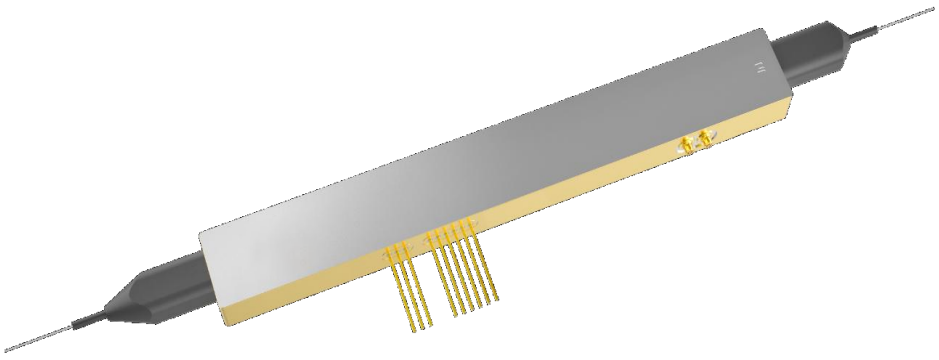
C-Band 40 GHz QPSK (IQ) $LiNbO_3$ Modulator

40 GHz QPSK



GKER 40 GHz QPSK modulator design is based on a dual parallel structure of two Mach-Zehnder modulators (DP-MZM) embedded in a Mach Zehnder Super-Structure. Each internal modulator is designed to have EO bandwidth above 20 GHz. Monitor photodiode is provided for automatic bias control (ABC).

Key Features

- Nested Mach-Zehnder Modulators
- X-Cut Lithium Niobate
- Operating at 1525 - 1570 nm
- High Bandwidth operating > 30 GHz
- High Extinction Ratio
- Low Optical Insertion Loss
- Excellent Linearity

Applications

- OFDM Coding
- QPSK Coding
- QAM Coding
- CS-SSB (Carrier Suppressed Single Side Band)
- FMCW LiDAR

Absolute Maximum Ratings

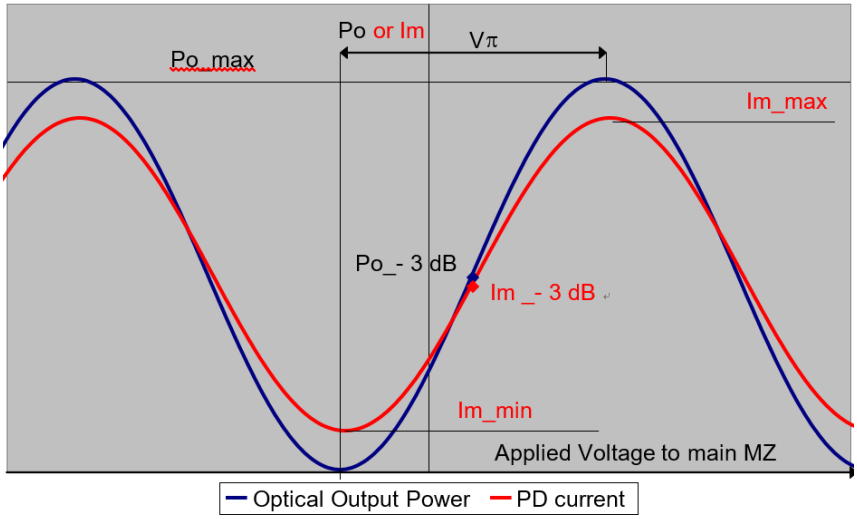
Parameters	Operating Conditions [1]	Min.	Max.	Unit
Maximum Input Power (Electrical)	RF port AC coupled	-	10	V_{pk-pk}
Maximum Input Power (Optical)	CW	-	100	mW
DC Voltage at DC port	-	- 40	40	V
Monitor Photodiode Reverse Current	-	-	< 2	mA
Monitor Photodiode Forward Current	-	-	< 10	mA
Monitor Photodiode Reverse Voltage	-	-	< 15	V
Operating Case Temperature	-	- 5	+ 75	°C
Maximum T_{op} Variation Rate	-	-	5	°C/min
Storage Temperature	-	-	+ 85	°C
Operating Humidity	Non-Condensing	5	85	%
Leads Soldering Temperature	-	-	250	°C
Leads Soldering Time	-	-	10	s

