

PLA-6XX – High Sensitivity APD Front End Receiver Modules

Product Features

- 80 or 200 μm InGaAs APD
- ultra-low noise TIA
- 100 MHz bandwidth
- Overload protection circuitry
- Industry leading sensitivity and overload performance
- Small form-factor



Princeton Lightwave's PLA-6XX series APD with GaAs-based FET transimpedance amplifier product family offers industry-leading sensitivity in multiple packaging formats. These modules leverage PLI's high performance, planar InP-InGaAs avalanche photodiodes (APDs) developed specifically for demanding low light level detection in ranging, LADAR and scientific applications.

Applications

- Laser Radar (LADAR) and Ranging
- Low-level Optical Pulse Discrimination
- Free-space Optical Communication
- Optical Time Domain Reflectometry
- Confocal Microscopy

The PLA-641 incorporates the above features in a 6-pin, TO-46 style package. It achieves a 100-MHz bandwidth, enabling 2 nanosecond timing accuracy. The ultra low noise of the GaAs-based FET amplifier, in combination with the low dark current of the APD, offers excellent low light-level performance over a wide operating temperature range. The APD module also includes circuitry for overload protection of the receiver, and to enhance recovery from high optical input pulses. The combination of minimal dependence on temperature variation, un-cooled operation and compact packaging enables significant SWaP (size, weight and power) advantages.

For more demanding applications where the dependence of the APD operating voltage on temperature must be controlled by temperature stabilization, the PLA-66X version incorporate, in a flanged packaging format, the receiver performance of the PLA-641 with an internal thermo-electric cooler (TEC) and temperature sensor. The PLA-66X receiver is a TO-66 module, also with an internal TEC, designed to provide drop-in compatibility with industry standard pin-outs for applications in legacy systems.

All versions are assembled in a hermetic enclosure, and incorporate packaging designs and processes that ensure robust, reliable operation in harsh environments.



PERFORMANCE SPECIFICATIONS: PLA-641 AND PLA-66X

Operating conditions: VDD=+3.3V to GND; Case temperature = 25°C; R_{LOAD}=100 Ω differential

| Parameter Description | Test Conditions | Specifications | | | Units |
|--|---------------------------|----------------|---------|-----|--------|
| | | Min | Typical | Max | |
| Effective Optical Diameter | 200µm APD | | 200 | | µm |
| | 80µm APD | | 80 | | |
| Breakdown voltage, V _b | I _d = 10 µA | 50 | | 90 | V |
| Temp. dependence ΔV _b /ΔT | | | 0.15 | | V/°C |
| Impulse Response (FWHM) | M=10, 80µm APD | | 2.4 | | ns |
| | M=10, 200µm APD | | 3.5 | | ns |
| Bandwidth (3dB, optical) | M=10, 80µm APD | | 150 | | MHz |
| | M=10, 200µm APD | | 100 | | MHz |
| Responsivity @ 1550 nm | Differential output, M=10 | | 280 | | kV/W |
| | Single-ended output, M=10 | | 140 | | |
| Dark noise equivalent power [†] | 1550 nm, M=10, 80µm APD | | 90 | | fW/√Hz |
| | 1550 nm, M=10, 200µm APD | | 130 | | |
| Output Impedance | Differential output | | 100 | | Ω |
| | Single-ended output | | 50 | | |
| Output voltage swing | Differential output | | 0.8 | | Vp-p |
| | Single-ended output | | 0.4 | | |
| Dynamic range | 1550 nm, M=10 | | 30 | | dB |
| Overload recovery ^{††} (equiv. optical signal @ 1us) | Optical input: 10mW, 30ns | | 65 | | nW |
| | Optical input: 1mW, 30ns | | 10 | | nW |
| Power supply current | 0nW optical input | | 30 | | mA |
| TEC Voltage | | | | 0.6 | V |
| TEC Current | | | | 1.5 | A |

† NEP computed with measured output noise, with no optical illumination, divided by responsivity.

†† Equivalent optical signal computed by dividing measured output voltage by responsivity.

