# MICOD

# CHARGE SENSITIVE AMPLIFIER CSA-250

**Revision: January 2018**

**FEATURES:**

- **Unipolar power supply**
- **Ultra-low consumption**
- **Hermetically sealed housing**
- **Small size**
- **Metal case**
- **Low cost**


**APPLICATIONS:**

- **Medical equipment**
- **Personal dose monitor**
- **Portable devices**
- **Nuclear monitoring**
- **Nuclear electronics**
- **Gamma-ray spectrometer**

## PRODUCT DESCRIPTION

**Charge sensitive amplifier (CSA) is designed for charge primary converting and subsequent signal amplification. CSA is tailored to work with scintillator—photodiode assemblies. It's main function is registering gamma quanta. This CSA is of small size and low cost, and has ultra low power consumption. The CSA is ideal for radiation safety systems in hospitals, for personal dose monitors, counters, and gamma-ray valuator spectrometers. The 153.15-2 sealed metal case effectively shields the high-sensitive circuity of the CSA.**

**ATTENTION! The device may be damaged by electrostatic discharge (ESD).**

Electrostatic damage may range from partial derating to complete device failure.

## Table 1— ABSOLUTE MAXIMUM RATINGS (1)

| Name | Value |
|---|---|
| Vcc Supply voltage | + 6.5 V |
| Vbias Bias Voltage(2) | 220 V |

## Table 2 — SPECIFICATIONS

| Name | Min. | Recommended/ Set-point | Max. |
|---|---|---|---|
| Vcc Supply voltage | + 4 V | + 5 V | + 6 V |
| Vbias Bias voltage (2) | | | 200 V |
| Icc Current consumption (3) | | 1 mA | 2.5 mA |
| RF Feedback resistance | | 1 GOhm | |
| CF Feedback capacity | | 0.1 pF | |
| Output constant component , Vcc = 5.0 V | | 0.8-0.9 V | |
| Storage temperature | - 65°C | | + 70 °C |
| Operation temperature | - 50°C | | + 60°C |
| Weight, grams | 5.5 | | 7 |

(1) Voltages beyond the limits specified in absolute maximum values may cause permanent damage to the device. Exposure to maximum voltages for extended periods of time may affect reliability of the device or its failure.

(2) The maximum bias voltage is specified provided a TVS protective diode is installed between the power input and the ground, the maximum bias voltage is limited to 55V in the absence of the TVS diode.

(3) The current consumption values are given in the natural background radiation, the scintillator volume of 1 $см^3$, the photodiode area 25 $mm^2$, Vcc=5 V, T=20°C.

## OPERATING PRINCIPLE

Ionizing radiation strikes the scintillator producing a flash of light proportional to the energy of radiation, this flash of light is recorded by a silicon PIN photodiode photodetector. The charge sensitive amplifier (CSA) receives a charge Q in its input, converts it to a voltage pulse and then amplifies. The output signal from CSA has a sharp front and exponential decay. The amplification factor of the circuit is:

$$Uout \sim \frac{Q}{Cf}$$

where Q is the charge induced on the detector, Cf is the feedback capacitance.

**Theoretical** pulse width is calculated by the formula:

$$\tau = Rf * Cf$$

## FUNCTIONAL DIAGRAM

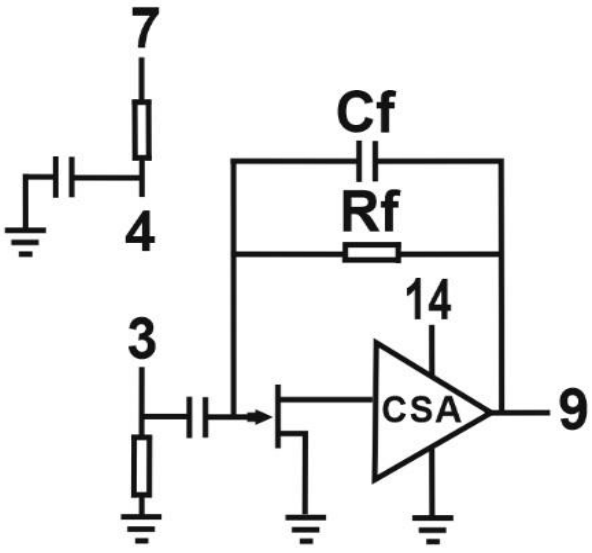


Fig. 1. Functional diagram with pin numbers.