Specifications

Characterisitcs	Operating Conditions [1]	Min	Typical	Max	Unit
Optical					
Operating Wavelength Range	-	1525	-	1570	nm
Insertion Loss, IL [2]	EOL, - 5 ~ + 75 ℃, over C-Band	-	5.0	7.0	dB
Phase-MZI Optical Extinction Ratio	Measured @ DC	24	-	-	dB
RF-MZI Optical Extinction Ratio	Measured @ DC	24	29	-	dB
PER	-	20	-	-	dB
Optical Return Loss, RL	Input & Output	40	-	-	dB
Electrical RF Ports					
RF-MZI V_{π}	@ 1 kHz	-	5.0	7.0	V
RF-MZO - 3 dB E/O Bandwidth	wrt. 2 GHz	20	23	-	GHz
RF-MZI S_{21} Flatness	300 MHz - 20 GHz	- 1	-	1	dB
Amplitude difference between RF-MZIs (Difference between S_{21}s)	-	- 1	-	1	dB
RF Delay between RF-MZIs	-	- 5	-	5	ps
RF-MZI Electrical Return Loss S11	40 MHz - 17 GHz 17 GHz - 30 GHz	10 8	12 10	- -	dB

Characterisitcs	Operating Conditions [1]	Min	Typical	Max	Unit
Electrical Bias Ports [4]					
RF MZI Bias V_π Voltage	@ 1 kHz	-	7	8	V
Phase MZI Bias V_π Voltage	@ 1 kHz	-	7	8	V
RF and Phase MZI Bias V_π Voltage variation over Wavelength	C-Band wrt 1550 nm	- 5	-	5	%
Bias port impedance	@ DC	1	-	-	MΩ
Monitor Photodiode [5]					
Responsivity [6]	-	20	-	120	mA/W
Linearity	-	- 10	-	10	%
Phase Error [7][8]	PD is not inverting	- 5	-	5	Degree

(1) T_{op} = 25 ℃, BOL, wavelength at 1550 m, unless otherwise specified.
(2) Insertion loss has to be measured at the maximum of the modulator's transfer function, and exclude connectors
(3) Test set up to be agreed.
(4) Each bias section has two control pins: to ensire EOL bias voltage range, during operation, bias electrode of all MZs should be supplied with differential voltage.
(5) Single PD monitors overall output.
(6) PD responsivity definition (see also picture below)
- Inner MZs set to maximum transmission.
- The voltage is applied to the outer (phase) MZ
- Responsivity: R = (Im_- 3 dB) / (Pout_- 3 dB)
- Im_ - 3 dB is the photodiode current when output optical power is - 3 dB from maximum.
- Pout_- 3 dB is the output optical power at - 3 dB from maxximum.

