DRIVER

# DR-VE-10-MO

## VErsatile RF amplifier module

The DR-VE-10-MO is a high-grade OEM RF amplifier assembled with the latest generation of monolithic microwave integrated circuits (MMICs) chips. This confers to the device the highest performance we can expect from an RF amplifier: wide bandwidth for fast rise and fall time, high linearity, very good signal to noise ratio, and very low time jitter.

The DR-VE-10-MO is a non-inverting medium output voltage RF amplifier module. It is named VErsatile because it can be used for linear (analog, RFoF, PAM), low duty cycle pulses (square or pulse shaping, PPM) and digital modulation schemes (RZ & NRZ).

For each of these applications, the RF amplifier is factory preset with optimal setpoints for a convenient and ease of use operation. An embedded microcontroller allows the user to select the right operating mode through a Graphical User Interface. The GUI also comes with a custom tuning mode where the gain, amplitude and cross point can be optimized over a very wide tuning range.


### Features

- Output voltage up to 8 Vpp
- Linear / pulse / digital amplifier
- Bandwidth from 16 kHz up to 11 GHz
- Preset modes

### Applications

- RFoF, PAM, Analog modulation
- PPM, low duty-cycle pulse train
- Pulse carving and shaping
- Digital RZ, NRZ

### Related Equipments

- Phase and intensity modulators

### Performance Highlights

| Parameter | Min | Typ | Max | Unit |
|---|---|---|---|---|
| Cut-off frequencies | 16 k | - | 11 G | Hz |
| Output voltage | - | - | 8 | $V_{pp}$ |
| Gain | - | 30 | 33 | dB |
| Saturated power | - | - | 23 | dBm |

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# DR-VE-10-MO

VErsatile RF amplifier module Driver

## Characteristics and measurements

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Impedance | Z | - | - | 50 | - | Ω |
| Low frequency 3dB point | $f_{lower}$ | - | - | 16 | 25 | kHz |
| High frequency 3dB point | $f_{higher}$ | - | 10 | 11 | - | GHz |
| Small signal Gain | $S_{21}$ | - | 30 | 33 | - | dB |
| Gain ripple | - | f < 11 GHz | - | - | +/- 1.5 | dB |
| Input return loss | $S_{11}$ | f < 16 GHz | - | - | -10 | dB |
| Output return loss | $S_{22}$ | f < 12 GHz | - | - | -10 | dB |
| Isolation | $S_{12}$ | f < 20 GHz | - | - | -60 | dB |

## Analog Mode

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Output power 1 dB compression | $P_{1\ dB}$ | 0 - 10 GHz<br>10 - 16 GHz | - | 21<br>19 | - | dBm |
| Saturated Output power | $P_{sat}$ | F < 10 GHz<br>$V_{in}$ ~ 0.6 $V_{PP}$ | - | - | 23 | dBm |
| Input power | $P_{in}$ | - | - | - | 0 | dBm |
| Noise figure | NF | 2 - 10 GHz | 2 | - | 4 | dB |
| Delay time | $t_d$ | f < 16 GHz | - | 450 | - | ps |

## Pulse Mode

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Pulse width | PW | - | 70 p | - | 300 n | s |
| Pulse repetition frequency | PRF | Depending on duty cycle | 10 | - | 1 G | Hz |
| Input pulse amplitude | $V_{in}$ | Square pulse | - | 0.18 | 0.35 | $V_{pp}$ |
| | | Pulse shaping | - | - | 0.12 | |
| Rise / Fall time | $t_r/t_f$ | 20 % - 80 % | - | 24/24 | 28/28 | ps |
| Output pulse amplitude | $V_{out}$ | $V_{in}$ ~ 0.2 $V_{PP}$ | - | - | 8 | $V_{pp}$ |

