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PDM LASERS
Pulse-on-Demand Modules

Version 1.3 - P.N.10

MAIN FEATURES OF PDM LASERS

The PDM series consists of single-mode laser modules which generate optical pulses from input TTL/LVTTL digital signal. From single-shot to continuous wave (CW), with pulse length from 1.5 ns to any required pulse-burst configuration, the PDM series offer the best temporal flexibility and spatial precision on the laser market.

WHY **PDM+ LASERS** ARE ADAPTED FOR MY APPLICATION?

- **I need the smallest spot as possible to affect the smallest part of my chip and understand which part of my chip I'm perturbing.**

  Our PDM+ lasers are single-mode lasers. The output fiber core size is 6 µm and through our microscope, you can focus it down to less than **1 µm**. The full power delivered by the laser is focused on this circular spot size!

- **I need temporal precision and temporal agility to synchronize the laser pulse with my chip**

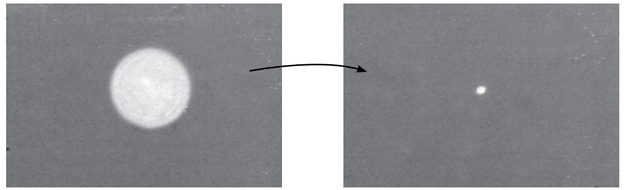
  The jitter of every PDM+ is less than 8 ps. You can synchronize the PDM+ with your chip and know at +/- 8ps when your laser pulse is arriving on your sample. You can choose any pulse from 1.5 ns to CW (continuous wave) and from single-shot to 250 MHz.

- **The silicon of my chip is thick and I need high power**

  With the large range of PDM+ lasers, you can choose the adapted peak power for your application, up to 10 W. Typical required power is ~1 W on the back side. At 2 W singlemode laser power level, you can easily affect your chip even through a high thickness of silicon.

- **What about reliability and product support?**

  PDM+ lasers are all fiber design lasers. There is no risk of optical misalignment or losses. The module is electronically secured and cannot be damaged by a mishandling. For any support or assistance, our dedicated engineers answer your questions.



Typical multimode spot size **Typical single-mode spot size**

FOR ULTRA SHORT PULSES

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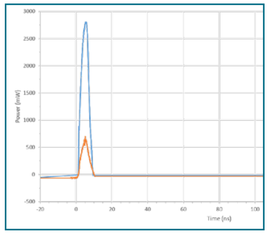
PDM HPP

High pulse performance

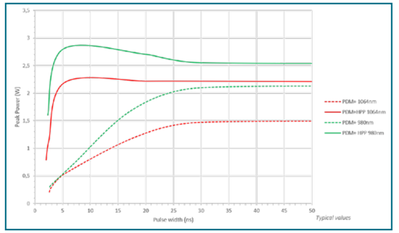
This new *High Pulse Performance* (HPP) version, four times faster than the previous PDM+, allows to reach nanosecond or even sub-nanosecond pulses with high peak power. This pulse-on-demand module is ideal for laser fault injection on high frequency IC components if short pulses are required.

PDM HPP - *High pulse performances*

Product	PDM - HPP		
Wavelength	**808 nm**	**980 nm**	**1064 nm**
Version	HPP	HPP	HPP
Application	**Front side LFI**	**Back side LFI**	**Back side LFI**
Peak power	**500 mW**	**2 W**	**1.8 W**
Pulse duration	**from 1ns** to CW		
Repetition rate	From single-shot to 250 MHz		
Beam quality	Single-mode		
Jitter	< 8 ps		
Output fiber	Single-mode output fiber		
Minimum spot size	**Accessible spot size of 1 µm**		



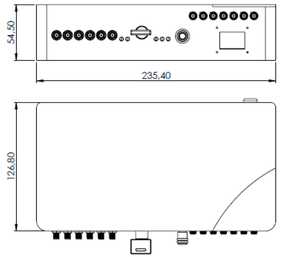
Typical 5 ns optical pulse at 980 nm vs peak power: PDM HPP in blue ; standard PDM+ in orange



Rise time of the PDM-HPP four times faster of the PDM-HPP (solid lines - green at 980 and red at 1064 nm) and standard PDM+ (dotted lines)

Key features

- **Min. pulse duration: 1 ns** (FWHM)
- Single-shot, burst mode or CW operation
- Up to 2 W peak power
- Extremely low jitter (< 8 ps)
- Up to 250 MHz repetition rate
- **Pulse delay generator included**
- Python compatible



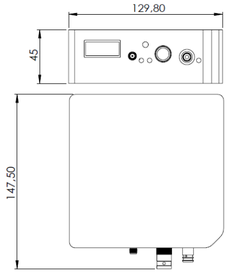
PDM+ & PDM+ HP

The PDM+ version can generate up to **3.2 W** peak power. They are available at 808 nm, 980 nm, 1064 nm and 1420 nm. This single-mode laser can be focused down to 1 µm with an ALPhANOV's microscope.