## PINOUT CONFIGURATION

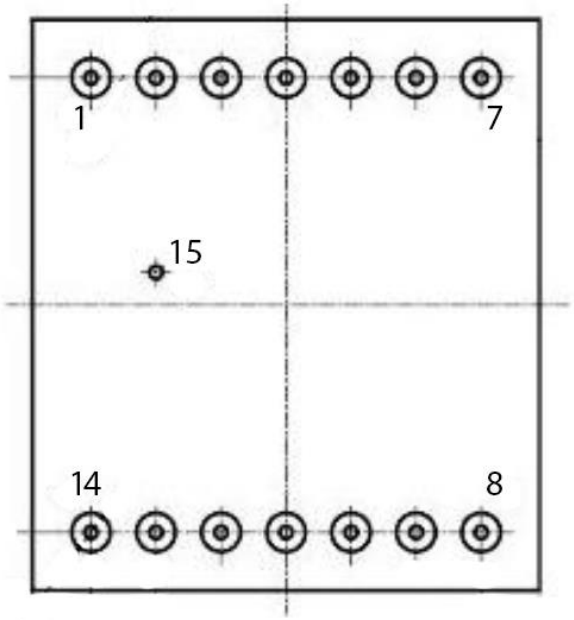


Fig. 2. Pinout, bottom view.

**Table 3 - PIN ASSIGNMENT.**

| Pin # | Identification | Assignment |
|---|---|---|
| 1 | GND | Analog ground |
| 2 | GND | Analog ground |
| 3 | A | Photodiode anode |
| 4 | K | Photodiode cathode |
| 5 | GND | Analog ground |
| 6 | GND | Analog ground |
| 7 | BIAS | Photodiode bias filter circuit |
| 8 | GND | Analog ground |
| 9 | OUT | Output |
| 10 | GND | Analog ground |
| 11 | GND | Analog ground |
| 12 | GND | Analog ground |
| 13 | GND | Analog ground |
| 14 | Vcc | Power supply |
| 15 | GND | Analog ground |

## PIN IDENTIFICATION

### BIAS

Positive bias voltage of the PIN photodiode is supplied to the BIAS pin to reduce the diode capacitance. This voltage determines noise level and detector sensitivity. The high voltage value is determined empirically based on objectives. HV source voltage should be very stable and have low ripple. It is possible to operate the detector at Vcc=Vbias.

### A

Connects to PIN photodiode anode. Line should be as short as possible and well shielded.

### К

Connects to PIN photodiode cathode. Line should be as short as possible and well shielded.

### Vcc

Power output. Each amplifier has its filter, however, a stable and low-noise voltage source is required to power the detector. Installation of the SMAJ5.0CA, SMAJ6.0CA or equivalent protective TVS diode between the VCC pin and GND is recommended. **In the case of no protective TVS diode installed, maximum bias voltage of the diode is limited!**

### OUT

CSA signal output. It is recommended to use an application-specific amplifier-shaper, manufactured by the company.

### GND

The GND pin should connected to analog ground. Never use common ground with high current, high power and other devices (UHF, GSM transmitters, etc.) that may interfere with CSA. It is recommended to use a multilayer board; top layer and bottom layer should connect to the ground and the conductors from pins: Vcc, BIAS, OUT pass through the inner layers shielded against interference.

## INSTALLATION

Only manual soldering with “POS-60” (Sn 60%, Pb 40%) or similar solder is allowed. The maximum heating temperature of the CSA terminals should never be over 250 degrees for 4 seconds. Never use an oven for soldering! Flux residue removal is mandatory.