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## Digital Mode

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Data rate | - | - | 0.1 | - | 10 | Gb/s |
| Input eye amplitude | $V_{in}$ | - | - | 0.2 | 1 | $V_{pp}$ |
| Output eye amplitude (user ajustable) | $V_{out}$ | $V_{in}$ ~ 0.2 $V_{PP}$ | 2.5 | 6 | 8 | $V_{PP}$ |
| Saturated output eye amplitude | $Vout_{sat}$ | $V_{in}$ ~ 0.25 $V_{PP}$ | - | - | 8.5 | $V_{PP}$ |
| Eye cross point (user adjustable) | Xp | - | 45 | 50 | 55 | % |
| Output Jitter, RMS value | $J_{RMS}$ | $J_{RMS} = \sqrt{J^2_{OUT} - J^2_{IN}}$ | - | 1.20 | 1.40 | ps |
| Rise Time / Fall Time | $t_r/t_f$ | 20 % - 80 % | - | 20/20 | 24/24 | ps |
| Q Factor | Q | $V_{out}$ ~ 6 $V_{PP}$ | 16 | 18 | - | - |

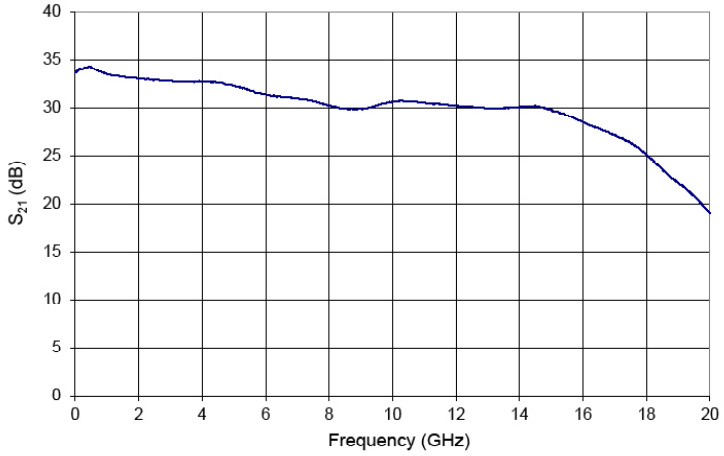
## Power supply

| Parameter | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Supply voltage | $V_{bias}$ | - | 12 | 15 | V |
| Supply current | $I_{bias}$ | - | - | 450 | mA |
| Power dissipation | $P_{diss}$ | - | - | 6.7 | W |
| Operating temperature | $T_{op}$ | 0 | - | +40 | °C |

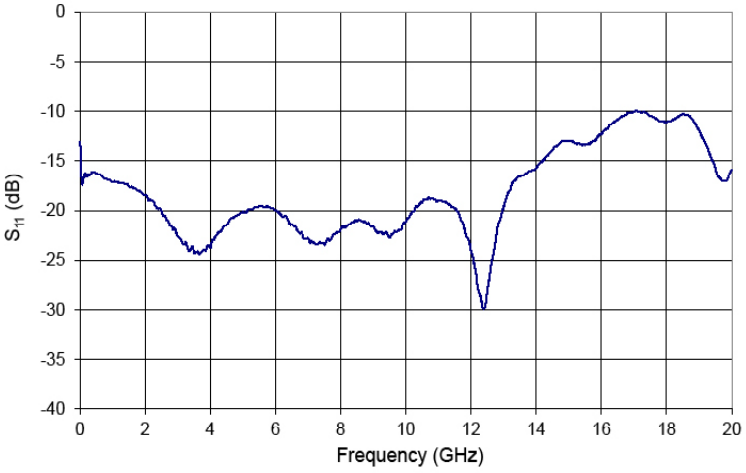
# DR-VE-10-MO

Test conditions: Output amplitude = 70 %, Gain = 40 %, Crosspoint = 60 %, 12 V, 300 mA