Product	PDM+ & PDM+ HP					
Wavelength	**808 nm**	**980 nm**		**1064 nm**		**1420 nm**
Version	Standard	Standard	HP	Standard	HP	Standard
Application	**Front Side LFI**	**Backside LFI**		**Backside LFI**		**Laser Thermal Stimulation**
Peak power	**500 mW**	**2 W**	**3.2 W**	**1.8 W**	**2.8 W**	**1.2W**
Pulse duration	from 1.5 ns to CW	from 1.5 ns to CW	from 5 ns to CW	from 1.5 ns to CW	from 5 ns to CW	from 1.5 ns to CW
Repetition rate	From single-shot to 250 MHz					
Beam quality	Single-mode					
Jitter	<8 ps					
Output fiber	Single-mode output fiber					
Minimum spot size	**Accessible spot size of 1 µm**					

Key features

- Min. pulse duration: 1.5 ns (FWHM)
- Single-shot, burst mode or CW operation
- Up to 3.2 W peak power
- Extremely low jitter (< 8 ps)
- Up to 250 MHz repetition rate
- Python compatible



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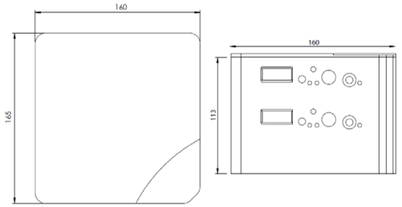
PDM 2+ & PDM 2+ HP

The PDM2+ version combines two PDM+ modules into the same single-mode output fiber. The properties of the beam (spot size, beam quality, pulse duration, jitter) are exactly the same as a PDM+ laser but with higher peak power.

Product	PDM 2+ & PDM 2+ HP					
Wavelength (nm)	**980/980**		**1064/1064**		**980/1064**	
Version	Standard	HP	Standard	HP	Standard	HP
Application	**Backside LFI**		**Backside LFI**		**Backside LFI**	
Peak power	**4 W**	**5 W**	**3 W**	**4.5 W**	**3.5 W**	**4.8 W**
Pulse duration	from 1.5 ns to CW	from 5 ns to CW	from 1.5 ns to CW	from 5 ns to CW	from 1.5 ns to CW	from 5 ns to CW
Repetition rate	From single-shot to 250 MHz					
Beam quality	Single-mode					
Jitter	< 8 ps					
Output fiber	Single-mode output fiber					
Minimum spot size	**Accessible spot size of 1 µm**					

Key features

- Min. pulse duration: 1.5 ns (FWHM)
- Single-shot, burst mode or CW operation
- **Up to 5 W peak power**
- Extremely low jitter (< 8 ps)
- Up to 250 MHz repetition rate
- Python compatible



PDM 2X2 & PDM 4+

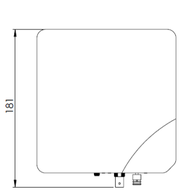
The PDM4+ combine 4 PDM+ into one single-mode output fiber. The beam features are the same than PDM+ or PDM2+ but the peak power can be driven up to **6W** in the standard version and to **more than 10 W** in the HP version.
The PDM+ 2X2 combine two PDM+ into a first single-mode output fiber and two PDM+ into a second output fiber.

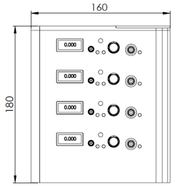
Product	PDM2x2+ & PDM2x2+ HP					
Wavelength (nm)	980/980		1064/1064		980/1064	
Version	Standard	HP	Standard	HP	Standard	HP
Application	**Backside LFI**		**Backside LFI**		**Backside LFI**	
Peak power	**2x 4 W**	**2x 5 W**	**2x3 W**	**2x 4.5 W**	**2x 3.5 W**	**2x 4.8 W**
Pulse duration	from 1.5 ns to CW	from 5ns to CW	from 1.5 ns to CW	from 5 ns to CW	from 1.5 ns to CW	from 5 ns to CW
Repetition rate	From single-shot to 250 MHz					
Beam quality	Single-mode					
Jitter	< 8 ps					
Output fiber	Single-mode output fiber					
Minimum spot size	**Accessible spot size of 1 µm**					

PDM4+ & PDM4+ HP	
980/1064	
Standard	HP
Backside LFI	
6 W	**10 W**
from 1.5 ns to CW	from 5 ns to CW
From single-shot to 250MHz	
Single-mode	
< 8 ps	
Single-mode output fiber	
Accessible spot size of 1 µm	

Key features

- Min. pulse duration: 1.5 ns (FWHM)
- Single-shot, burst mode or CW operation
- **Up to 10 W peak power**
- Extremely low jitter (<8 ps)
- Up to 250 MHz repetition rate
- Python compatible

