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PRELIMINARY

ANALOG MODULES, INC.

a HEICO company

MODEL 759A

HYBRID EYESAFE
LASER RANGEFINDER RECEIVER

HYBRID EYESAFE LASER RANGEFINDER RECEIVER

- **HIGH SENSITIVITY – 33nW**
- **HERMETIC LOW PROFILE TO-8 PACKAGE, 0.1 CU. IN.**
- **FAST RECOVERY – LOW MINIMUM RANGE**
- **InGaAs PIN DETECTOR**
- **SINGLE +5V SUPPLY AT 25mA**
- **SECOND GENERATION PROVEN PERFORMANCE**

DESCRIPTION:

The ***Model 759A*** is a next generation hybrid eyesafe laser rangefinder receiver. The compact construction (modified TO-8 header) and PCB mounting capability make the *Model 759A* ideal for miniature applications. Fast recovery from overload allows ranging to near objects and to multiple closely-spaced targets. The high sensitivity provides excellent long-range performance with small apertures. Total power consumption of 125mW allows operation from batteries.

SPECIFICATIONS:

Detector 1.54µm, InGaAs PIN, 300µm +60/-30µm ∅

Sensitivity 33nW typical, 45nW maximum at 1.54µm, 20ns pulse, 50% detection, 0.1% FAR, 25°C, degrades with narrower pulses and higher temperatures.

T_o Pulse Optical >5µW

Time Programmed Gain (TPG) $1/R^2$ law operates from minimum range of ~20m to 1km with separate Tx/Rx optics. Minimum range of 30m with 50mW T_O pulse. Open circuit on Pin 11 holds high gain. 0V or GND on Pin 11 holds low gain (-24dB voltage typical).

Adjustments Trigger level is adjustable to optimize pulse detection characteristics.

Outputs TTL or HCT CMOS compatible, negative logic. Start/Stop on common line. ≥18ns pulses. Maximum source/sink current 2mA.

Alignment Analog test point for alignment

Power +5 ± 0.25VDC at 25mA typical

Temperature
Operating -40° to +85°C
Storage -55° to +125°C

Connections PCB mount pins
For optional test PCB (Add -PCB to part number.)

Size 0.616" ∅ x 0.415"$_{max}$

ISO 9001 CERTIFIED

Specifications subject to change without notice.

U. S. Patent No.: 4,939,476

APPLICATIONS:

Man-Pack, Weapon-Mount, Vehicle-Mount, TUAV, Airborne Laser Rangefinding

"In the event this commodity will be transferred to a "foreign person" as defined in 22 CFR 120.16, either outside or within the United States, a validated US State Department license is required."

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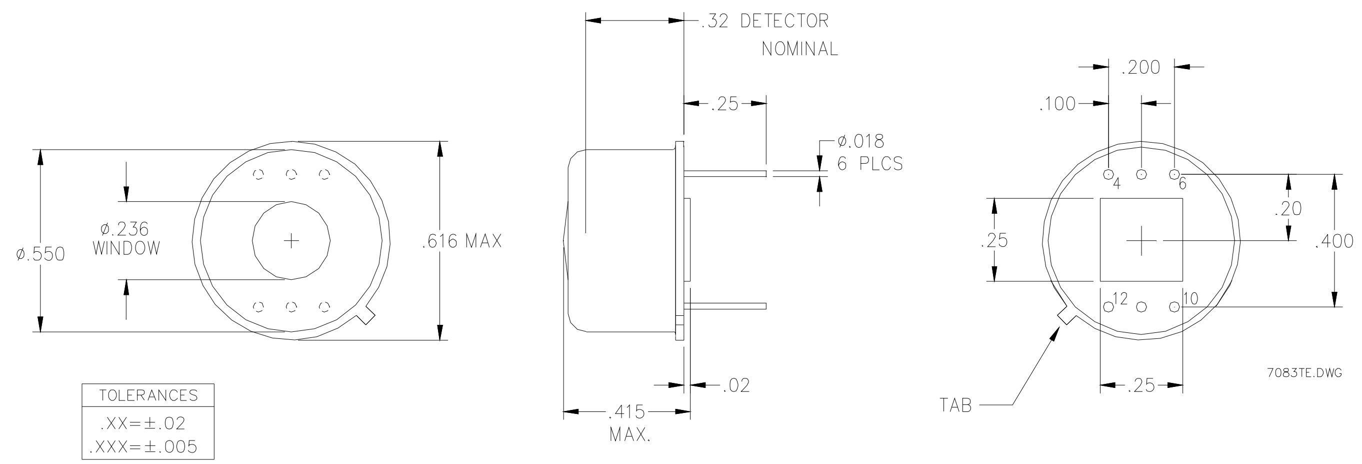
MODEL NUMBER

CONNECTIONS	759A, PCB mount PINS	**759A**

Typical Part Number: ***759A-PCB* =** Connections: PCB mount PINS with optional test PCB



ANALOG MODULES, INC.