## OUTPUT SIGNAL EXAMPLES

### Vbias=50 V, Vcc=5 V;

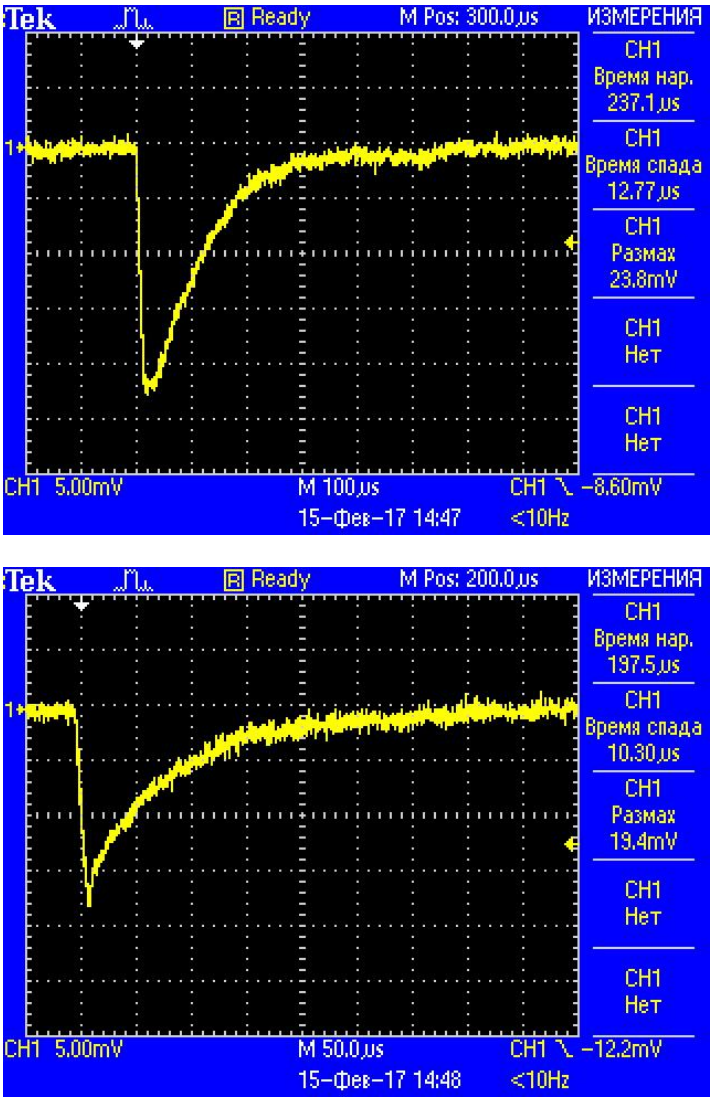


Fig. 3. Output voltage example.

## SAMPLE SPECTRUM

A gamma spectrum obtained when CSA working together with the scintillator—photodiode detector and amplifier-shaper.

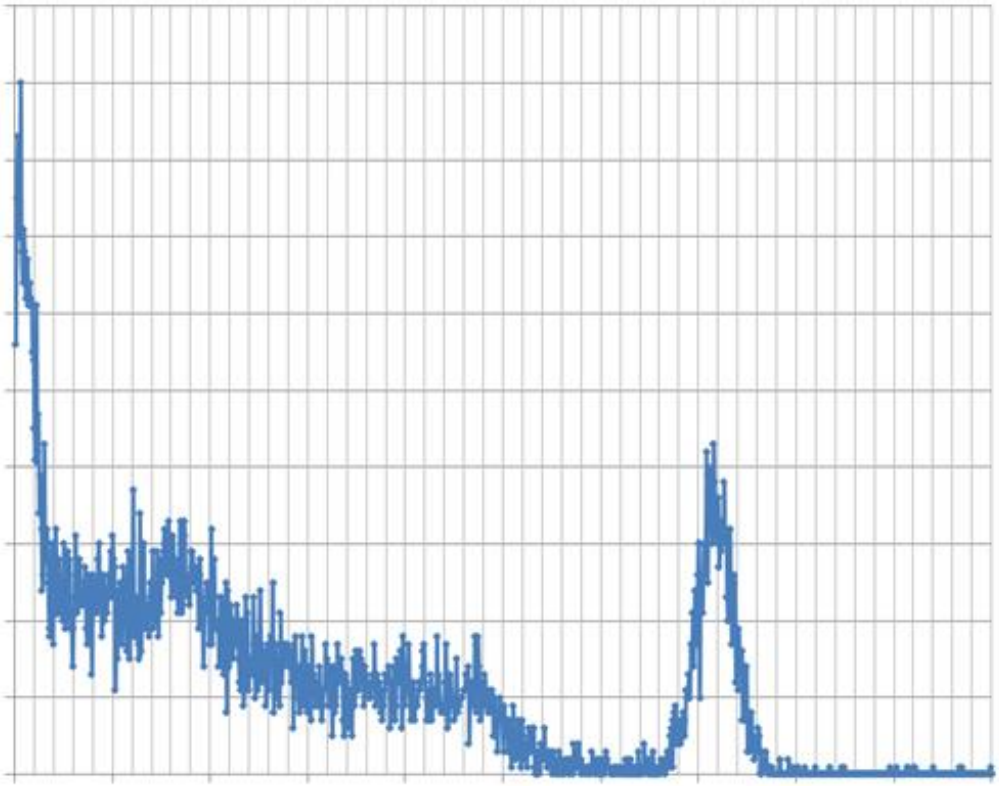

Fig. 4. Cs137 isotope spectrum.

