Test Data Sheet

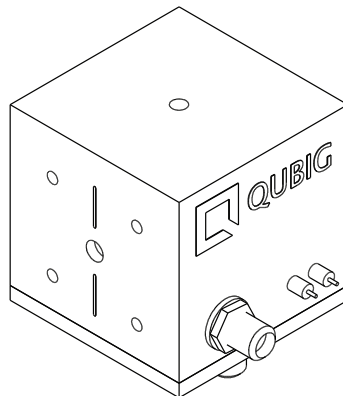**EO-F25L3-DC**

S/N:

Resonant electro-optic phase modulator

with
- temperature sensor (NTC)
- thermal crystal mount
- DC port (SMA)

RF properties	Value	Unit
Resonance frequency: f_0 [1]	25.1	MHz
Preset frequency: f_{set} [1]	25.1	MHz
RF Bandwidth: Δν_RF	367	kHz
Quality factor: Q	68	
Required RF power for 1rad @ 1070nm [2]	20	dBm
max. RF power: RF_{max} [3]	1	W

DC properties	Value	Unit
DC Bandwidth: Δν_DC (-3dB)	10	kHz
Required DC voltage for π rad (PM) @ 1070nm	347	V
max. DC voltage: V_{max}	500	V
Input capacitance (DC)	2	nF

Optical properties		
EO crystal	LN	
Aperture	3x3	mm²
Wavefront distortion (633nm)	< λ/6	nm
recommended max. optical intensity (1070nm)	< 20	W/mm²
AR coating (R_{avg}<0.5%)	1.0 - 1.7	um

[1] at 24.3°C   [2] with 50Ω termination   [3] no damage with RF_{in} < 2W

Fig. 1: Oscilloscope trace

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f_0 = 25.1 MHz
β = 1.42 rad
λ_{test} = 671 nm
RF_{in} = 18.5 dBm

Modulation frequency [MHz]

Intensity [arb. units]
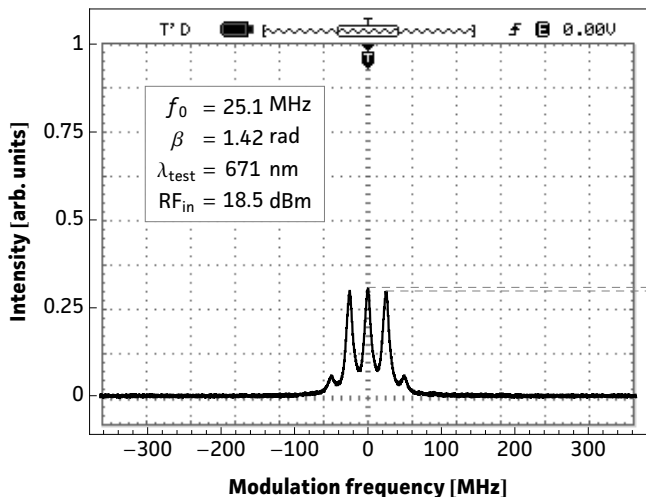
Fig. 2: Carrier/sideband ratio

Bessel Fct.

— $|J_0|^2$
— $|J_1|^2$
— $|J_2|^2$

Modulation depth β [rad]

Intensity [arb. units]
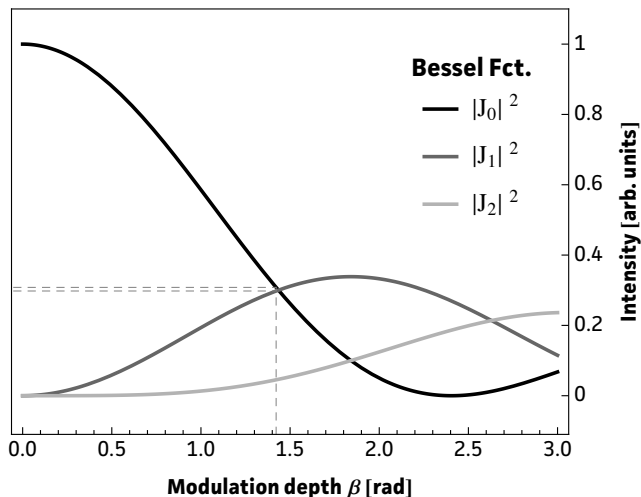
Table 1: Expected modulation