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Specialists in Analog and Laser Electronics

Model 759 Laser Receiver
Application/Operation Notes

General

The Model 759 is a second-generation laser receiver with proven performance in military applications. Using a 300 μm InGaAs PIN detector and the latest in miniature electronic components, the Model 759 provides high sensitivity, fast overload recovery, and low power consumption in a small TO-8 package.

Circuit Description and Application

T_O (Laser Start Pulse)

It is desirable to use the Model 759 for both optical T_o and return pulses since the time delay through the receiver is similar, thus reducing sources of range error. Pin 11, THRESHOLD/TPT is held or pulsed low prior to T_o resulting in low gain. The T_o pulse should be 3 ~ 4 orders of magnitude greater than the minimum signal (i.e. 10 to 100 μW peak). Normally this is easy to achieve since most lasers used in rangefinding output ~1MW for short pulses. If the signal is too strong, the pulse build-up may cause a premature T_o resulting in a slightly longer range result. To achieve the best minimum range performance, the strength of the T_o signal should be limited; ideally to tens of microwatts. A convenient method of T_o coupling is to use a fiber optic or access hole between the transmitter and receiver.

Return Pulses and Time Programmed Threshold (TPT)

The Model 759 has a TPT feature by which the sensitivity of detection is varied from minimum at T_o to a maximum at a range of typically 1.0 km. For ranges beyond 1.0 km, the gain remains at maximum but the receiver has an overload capability to allow stronger signals to be correctly resolved. The TPT has two functions; it reduces the probability of erroneous ranges due to smoke, fog and other backscatter, and it increases the range accuracy by adjusting the sensitivity in accordance with $1/R^2$ to $1/R^3$ (depending on signal level). A constant-fraction discriminator is not used in this design, so it is desirable to reduce the dynamic range of the detection level within the rising edge of the laser pulse. A short pulse laser has an advantage in range accuracy versus varying signal return strengths, because of the reduced "time walk" within the leading edge. The range counter should use leading edge START and STOP functions.

When using the TPT feature, control of Pin 11 determines the time (range) at which the gain begins to increase, normally T_o. Pin 11 must be held low (> 2 μs) prior to and released at T_o. This can be achieved by grounding Pin 11 with a small FET or bipolar transistor and turning off the transistor at T_o. A signal to drive this transistor is usually found in the range counter; going low at T_o to initiate TPT (counting) and high at maximum range or beyond. The time constant of the TPT is extended by adding an optional capacitor from Pin 11 to ground. A value of 330 pF doubles the TPT time (i.e. doubles the range for a given attenuation). With no TPT used, a T_o overload will cause a temporary gain reduction depending on the level applied.

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Test Points

Two test points are provided for optical alignment or troubleshooting; the high gain test point following the post amp (Pin 6) and the low gain test point following the pre amp (Pin 10). When monitoring either test point, the instrumentation should present a high-impedance (> 100 k) to the circuit such that it does not alter performance. The pre amp output is best used for optical alignment but care should be taken to maintain a linear response so that optical focus is discerned. Long wires or PCB traces connected to the test points will degrade the stability of the receiver. Wire or probe routing is critical to obtaining satisfactory results. It is recommended that only one of the test points be connected at a time. Feedback between the high gain test point and the preamp test point can cause oscillation. A small value (50-500 ohm) resistor connected in series with the probe or wiring as close a possible to the preamp test point (pin 10) will make the receiver more forgiving.

START/STOP Output Pulse

The output signal is TTL or HCT CMOS compatible with the ability to source/sink up to 2 mA. The active low (negative logic) output pulse has a minimum pulsewidth of 18 nS to ensure enough time for the range counter input. After a high level of T_o or signal return, a wider pulse may be generated. The range counter must include a minimum range lockout period whose value depends on the magnitude of T_o backscatter. This output should also make use of short interconnects. For longer runs, shielding may be needed to maintain stability. Use of a small resistor in series with the output wiring installed as close to pin 4 as possible will improve stability. The resistor should be selected to give a rise time of 3-5nS at the load.

