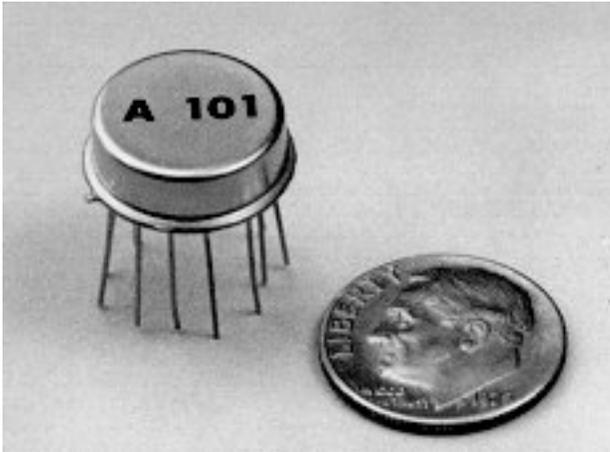


Charge Sensitive Preamplifier-Discriminator

A101



Features

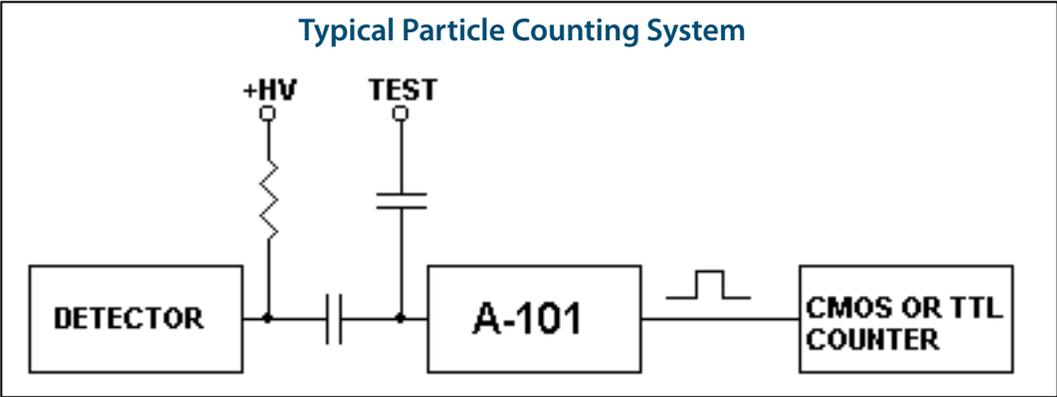
- Small size (TO-8 package) allows mounting close to collector of multiplier.
- Power required is typically 15 mW.
- Single supply voltage.
- Outputs interface directly with CMOS and TTL logic.
- Input threshold is externally adjustable.
- Output pulse width is variable with external trim capacitor.
- High reliability process.
- One year warranty.

Applications

- Mass spectrometers
- Laboratory experiments
- Research experiments
- Portable instrumentation
- Aerospace
- Medical electronics
- Electro-optical systems

Overview

Model A101 is a hybrid charge sensitive preamplifier, discriminator, and pulse shaper developed especially for instrumentation employing photomultiplier tubes, channel electron multipliers and other low capacitance charge producing detectors in the pulse counting mode. The A101 is widely used in laboratory and commercial applications.



A101 Specifications

Test Conditions: ($V_s = +5\text{ V}$, $T = +25\text{ }^\circ\text{C}$)

INPUT CHARACTERISTICS

Threshold	Model A101 has a nominal threshold referred to the input of 1.6×10^{-13} coulomb. This is equivalent to 10^6 electrons. The threshold can be increased by the addition of a resistor between Pins 9 and 12. See Figure 1.
Stability	< 1.5% of threshold, 0 to +50 °C. See Figure 3.
Noise	RMS noise level <0.4% of threshold.
Protection	Back-to-back diodes to ground.
Detector Capacitance	0 to 60 pF
Polarity	Negative or positive

OUTPUT CHARACTERISTICS

Pin 5 provides a positive 5 V output pulse capable of interfacing directly with CMOS.