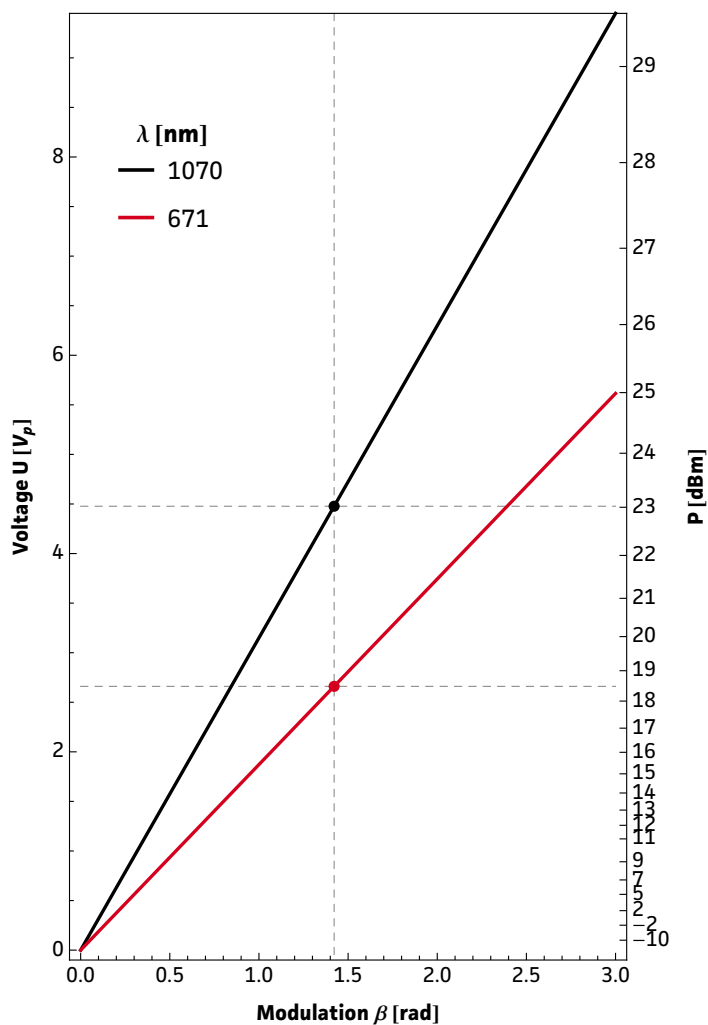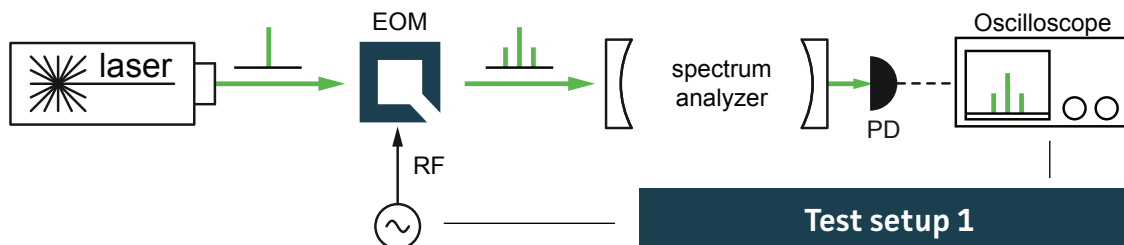| $\beta = 1$ rad	unit	λ_1	λ_2
λ	nm	**671**	**1070**
P	dBm	15.4	20.
P	mW	35	99
U	V_p	1.9	3.1
U_π	V_p	5.9	9.9
β / U	rad / V	0.53	0.32

Fig.1: Recorded oscilloscope trace retrieved from a test setup as illustrated below.

Fig.2: Squared absolute values of first-kind Bessel functions vs. modulation depth. Vertical lines reveal the ratio between the carrier $|J_0|^2$ and the ith sideband $|J_i|^2$ at a specific ß.

Fig.3: Dependency between RF amplitude and modulation depth for different wavelengths. Points on the curve allow to retrieve either the required RF amplitude for a specific/desired ß or the max. achievable modulation depth for a given/available RF power.

Table 1: Expected RF-amplitude/-power values and conversion factors for the required wavelength at the reference modulation depth of 1 rad. **Note:** Experimentally recorded modulation depth displayed in Fig.1 might vary from the respective values (ß=1rad) provided in the table.

Voltage U [V_p]

λ **[nm]**
— 1070
— 671

P [dBm]

Modulation β [rad]

Fig. 3: RF−signal amplitude vs. modulation depth

laser

EOM

spectrum analyzer

PD

Oscilloscope

RF

Test setup 1

Resonance characteristics

Test setup 2: laser → Glan-Thompson Polarizer (+45°) → EOM → Glan-Thompson Polarizer (−45°) → PD → Vector Network Analyzer (Transmission / RF sweep / Return)

Trc2 S11 dB Mag 3.1 dB/ Ref −14.5 dB Cal int   1

M1	25.070480 MHz	−27.8146 dB	
M2	24.883762 MHz	−3.2373 dB	
M3	25.070480 MHz	−27.8146 dB	
M4	25.070480 MHz	−27.8146 dB	