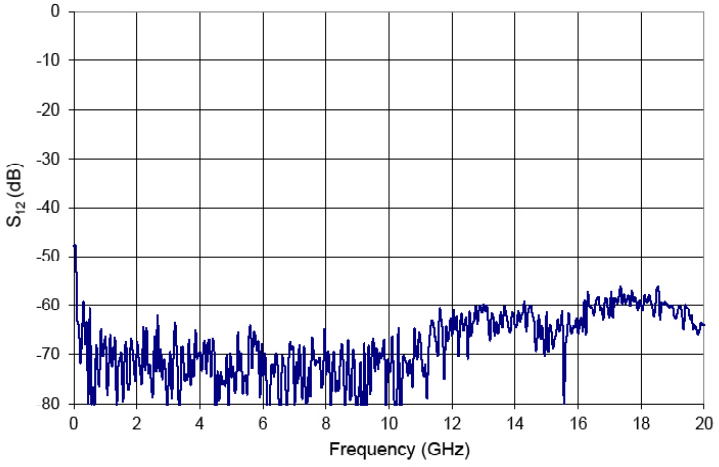
## $S_{21}$ Parameter Curve



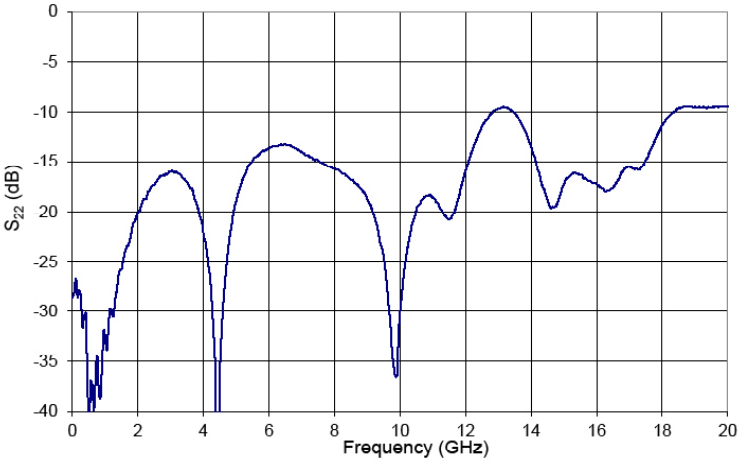

## $S_{11}$ Parameter Curve



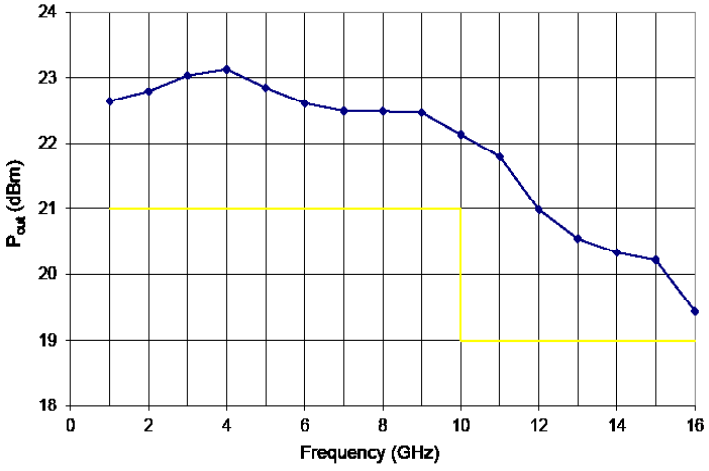

## $S_{12}$ Parameter Curve




## $S_{22}$ Parameter Curve




## P1 dB Parameter Curve



# DR-VE-10-MO

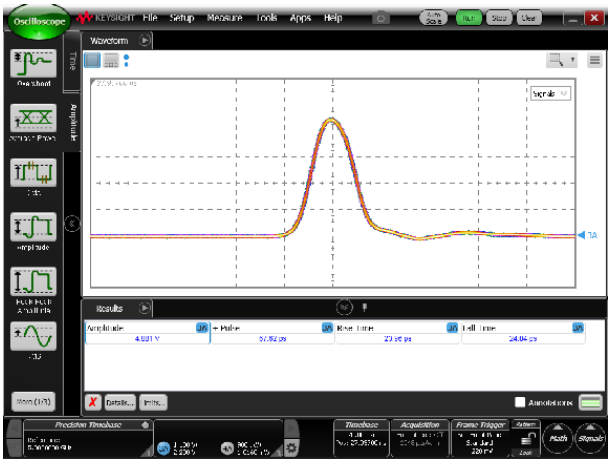
**Pulse measurement** (Pulse mode, square pulse, 0.18 Vpp < VIN < 0.35 Vpp)