Pin 6 is an open collector output and with an external pullup resistor provides a negative going pulse (the complement of Pin 5). This output can drive TTL and can be wire-ored with other units. Pullup resistor may be connected to V_s or to other positive supply up to +15 V.

Pulse Characteristics

Risetime	6 ns
Falltime	20 ns
Width	220 ns nominal. May be increased to greater than $1\text{ }\mu\text{s}$ by the addition of a capacitor between Pins 3 and 4. See Figure 2.
Amplitude	5 V

GENERAL

Count Rate	4×10^6 CPS, Periodic
Pulse Pair Resolution	250 ns
Operating Voltage	+4 to +10 VDC
Operating Current	3 mA quiescent, 4 mA @ 10^5 CPS
Temperature	-55 to +70 °C operational
Warranty	One year
Package	12-Pin, TO-8 case.
Screening	Amptek High Reliability
Test Board	PC-11

Vacuum

Due to its hermetic seal and small size, the A101 is well suited for use within a vacuum chamber. In such applications the mounting should provide adequate heat dissipation and care should be taken to avoid electrical discharge near the input, which can damage the unit and void the warranty.

Use care in soldering leads - avoid overheating.

Pin Configuration (14 pin hybrid DIP)

Pin 1	Ground
Pin 2	V_s (+4 to +10 VDC)
Pin 3	Pulse Width Adjust
Pin 4	Pulse Width Adjust
Pin 5	Positive Output
Pin 6	Open Collector Output
Pin 7	No Connection
Pin 8	No Connection
Pin 9	Threshold Adjust
Pin 10	No Connection
Pin 11	No Connection
Pin 12	Input

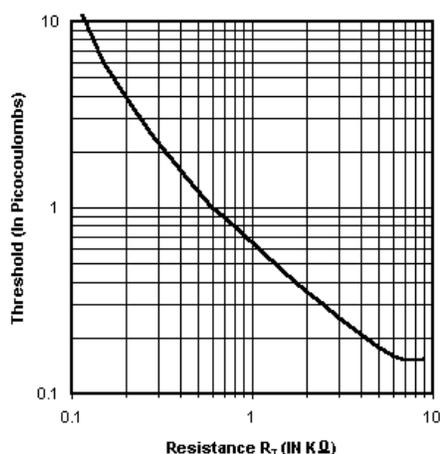
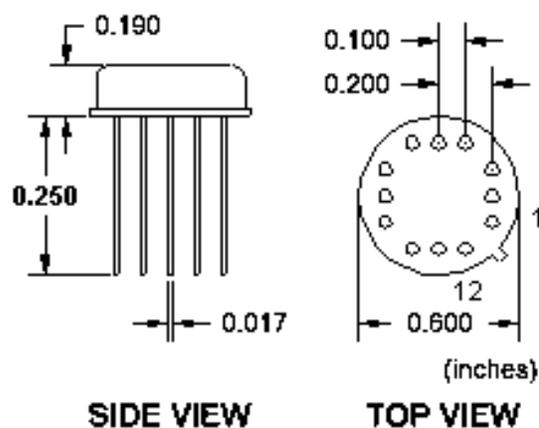


Figure 1: Input threshold as a function of external resistance.

A101 Mechanical Dimensions



A101 Operating Notes

Power Requirements

All device specifications apply to operations at +5 V. The unit can be operated up to +10 V with increased power dissipation and threshold. Supply is internally bypassed. Care should be taken in the circuit layout and in some applications power supply decoupling may be helpful.