False Alarm Rate (FAR)

When the receiver is at maximum gain (> 1.0 km) or with FET at pin 11 (THRESHOLD/TPT) open, there is a probability of false alarms on the output. To measure the FAR, the receiver is held in high gain (Pin 11 open) and a frequency counter is connected to Pin 4 (START/STOP output) with the return connected to Pin 5. Adjust the counter threshold to trigger on a negative edge at 1.5 V amplitude. Reduce the ambient lighting or shade the detector. To determine the counts per second for a given false alarm rate (FAR) and range:

$$\text{Counts per second} = \frac{\text{False alarms / shots}}{1.0 - (\text{Max range (km)} \times 6.67 \times 10^{-6})}$$

For example, with 0.1% FAR (1/1000) and 10 km maximum range, the counts per second are:

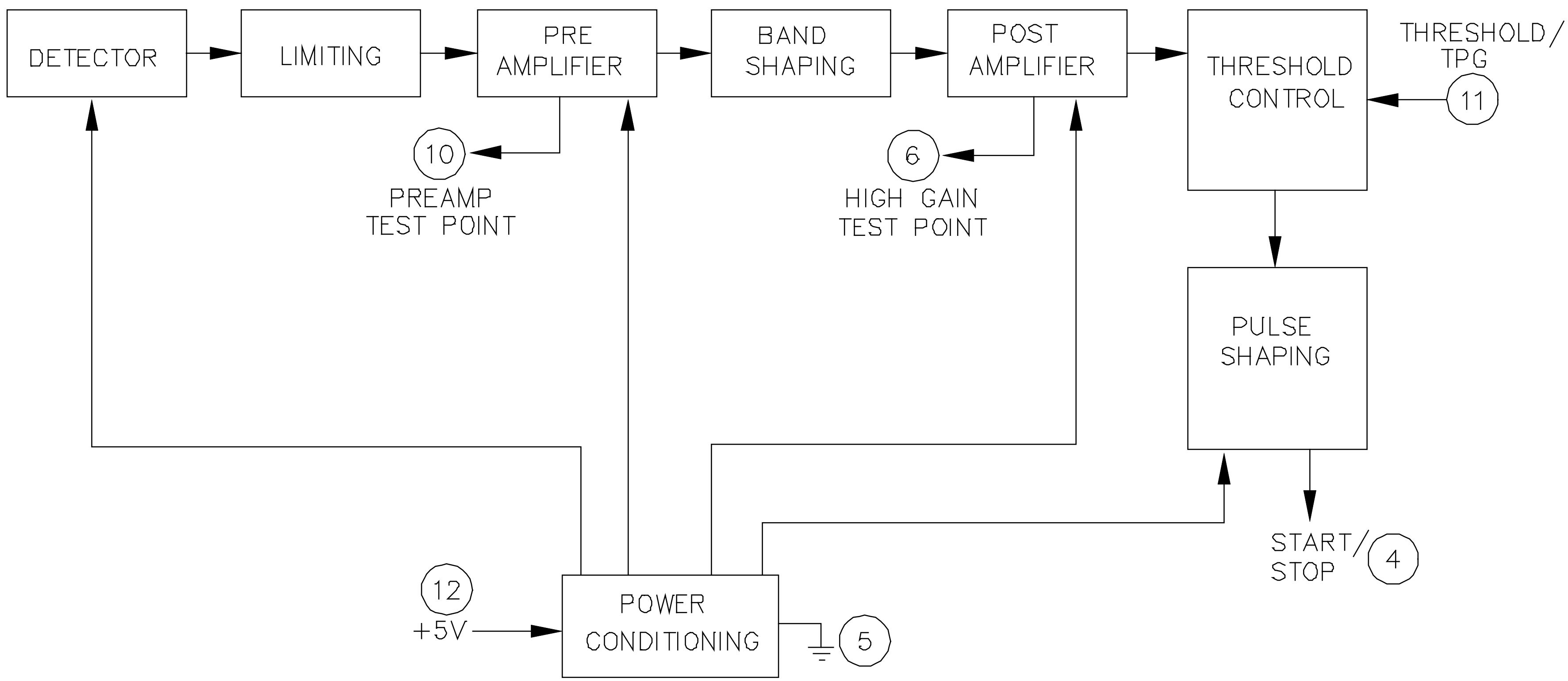
$$\frac{1/1000}{1.0 - (10 \times 6.67 \times 10^{-6})} = 16.7$$

To adjust the FAR, a 6.9 k resistor and 50 k potentiometer are connected in parallel between Pin 11 (THRESHOLD/TPT) and Pin 5 (GROUND). Increasing the resistance value increases the FAR.