## CONNECTION DIAGRAM

Figures 5, 6 shows the circuity of the amplification channel engagement with a detector of a scintillator-photodiode type or a silicon detector. The amplification channel consists of the charge sensitive preamplifier (CSA-250) and the amplifier-shaper (SA-25). Fig. 5. shows a typical connection diagram. Fig. 6 depicts an optional circuity for special settings of the bias voltage circuit.

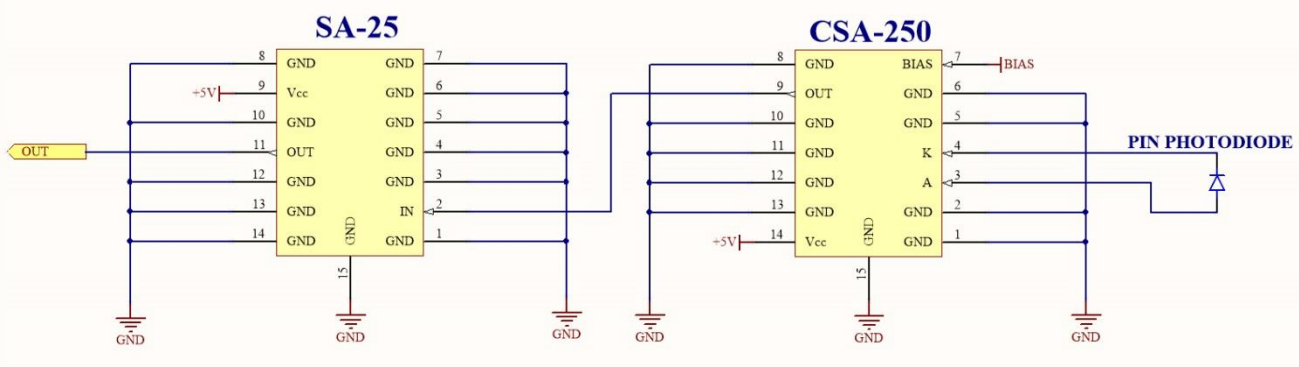


Fig. 5. Main connection diagram.

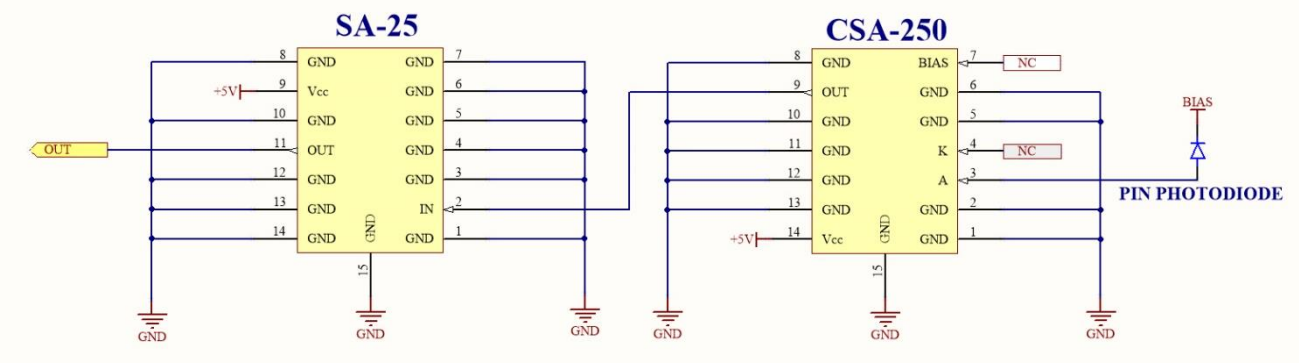


Fig. 6. Optional connection diagram.

## DIMENSIONS AND DESIGNATIONS

Figure 7 shows the case of the amplifier, measurements are in mm. The Altium Designer CAD library available for free download on the manufacturer's website contains mounting sites for the board and circuity symbols for all products of the company. Case glass and metal 153.15-2. Case materials: Fe-53%, Ni-29%, Co-17%, nickel plating; pins: Fe-53%, Ni-29%, Co-17%, nickel plating; insulator: glass.

