

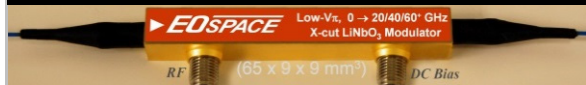
2017

Advanced Products

λ (0.65, 0.78, 0.85, 0.98, 1.06, 1.3, 1.55, 1.7, 2.0⁺ μm)

- **Low-V π** : 1x1, 1x2, 2x2 X-cut (zero-chirp) **20 & 40 & 60⁺ GHz Compact Modulators**
- **Low-V π** : Intensity & Phase Modulators (<4V, <3.5V, <3V, custom <2.5V)
- **Low-V π** : **QPSK (I/Q) Dual-Parallel Nested-MZM X-cut Modulators**
- 1x1, 1x2 **Dual-Drive Low-V π** (<2.5V/side) 10 & 20 & 40⁺ GHz Modulators
- Custom: **Extremely-High Extinction-ratio** (>30, >40, >50, >60dB) Modulators
- Custom: **High power-handling** Modulators: λ 1.55 μm (>1W); λ 1.06 μm (>1/2W); **0.8 μm** (please call)
- Custom: **Extremely-High temperature-handling** Modulators: **-55 $^{\circ}\text{C}$ \rightarrow > +150 $^{\circ}\text{C}$**
- Custom: **Ultra-wideband (DC \rightarrow 60⁺GHz; DC \rightarrow 110⁺GHz) LiNbO₃ Modulators**
- Custom: **Y-branch 1x2 Phase** modulator
- Custom: **Ultra-compact** LiNbO₃ modulators
- Custom: Electro-optic LiNbO₃ components

65 x 8.9 x 8.9 mm³



Low-V π 1x1, 1x2, 2x2 X-cut (0-chirp) Compact Modulators

- **20G** version: Low-V π ~ 3.5-3.8V@1GHz; >20-25GHz; <4dB (<3dB option)
- **40G** version: Large BW ~ 30-40GHz; V π ~ 4.5-4.9V@1GHz; <4dB (<3dB option)
- **Extended frequency** operation versions (to >60/70GHz) available

for High-Dynamic-Range 0 \rightarrow 20/40/60⁺ GHz RF Fiber Optic Links
65x9x9mm³ with 2.9mm connector; thinner 65x5x9mm³ with GPPO



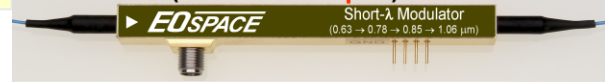
Low-V π QPSK (I/Q) Dual-Parallel MZM (X-cut Single-Drive)

- **25⁺ Gbaud** version: Low-V π ~ 2.9-3.3V@1GHz; >20-25GHz; Excess Loss: <4dB
- **50 Gbaud** version: >30-35GHz; V π ~ 3.9-4.3V@1GHz; Excess Loss: <4dB

Short- λ : 0.65 \rightarrow 0.78 \rightarrow 0.85 \rightarrow 0.98 \rightarrow 1.06 μm Phase & Intensity

- 10 & 20 & 40GHz, V π : <4V, <3V & <2V, Insertion loss: <4, <3 & 2dB-custom
- **High-Extinction-Ratio** versions (λ =1.06 μm : 30, 40 & 50dB)

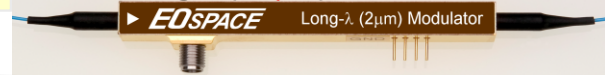
Short- λ (0.63 \rightarrow 1.06 μm) Modulators



Long- λ : 2 μm Intensity & Phase Modulators (10 & 20 & 40⁺GHz)

- Insertion loss: <4dB, 3dB & (2dB - custom)
- V π : Intensity modulator: <7V, (5V-opt.); Phase Modulator: V π <10V, (7V-opt.)

Long- λ (2⁺ μm) Modulator



10 & 20 & 40 & 60⁺ GHz Phase Modulators

- **Ultra-Low-V π** version: ~3V@1GHz, >20GHz, <4 & <3dB
- **Extra-Bandwidth** version: ~4V@1GHz, >30GHz, <4 & <3dB
- **Ultra-Low-Loss** version: <2dB & <3dB, <5V@1GHz, 10&20GHz

40/60⁺ GHz (Z-cut & X-cut) Modulators

- **Z-cut: Pre-chirp**
 - V π ~ 3.5V@1GHz, BW >30-40GHz, <4dB, (<3dB option)
- **X-cut: Zero-chirp**
 - V π <4.5V@1GHz, BW >30-40GHz, <5dB, <4dB & (<3dB option)

Low-V π (<2.5V/side) Dual-Drive (10/20/40GHz) Modulator

10 & 20⁺ Gb/s (Z-cut & X-cut) Modulators

- **Z-cut: Pre-chirp: Low-Loss <3dB, (<2dB option)**
 - BW >12.5GHz, (>18GHz version); V π <5V, <4V@1GHz
 - Lower-V π versions: V π <3.5V@1GHz; <3V, <2.5V (custom)
- **X-cut: Zero-chirp: Low-Loss <4dB, (<3dB option)**
 - BW >12.5GHz, (>18GHz version); V π <5, <4.5V@1GHz
 - Lower-V π versions: V π <4V@1GHz; <3V, <2.5V (custom)

Other available : • 1x2 (& 2x2) Dual-Outputs • Dual- λ : 1300/1550nm • Integrated PD • Ultra-High-Power Handling (>1W, >2W) device versions : • High Extinction-Ratio (>30 & >40 & >50 & >60dB) • Extended Temperature Range (-40 $^{\circ}$ & -55 $^{\circ}\text{C}$ \rightarrow +100 $^{\circ}\text{C}$)

General Polarization Control, Tracking, Scrambling



High-speed Polarization Controllers

- Low Insertion Loss <3dB, (~2dB option)
- Multiple Integrated Device Stages: 1, 3, 4, 6, 8

High-speed 1x2, 2x2, 1xN, NxN Switches

Single-Polarization (SP) or Polarization-Independent (PI)



1x8 SP Switches

1x2 (2x2) SP switch



1x2 (2x2) PI switch