

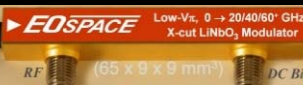
2019

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** : Phase / X-, Z-cut 1x1, 1x2, 2x2 20 & 40 & 60+ GHz Intensity Modulators
- **Low- V_π** : Intensity & Phase Modulators (<4V, <3.5V, <3V, custom <2.5V, ~2V)
- **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+ & 60+ 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°C → > +150°C
- Custom: **Ultra-wideband** (DC → 60+GHz; DC → 110+GHz) LiNbO_3 Modulators
- Custom: **Y-branch 1x2 Phase** modulator
- Custom: **Ultra-compact** LiNbO_3 modulators
- Custom: Application-specific LiNbO_3 components

65 x 8.9 x 8.9 mm³



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



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+GHz) available

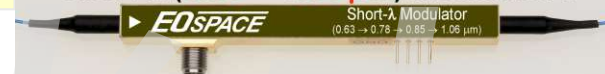
Low- V_π QPSK (I/Q) Dual-Parallel MZM (X-cut Single-Drive)

- 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 → 0.78 → 0.85 → 0.98 → 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)

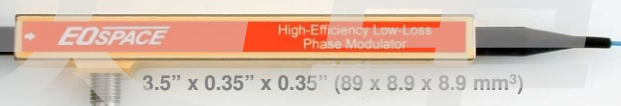
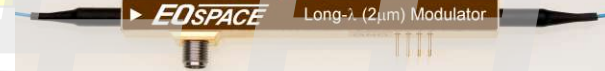
Short- λ (0.63 → 1.06 μm) Modulators



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
- **Very-Low-Loss** version: <2dB & <3dB, <5V@1GHz, 10&20GHz
- **Extended frequency of operation** option: >50, >60, >65GHz

40/60+ GHz (Z-cut & X-cut) Modulators

- V_π ~ 4.5V@1GHz, ~30-40GHz, ~4dB (~3dB-opt)
- **Lower- V_π Options**: ~4.0V & ~3.5V, ~25-35GHz, <4dB, (<3dB-option)
- **Extended frequency of operation**: >50, >60, >65 GHz
- **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° & -55°C → +100°C)

General Polarization Control, Tracking, Scrambling



High-speed Polarization Controllers

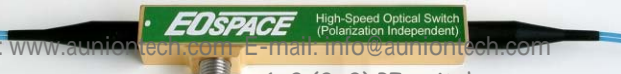
- Low Insertion Loss <3dB, (~2dB option)
- Multiple Integrated Device Stages: 1, 3, 4, 6, 8

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

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



1x2 (2x2) SP switch



1x2 (2x2) PI switch

1x8 SP Switches