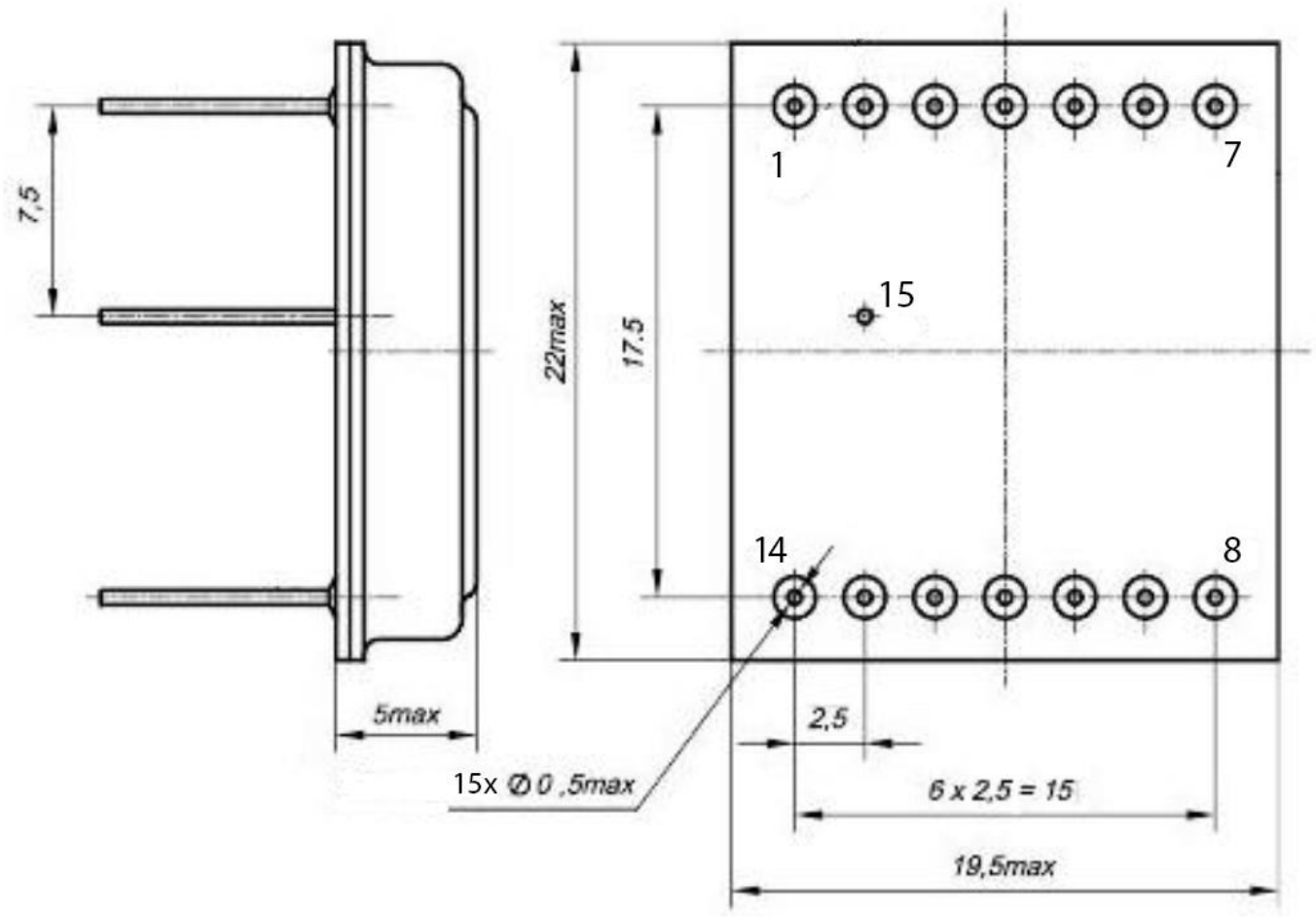


Fig. 7. Case drawing.

Information on the product: Name, Country of production, Manufacturer company.

## OEM PRODUCTS PURCHASE AND USE CONDITIONS

Products of the OEM category are not intended for the end user. Products of this category are designed exclusively for developers and manufacturers of electronic equipment. Manufacturer of this product can not check the conditions of use and storage, compliance with the requirements of "absolute electrical values" and "parameters" sections, other requirements listed in product documentation, or customer technical expertise. By purchasing this product, you agree that this product is not subjected to return or replacement. The manufacturer ensures the QC of the entire batch of products before shipment to the customer.