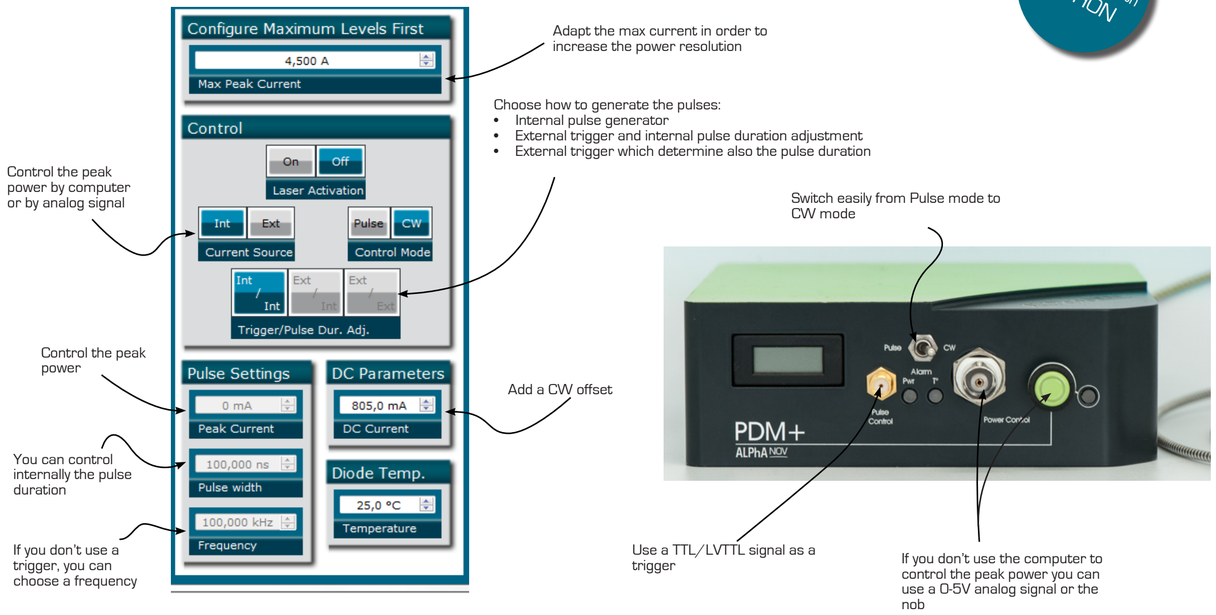




DRIVE YOUR LASER BY SOFTWARE/DLL OR ANALOG SIGNAL

All PDM+ version can be driven and controlled by computer (USB interface) with ALPhANOV's software or provided DLLs or by analog signal:

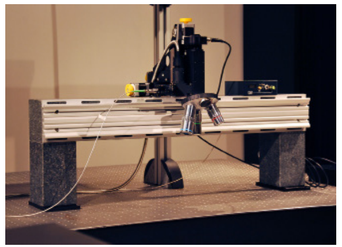
Compatible with PYTHON



ASSOCIATED PRODUCTS

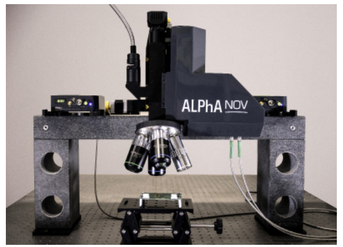
The PDM+ lasers are compatible with ALPhANOV laser benches for IC security testing:

S-LMS - Single Laser Microscope Station for laser fault injection



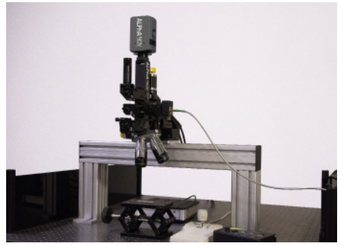
The S-LMS microscope station for laser fault injection is a high-precision platform for security evaluation of integrated circuits. It allows to focus the laser spot on the chip and scan the sample through the back side in order to evaluate the security levels of the electronic components.

D-LMS - Double Laser Microscope Station for dual laser fault injection



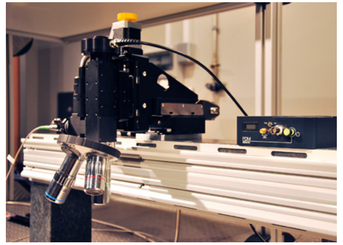
The D-LMS microscope station for double laser fault injection is a platform enable to focus and scan independently two laser spots for security evaluation of integrated circuits. Ideal for double spot injection processes, it offers all the spatial and temporal flexibility to analyze circuits through the back side.

Photoemission bench



When an integrated circuit is in operation, the zones requested by the routine naturally emit infrared photons through the back side. ALPhANOV's photoemission optical bench allows to capture and visualize these photonic emissions in order to obtain an accurate view of the circuit activities.