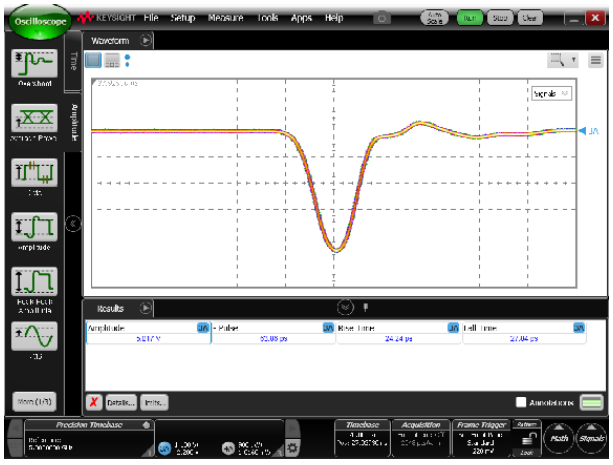
Test conditions depends on Pulse sign ( ⎍ or ⎍ )

Pulse ⎍, $V_{in}$ = 180 $mV_{pp}$

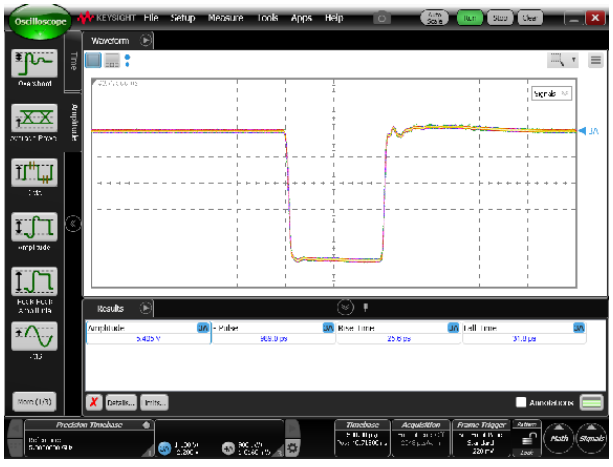
Pulse ⎍, $V_{in}$ = 180 $mV_{pp}$

Output pulse 70 ps

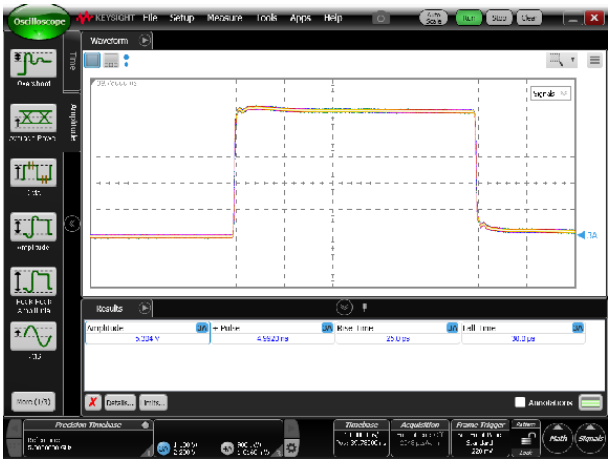




Output pulse 1 ns



Output pulse 5 ns

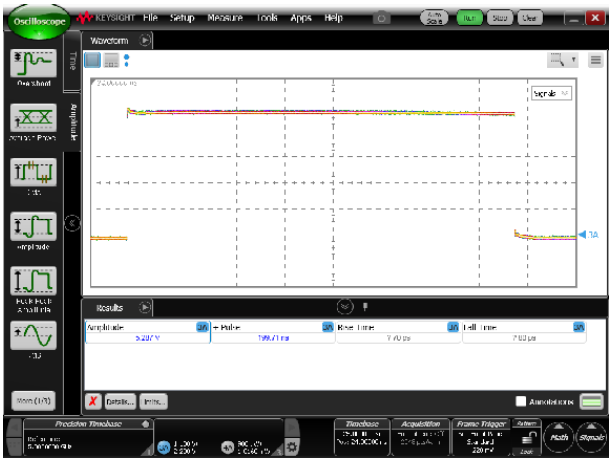


# DR-VE-10-MO

Output pulse 10 ns