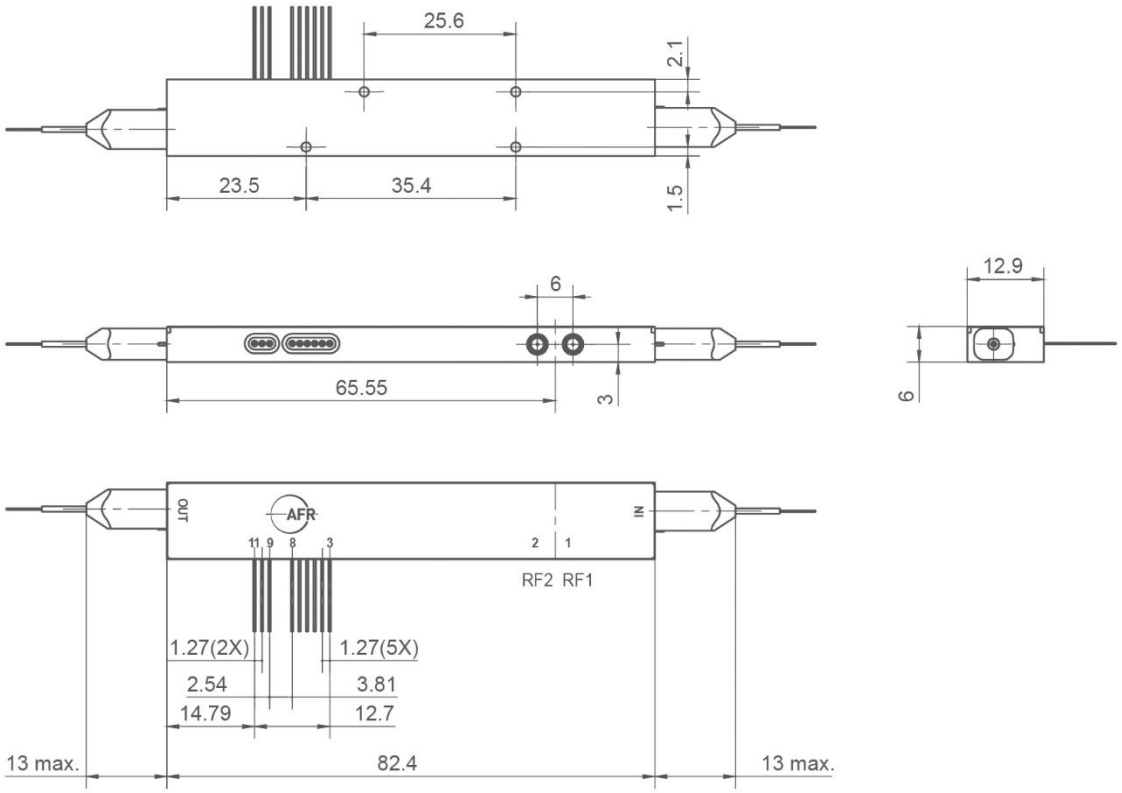


(7) The PD phase error is the difference (in modulator phase) between the maximum/minimum of the PD output and the maximum/minimum of the modulator optical output.
(8) PD phase error of ± 5° correspond to a phase error of ± 2.8%.

Pin-Out and Fiber Specifications

RF Connector	SMPM male
Bias Ports	DC pins
Input Fiber	Polarization Maintaining Fiber, PMF - Panda (Corning/Fujikura PM15-U25D), 900 µm loose tube, > 1.5 m
Output Fiber	Polarization Maintaining Fiber, PMF - Panda (Corning/Fujikura PM15-U25D), 900 µm loose tube, > 1.5 m
Minimum Bending Radius of Fiber	15 mm

Mechanical Outline



All dimension measured in mm.

Pin-Out Information

Pin	Name/Description	Note	Pin	Name/Description	Note
1	RF. 1	RF Input (SMPM male)	7	Bias PH+	Bias Phase +V
2	RF. 2	RF Input (SMPM male)	8	Bias PH-	Bias Phase -V
3	BIAS 2+	Bias wrt RF.2 +V	9	PD Cathode	-ve
4	BIAS 2-	Bias wrt RF.2 -V	10	PD Anode	+ve
5	BIAS 1+	Bias wrt RF.1 +V	11	GND	Ground
6	BIAS 1-	Bias wrt RF.1 -V			

Note: The pin# 3&4, 5&6, 7&8 pin pair doesn't need to be exact as above table, but any pin pair just need to be of opposite voltage.

Electrostatic Discharge (ESD)

Caution : Use of controls or adjustments or performance of procedures other than those specified herein may result in electrical component failure.

RoHS Compliance

GKER is fully committed to environment protection and sustainable development and has set in place a comprehensive program for removing polluting and hazardous substrates from all of its products. This product is RoHS compliant.

Reliability Requirements

This modulator is designed to meet Telcordia GR-468-Core requirements and hermetically sealed.

Ordering Information:

For more information on this product, optional optical connectors and their availability, please contact us.

Product Description	Part Number
40G QPSK, C-Band 40 GHz QPSK (IQ) LiNbO3 modulator (PM fiber, 900 µm loose tube, > 1.5 m, no connectors)	792001590