TLS - Thermal Laser Stimulation bench



The thermal laser stimulation bench is an optical microscope which enables to focus with precision, a PDM+ laser source (Pulse-on-Demand Module) at 1420 nm. Used through the back side of electronic components, the laser beam warms the sample locally and allows to extract and read out data in a memory according to the current consumption of the transistors.

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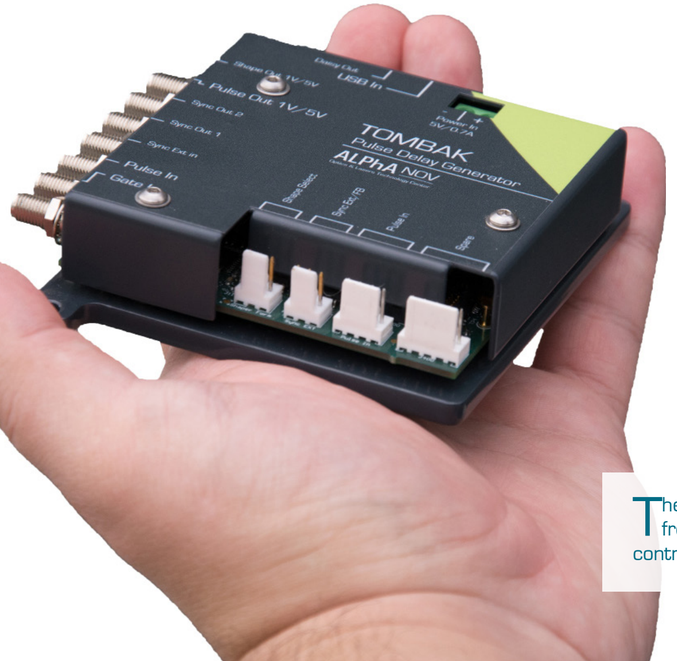


PULSE DELAY GENERATOR

The Pulse Delay Generator is a great asset to generate high frequency pulses, delays and bursts. It's an ideal testing and timing control instrument for electronics and lasers.

PULSE DELAY GENERATOR

USE IT AS PULSE/DELAY GENERATOR:

Adjustable pulse width: 5 ns to 2^{62} ns
Adjustable pulse delay: 10 ps to 2^{62} ns
Width resolution:

- 2 ns for pulse width: 5 to 510 ns
- 5 ns for pulse width: 511 ns to 2^{62} ns

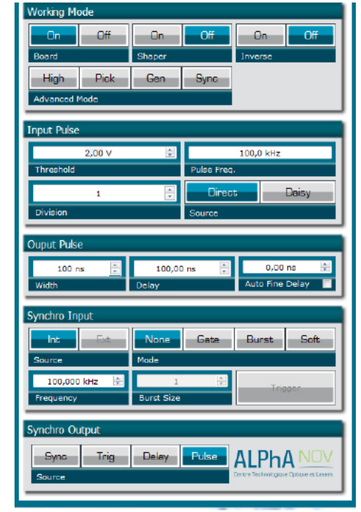
Delay resolution: 10 ps
Jitter:

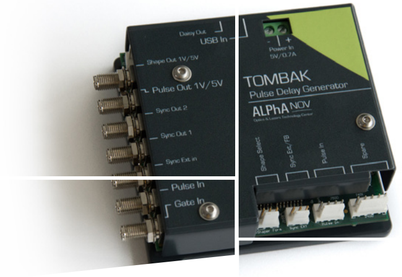
- < 80 ps RMS up to 100 ns delay
- < 200 ps RMS up to 500 ns delay
- 1.5 ns RMS otherwise

USE IT AS VOLTAGE LEVEL CONVERTER:

Rate: up to 150 MHz
Input Voltage: 30 mV to 3.3 V
Adjustable output level: 1 V/3.3 V/5 V_TTL
< 30 ps Jitter

GUI control software:





Electrical:

Pulse_Out Outputs (SMA connector)	
Output Impedance	50 Ω recommended coupling
Adjustable output level	1 V/3.3 V/5 V_TTL
Rise time	<1 ns typical
Max output rate	20 MHz

Pulse_In (SMA connector)	
Input voltage	0 to 3.3 V
Threshold	0-3.3 VDC software adjustable (Pulse In)
Max Input rate	200 MHz
Insertion delay	70 ns

Sync Ext/Gate Inputs (SMA connector)	
Input voltage	0 to 3.3 V
Threshold	1.2 V
Max input rate	20 MHz

General:

Power voltage/current	+5 VDC/500 mA (charger included)
USB 2.0 (cable included)	
Stackable units	Multiple channel setup using several units (single USB/single power supply/ single synchronization input signal)

YOUR CONTACT

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