Ch2 Center 25.07248 MHz Pwr 3 dBm Bw 10 kHz   Span 10 MHz

Trc5 S21 dB Mag 5 dB/ Ref −45 dB Cal int   2

		Ref to Max	Track
Bandpass			
Bandwidth		367.000000	kHz
Center		25.070710	MHz
Lower Edge		24.887882	MHz
Upper Edge		25.254882	MHz
Quality Factor (3dB)		68.313	U
Loss		32.6349	dB

M1	25.070480 MHz	−32.6349 dB	
M2	24.887882 MHz	−35.6349 dB	
M3	25.254882 MHz	−35.6349 dB	
M4	25.070710 MHz	−32.6422 dB	

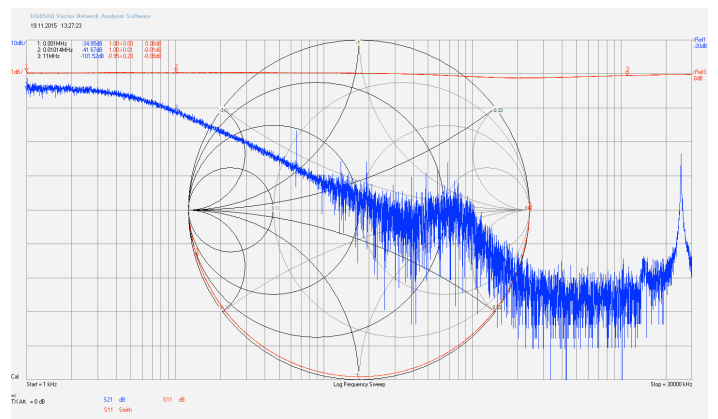Ch2 Center 25.07248 MHz Pwr 3 dBm Bw 10 kHz   Span 10 MHz

Trc6 S11 Smith 200 mU/ Ref 1 U Cal int   3

M1	25.056480 MHz	55.656 Ω	
		j6.351 Ω	40.341 nH
M2	24.883762 MHz	12.628 Ω	
		j29.743 Ω	190.234 nH
M3	25.250911 MHz	9.607 Ω	
		−j13.530 Ω	465.862 pF
M4	25.066664 MHz	54.573 Ω	
		j344.634 mΩ	2.188 nH

Ch2 Center 25.07248 MHz Pwr 3 dBm Bw 10 kHz   Span 10 MHz

Trc7 S21 Phase 36°/ Ref 0° Cal int   4

M1	25.056480 MHz	−57.93 °	
M2	24.883762 MHz	−17.23 °	
M3	25.250911 MHz	−107.10 °	
M4	25.066664 MHz	−61.07 °	

Ch2 Center 25.07248 MHz Pwr 3 dBm Bw 10 kHz   Span 10 MHz

DC characteristics

Test setup 3: laser → Glan-Thompson Polarizer (+45°) → EOM → Glan-Thompson Polarizer (−45°) → PD → Oscilloscope (RF)