Output pulse 100 ns

Output pulse 200 ns



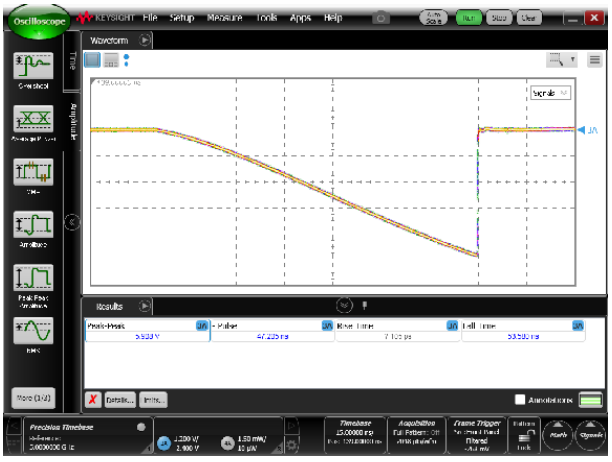
# DR-VE-10-MO

**Linear Operation** (Pulse mode, pulse shaping, $V_{IN}$ < 0.12 $V_{pp}$)

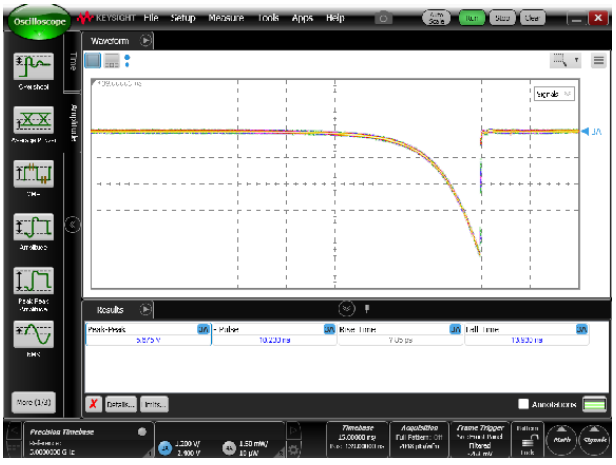
Pulse ⎍, $V_{in}$ ~ 90 $mV_{pp}$

Pulse ⎍, $V_{in}$ ~ 90 $mV_{pp}$

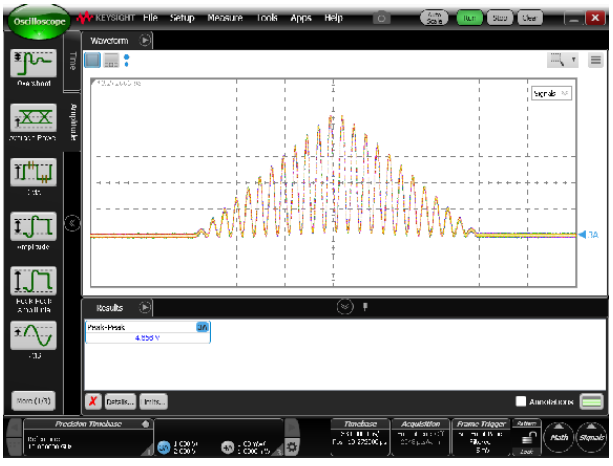
Ramp



Exponential



Pulse Train
