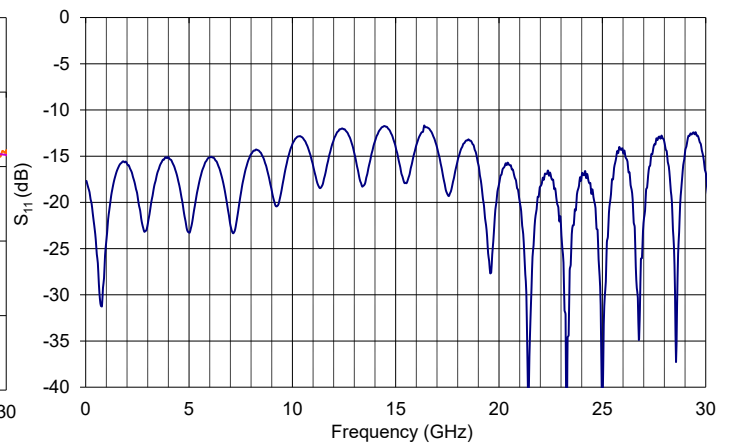
MX-LN-10 Typical S_{11} Curve



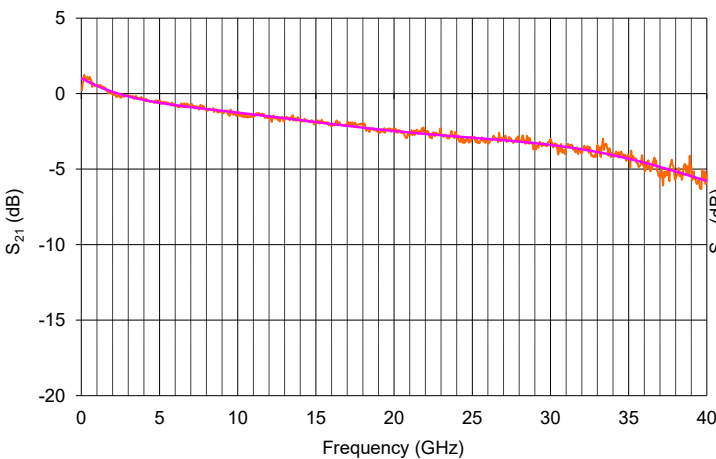
MX-LN-20 Typical S_{21} Curve



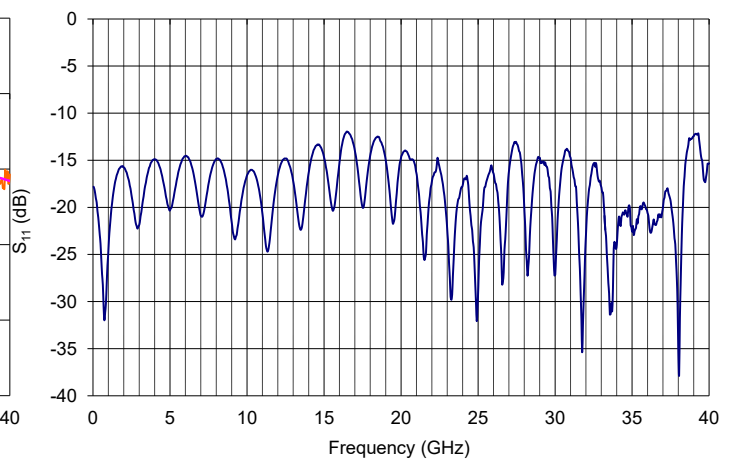
MX-LN-20 Typical S_{11} Curve



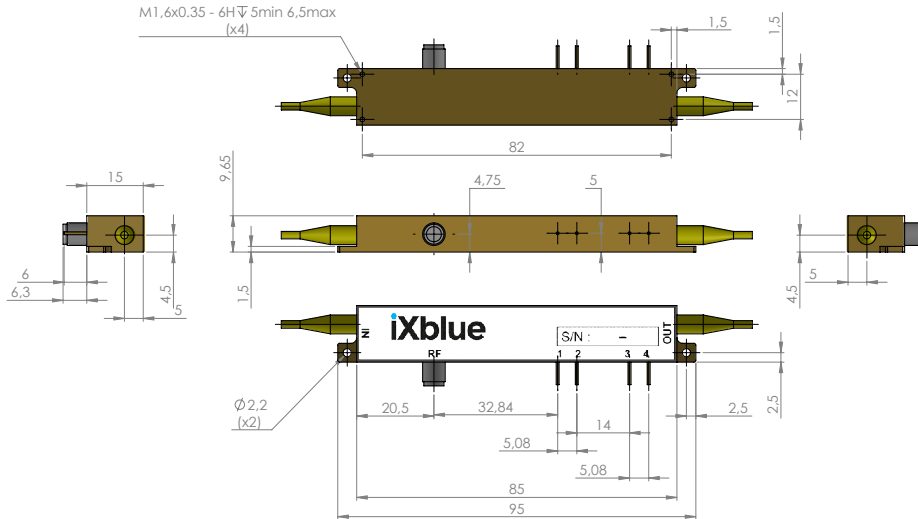
MX-LN-40 Typical S_{21} Curve



MX-LN-40 Typical S_{11} Curve



Mechanical Diagram and Pinout
All measurements in mm



| Port | Function | Note |
|------|---------------------------|---|
| IN | Optical input port | Polarization maintaining fiber, Corning PM 15-U25D, Length 1.5 meter. Buffer diameter 900 mm |
| OUT | Optical output port | Polarization maintaining fiber, Corning PM 15-U25D, Length 1.5 meter. Buffer diameter 900 mm |
| RF | RF input port | MX-LN-10: Wiltron female K (SMA compatible) MX-LN-20: Wiltron female K or V (optional) MX-LN-40: Wiltron female V |
| 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

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

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

About us

ixblue Photonics produces specialty optical fibers and Bragg gratings based fiber optics components and provides optical modulation solutions based on the company lithium niobate (LiNbO₃) modulators and RF electronic modules.

ixblue Photonics serves a wide range of industries: sensing and instruments, defense, telecommunications, space and fiber lasers as well as research laboratories all over the world.