ABSOLUTE MAXIMUM RATINGS

| Parameter | Min | Max | |
|-----------------------------------|------|-----|------|
| Supply Voltage (+3.3V) | -0.5 | 4 | Volt |
| Supply Voltage ¹ (+5V) | -0.5 | 6 | Volt |
| APD Reverse Bias ³ | 0 | Vbr | Volt |
| Limiter Voltage | 0 | 2.5 | Volt |
| TIA Output Voltage | -0.5 | Vdd | Volt |
| Tsens Current | | 1 | mA |
| TEC Voltage | | 1 | Volt |
| TEC Current | | 2 | A |

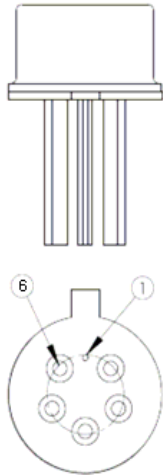
¹ For PLA661 and PLA662 versions only; applied as alternative to +3.3V; should be applied after APD reverse bias.

PRODUCT HANDLING

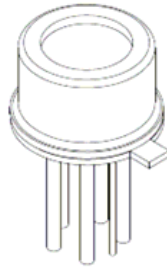
These avalanche photodiodes are sensitive to electrostatic discharge (ESD) and should be handled with appropriate caution, including the use of ESD protective equipment such as grounding straps and anti-static mats.

MECHANICAL SPECIFICATIONS: PLA-641

PLA-641 is a 6-pin TO-46 module.

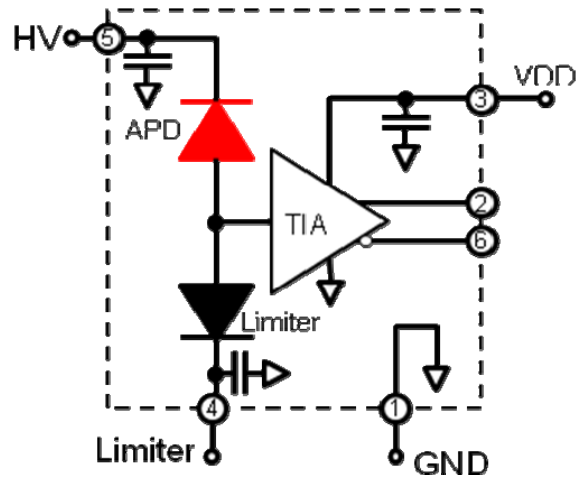


Bottom view



| Pin | Function |
|-----|----------|
| 1 | CASE GND |
| 2 | OUT+ |
| 3 | VDD |
| 4 | LIMITER |
| 5 | +HV |
| 6 | OUT- |