with Triangle envelope



# DR-VE-10-MO

## Digital measurement:

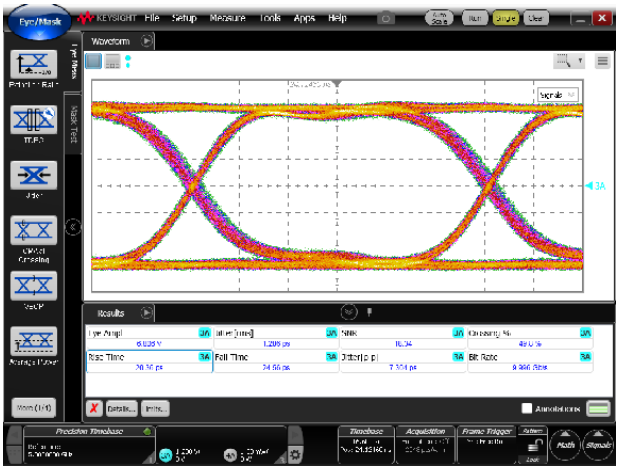
Test conditions: Output amplitude = 45 %, Gain = 30 %, Crosspoint = 55 %, 12 V, 280 mA

Data Rate =100 Mb/s, $V_{in}$ = 220 $mV_{pp}$

Data Rate = 1 Gb/s, $V_{in}$ = 220 $mV_{pp}$

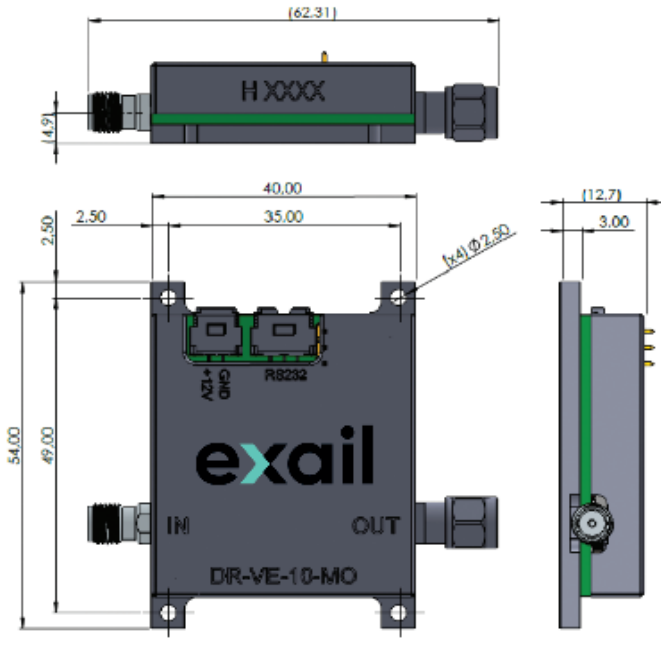
Data Rate = 2.5 Gb/s, $V_{in}$ = 220 $mV_{pp}$