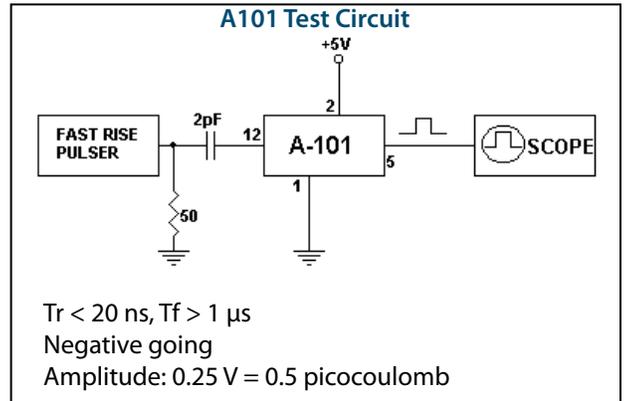
The case is internally connected to Pin 1, ground.

Input

The detector is normally capacitively coupled to Pin 12 with a capacitor of adequate voltage rating. Alternately, the detector anode can be direct coupled to the input if the cathode is at negative potential. The A101 is sensitive to a negative charge pulse of at least 0.16 picocoulomb. This threshold may be increased by the connection of a resistor between Pins 9 and 12. Approximate values are given in Figure 1.

The A101 can be tested with a pulser by using a small 2 pF test capacitor to inject a test charge into the input. The unit will trigger on the negative-going edge of the pulse which should have a much longer fall time ($> 1 \mu\text{s}$) or a square wave may be used. (If a square wave is used, triggering on the positive-going edge will occur for large pulses.)

Charge transfer in the test circuit is according to $Q = C \cdot V$ where Q = total amount charge, C = capacitance, and V = voltage. Use only a small capacitor in this circuit (1 to 10 pF). DO NOT connect a low impedance pulser through 500 pF when testing as this will produce a large pulse through the input transistor and may cause irreversible damage.



Outputs

The output at Pin 5 is a positive, 220 ns wide pulse.

Pin 6 is an open collector output and should be left unconnected if not used. A negative going output can be obtained by connecting a pullup resistor (typically 1 kohm) between V_s and Pin 6. The pullup resistor may be tied to any positive voltage up to 15 V (as required for example, in interfacing with particular logic families.) In multi-detector systems, where more than one preamp drives the same counter, the open collector outputs of several A101s can be connected together to the counter input with a single pullup resistor. DO NOT CONNECT THIS PIN DIRECTLY TO V_s (PIN 2) AS THIS MAY DAMAGE OUTPUT STAGE AND VOID WARRANTY.

The output pulse can be increased by the connection of a capacitor between Pins 3 and 4. See Figure 2.

If the standard pulse width is adequate Pins 3 and 4 must be left unconnected

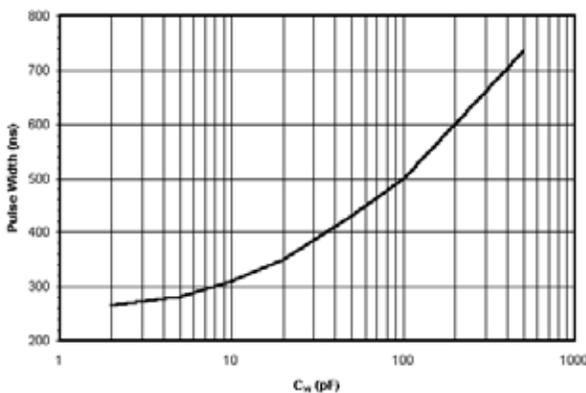


Figure 2: Pulse width as a function of detector capacitance

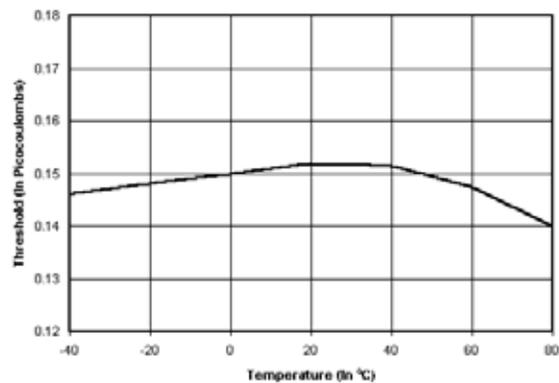


Figure 3: Threshold vs. Temperature (Typical)