ELECTRICAL BLOCK DIAGRAM: PLA 641

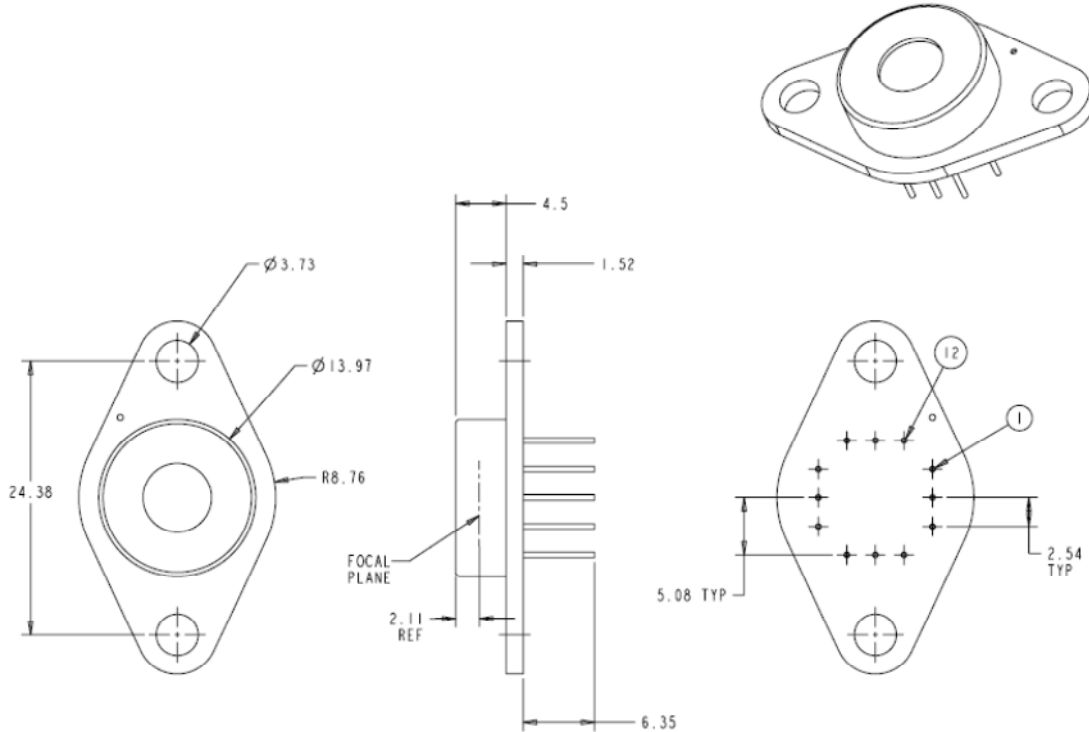


LIMITER

LIMITER is a control voltage that manages overload protection and recovery of the APD and TIA. Effective overload recovery is achieved by applying fixed voltage so that the limiter diode is zero-biased (typical 0.9V). Alternatively, the pin may be left unconnected, allowing the internal capacitor to hold the zero-bias voltage.

MECHANICAL SPECIFICATIONS: PLA-661 and PLA-662

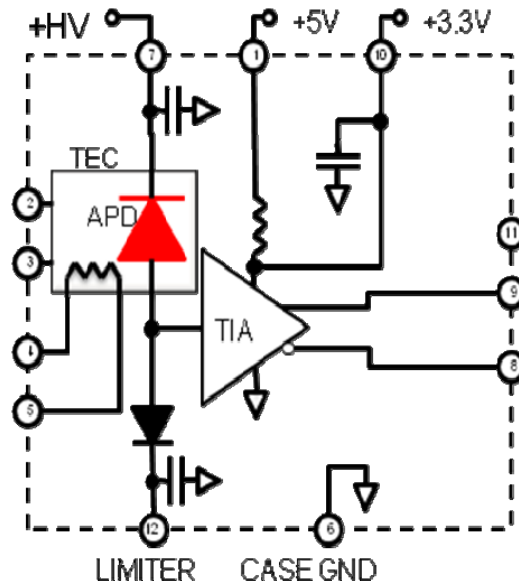
The PLA-661 and PLA-662 are 12-pin TO-66 modules. All dimensions are in millimeters.



| Pin | Function (PLA-661) | Function (PLA-662) |
|-----|--------------------|--------------------|
| 1 | +5V (alternative) | +5V (alternative) |
| 2 | -TEC | -TEC |
| 3 | +TEC | +TEC |
| 4 | TSENS1 | TSENS1 |
| 5 | TSENS2 | TSENS2 |
| 6 | CASE GND | CASE GND |
| 7 | +HV (APD Cathode) | +HV (APD Cathode) |
| 8 | OUT- | GND |
| 9 | OUT+ | OUT- |
| 10 | VDD (+3.3V) | VDD (+3.3V) |
| 11 | N.C. | N.C. |
| 12 | LIMITER | LIMITER |

The PLA-66X is designed to maintain drop-in compatibility with existing systems and applications. For example, though the internal electronics require only +3.3V, the option to use a +5V power supply is provided through use of an internal series resistor that lowers the supply voltage to the amplifier. The PLA-662 also internally terminates one of the TIA outputs to 50-ohms, thereby maintaining a pin-out compatible with applications that allow for a single-end output.

ELECTRICAL BLOCK DIAGRAM: PLA-661



ELECTRICAL BLOCK DIAGRAM: PLA-662