Data Rate = 10 Gb/s, $V_{in}$ = 220 $mV_{pp}$



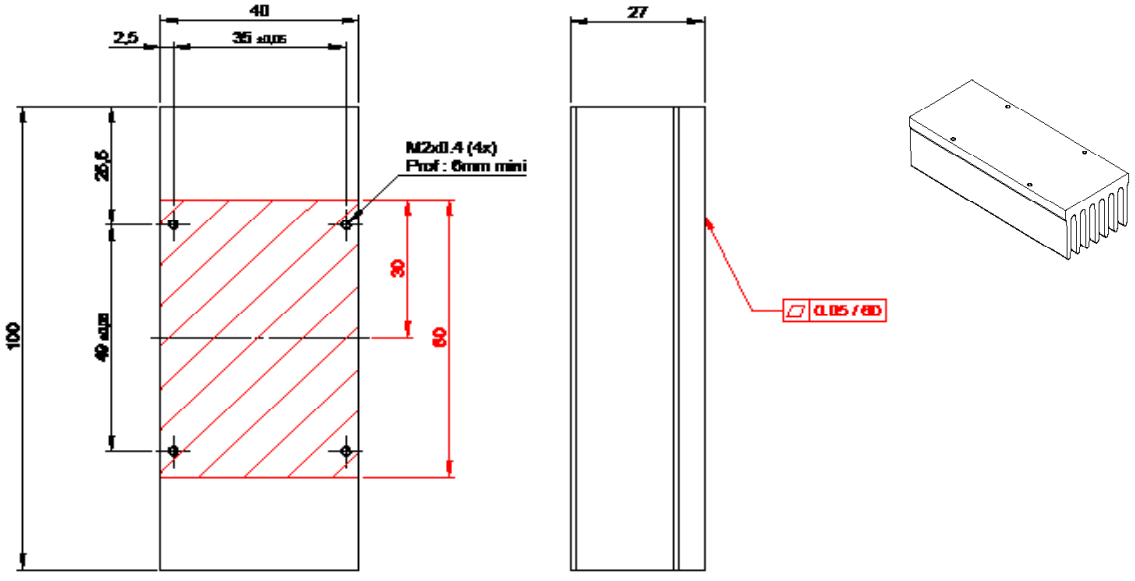
## Mechanical Diagram and Pinout

All measurements in mm



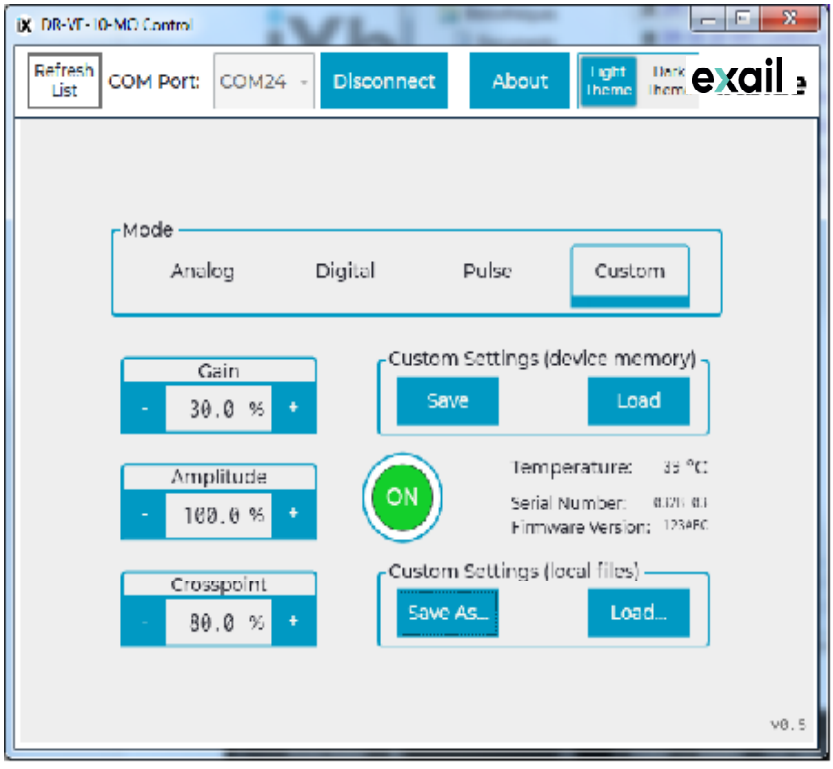

## Mechanical Diagram and Pinout with HS-MO5

All measurements in mm




| PIN | Function | Unit |
|---|---|---|
| Input connector | - | SMA Female |
| Output connector | - | SMA Male |
| Dimensions | Without connectors | 40 mm x 54 mm x 12.7 mm |

## Driver Control Application




## About us

Exail Photonics produces specialty optical fibers and Bragg gratings based fiber optics components and provides optical modulation solutions based on the company lithium niobate ($LiNbO_3$) modulators and RF electronic modules.
Exail 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.



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