Test setup 4: laser → Glan-Thompson Polarizer (+45°) → EOM → Glan-Thompson Polarizer (−45°) → PD → Vector Network Analyzer (Transmission / RF sweep / Return)
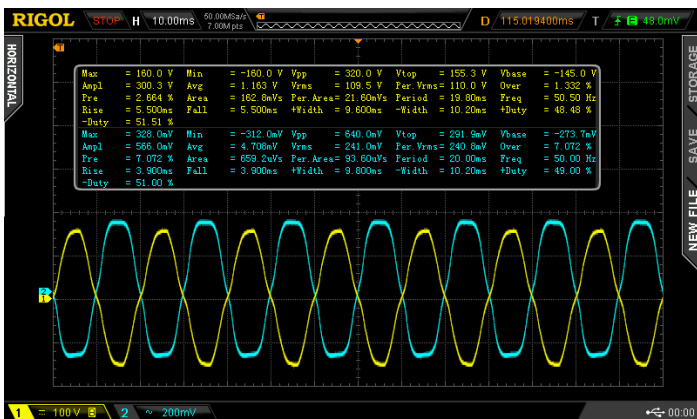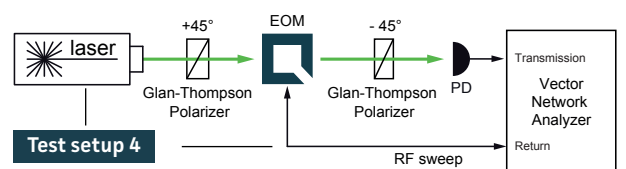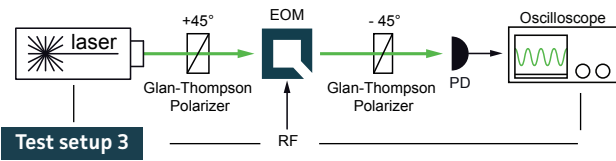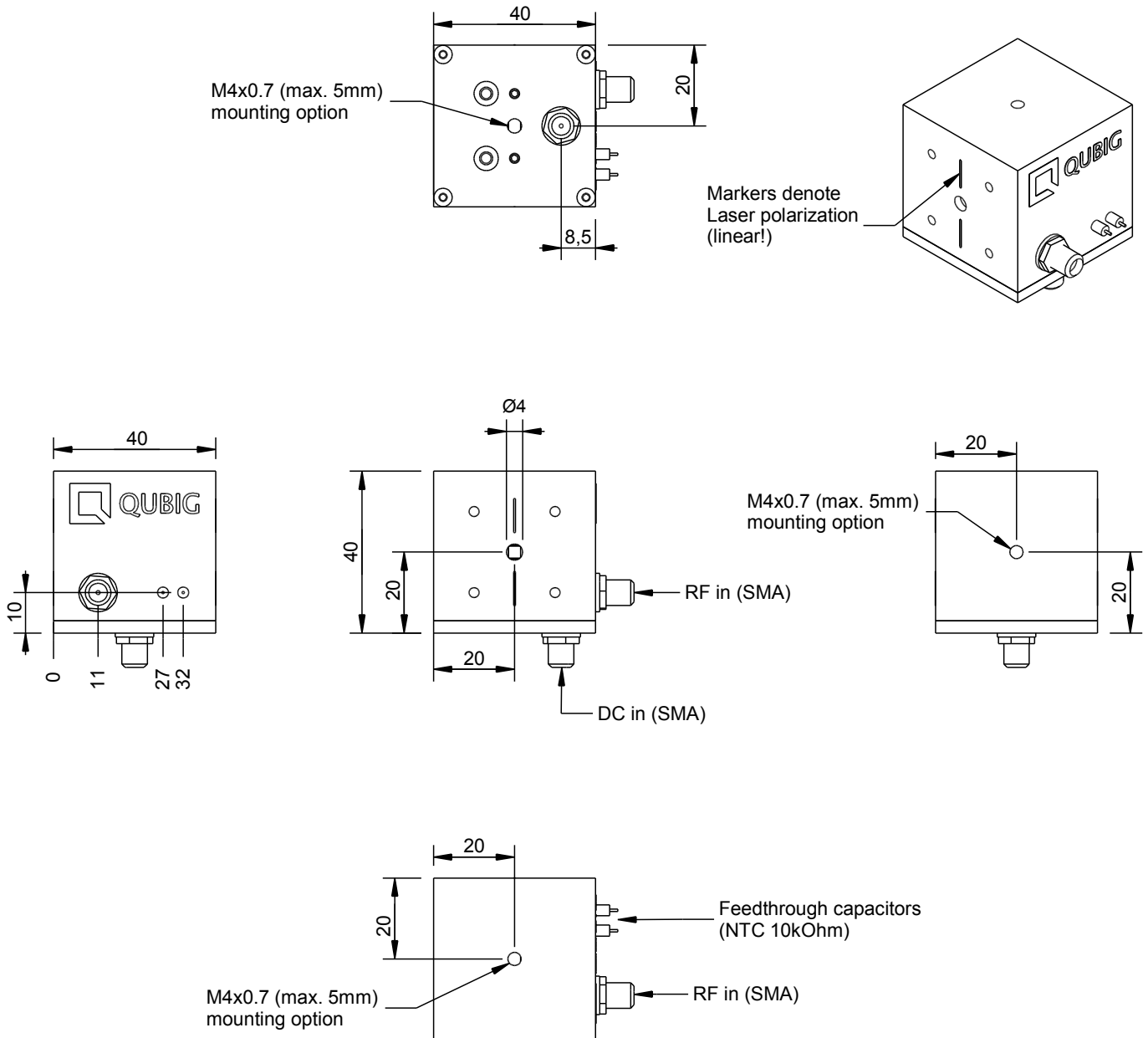
yellow: DC Voltage input signal (50Hz, 316Vpp)
blue: optical modulation (achieved mod. depth: π)

DC bandwidth measurement: −3dB point: ~10kHz
Resonance frequency suppression: ~20dB

Handling instructions

- Input laser polarization must be aligned with respect to the white markers on the housing
- Please handle device carefully. Avoid shock. Don't drop.
- After turn on the resonance frequency might drift slightly with applied rf power. Please compensate by tuning the rf drive frequency until steady-state (~min).
- Slight angle adjustment can reduce unwanted residual amplitude modulation (RAM)

Package drawing

M4x0.7 (max. 5mm) mounting option

40

20

8,5

Markers denote Laser polarization (linear!)

40

10

0 11 27 32

Ø4

40

20

20

RF in (SMA)

DC in (SMA)

20

20

M4x0.7 (max. 5mm) mounting option

20

20

M4x0.7 (max. 5mm) mounting option

Feedthrough capacitors (NTC 10kOhm)

RF in (SMA)