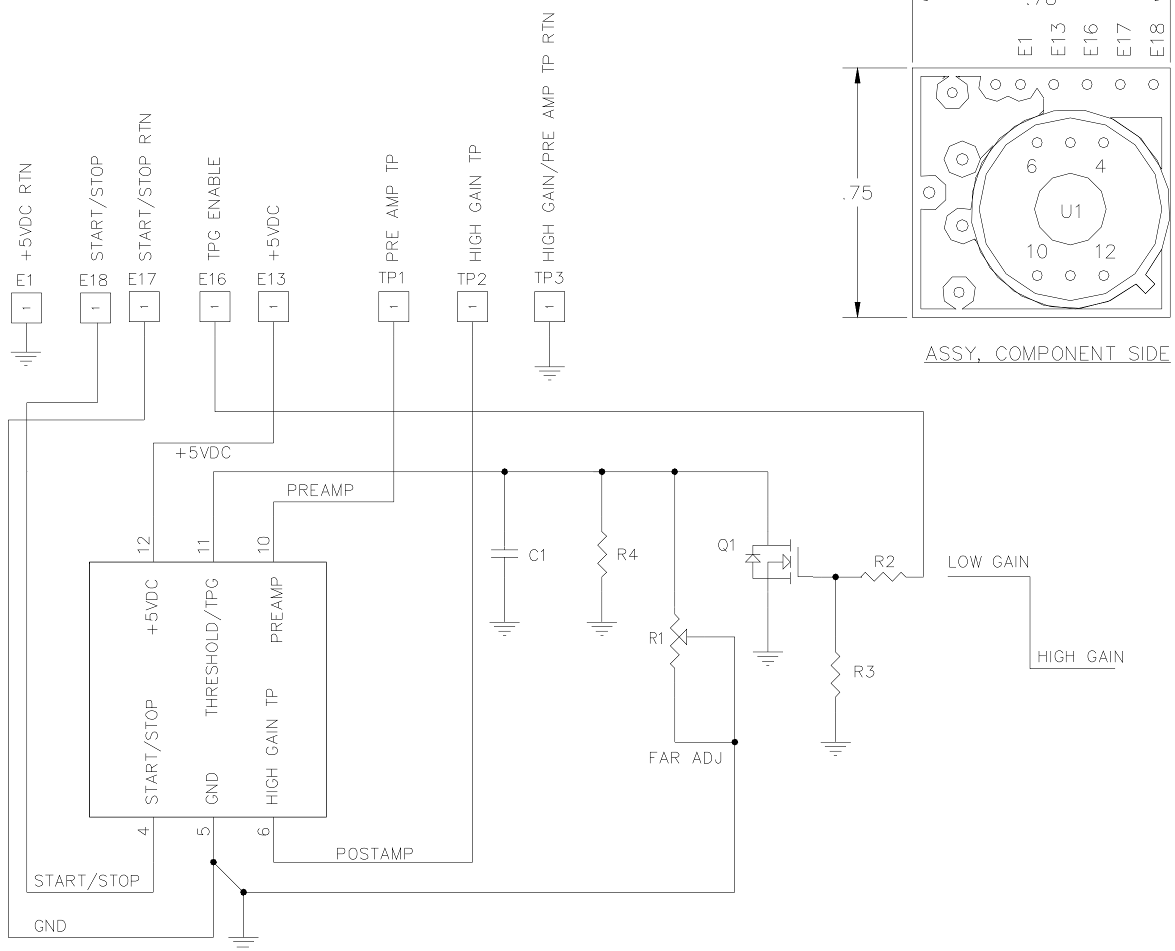
Internal temperature compensation provides a relatively stable FAR over the specified operating temperature range of -40 to +85^{0}C.

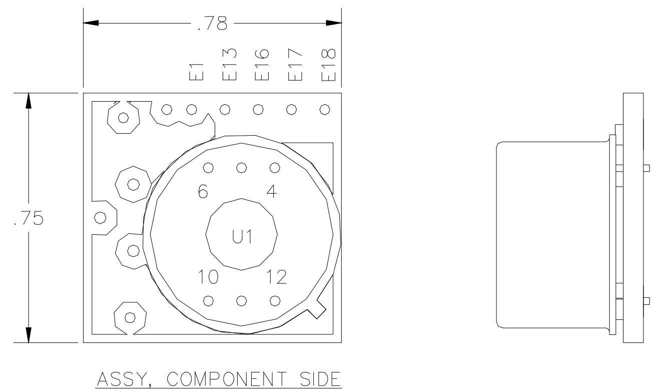
The optical window provides no shielding for the sensitive front end of the 759 Receiver. All wiring from the Start/Stop output and the test points must be routed behind the window face of the case, or oscillation can result. Additionally, system noise sources such as digital switching circuits, Pockel's cell drivers, and switching power supplies should be shielded or arranged so that radiated electrical noise does not enter the receiver through the optical window. It is recommended that all switching power supplies be inhibited during the ranging period.

Model 759 Block Diagram



Model 759 Interface Description





PIN #	SIGNAL NAME
4	START/STOP
5	GND
6	H. GAIN TP
10	PRE AMP TP
11	THRESHOLD/TPG
12	+5VDC

NOTES:
1. FAR means
   False Alarm Rate
2. TPG means
   Time Programmed Gain

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