SHMYTOV

CHARGE-SENSITIVE AMPLIFIER CSA-250

Revision: 07.2026

FEATURES:

- **Single-supply operation**
- **Ultra-low power consumption**
- **Hermetically sealed package**
- **Compact size**
- **Shielded metal case**
- **Low cost**

APPLICATIONS:

- **Medical instrumentation**
- **Personal dosimeters**
- **Portable radiation-detection devices**
- **Radiation monitoring systems**
- **Nuclear instrumentation**
- **Gamma-ray spectrometers**

PRODUCT DESCRIPTION

The CSA-250 is a charge-sensitive amplifier designed to convert detector charge pulses into voltage pulses and to provide initial signal amplification. It is intended for use with scintillator–photodiode detector assemblies, primarily for gamma-ray detection. The CSA-250 combines compact size, low cost, and ultra-low power consumption. It is suitable for hospital radiation-safety systems, personal dosimeters, radiation counters, and portable gamma-ray spectrometry equipment. The hermetically sealed 153.15-2 metal package provides effective shielding for the amplifier's highly sensitive circuitry.

ATTENTION!
The device may be damaged by electrostatic discharge (ESD). ESD damage may degrade device performance or cause complete device failure.

Table 1— ABSOLUTE MAXIMUM RATINGS (1)

Parameter	Maximum rating
VCC supply voltage	+ 6.5 V
VBIAS photodiode bias voltage (2)	220 V

Table 2 — SPECIFICATIONS

Parameter	Min.	Nominal	Max.
VCC Supply voltage	+4 V	+5 V	+6 V
VBIAS Bias voltage (2)			200 V
ICC supply current (3)		1 mA	2.5 mA
RF feedback resistance		1 GΩ	
CF feedback capacitance		0.1 pF	
DC output offset, VCC = 5.0 V		0.8–0.9 V	
Storage temperature	-65 °C		+70 °C
Operating temperature	- 50 °C		+60 °C
Weight, g	5.5		7

(1) Stresses beyond the absolute maximum ratings may cause permanent damage to the device. Extended exposure to absolute maximum conditions may degrade device reliability.
(2) The use of a TVS diode is recommended to protect the amplifier against power-up transients. Without a TVS diode, VBIAS must not exceed 55 V.
(3) Supply-current values are specified under natural background radiation conditions with a 1 cm^3 scintillator, a 25 mm^2 photodiode, VCC = 5 V, and T = 20 °C.

OPERATING PRINCIPLE

Ionizing radiation interacts with the scintillator and produces a flash of scintillation light proportional to the deposited energy. This light is detected by a silicon PIN photodiode. The charge-sensitive amplifier receives charge Q at its input, converts it into a voltage pulse, and provides initial amplification. The CSA output signal has a fast leading edge followed by an exponential decay.

The output pulse amplitude is approximately:

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

where Q is the charge delivered by the detector and CF is the feedback capacitance.

The theoretical decay time constant is:

$$\tau = Rf * Cf$$

FUNCTIONAL DIAGRAM

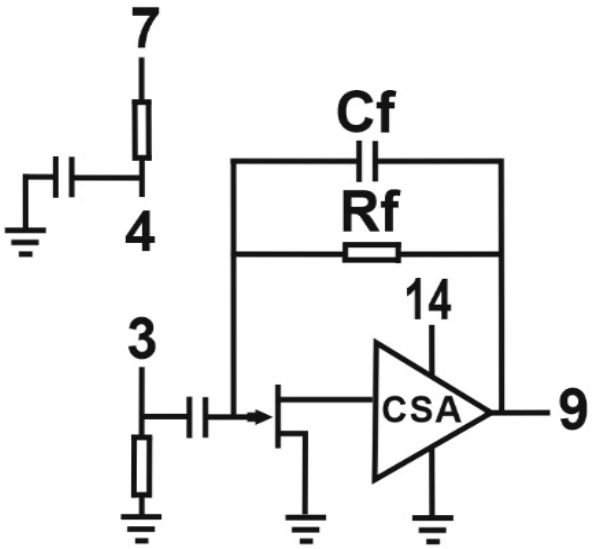

Fig. 1. Functional diagram with pin numbers.

PINOUT CONFIGURATION

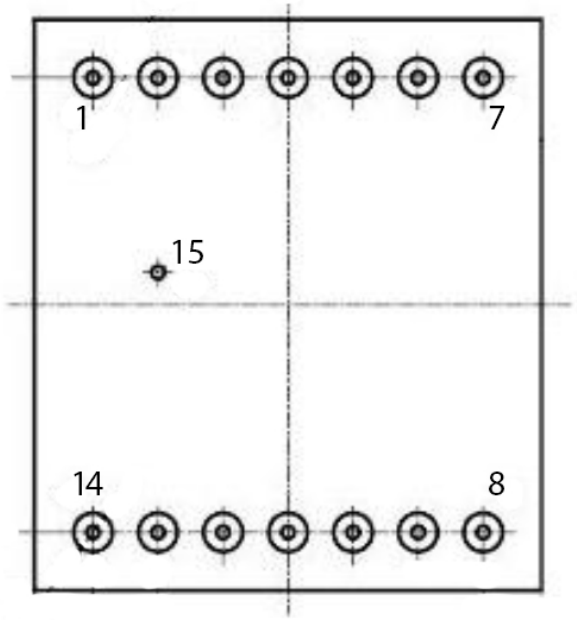

Fig. 2. Pinout, bottom view.

Table 3 — PIN ASSIGNMENT

Pin #	Symbol	Function
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 input/filter connection
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 input
15	GND	Analog ground

PIN IDENTIFICATION

BIAS pin

The reverse-bias voltage for the PIN photodiode is applied to the BIAS pin to reduce the photodiode capacitance. The selected bias voltage affects noise performance and detector sensitivity. The optimum bias voltage should be determined experimentally for the specific detector and application. The bias supply must be stable and have low ripple. VBIAS may be connected to VCC when only a low reverse-bias voltage is required.

A pin

Connect the PIN photodiode anode to pin A. Keep this connection as short as possible and provide adequate shielding.

K pin

Connect the PIN photodiode cathode to pin K. Keep this connection as short as possible and provide adequate shielding.

VCC pin

Power supply input. The CSA includes an internal supply filter; however, it should be powered from a stable, low-noise supply. Installing an SMAJ5.0CA or equivalent TVS protection diode between VCC and GND is recommended.

OUT pin

CSA signal output. For further signal processing, use a dedicated shaping amplifier. The manufacturer's SA-25 shaping amplifier is recommended.

GND pin

The GND pins must be connected to analog ground. Do not share this ground return with high-current, high-power, or RF circuits, such as UHF or GSM transmitters, that may introduce interference into the CSA. A multilayer PCB is recommended. Use the top and bottom layers as ground planes, and route VCC, BIAS, and OUT on inner layers shielded by ground.

INSTALLATION

Only manual soldering is permitted. Use Sn60Pb40 solder or an equivalent solder alloy. The CSA lead temperature must not exceed 250 °C, and the soldering time must not exceed 4 seconds per lead. Do not use reflow or oven soldering. Flux residues must be removed after soldering.

OUTPUT SIGNAL EXAMPLES

VBIAS = 50 V, VCC = 5 V.

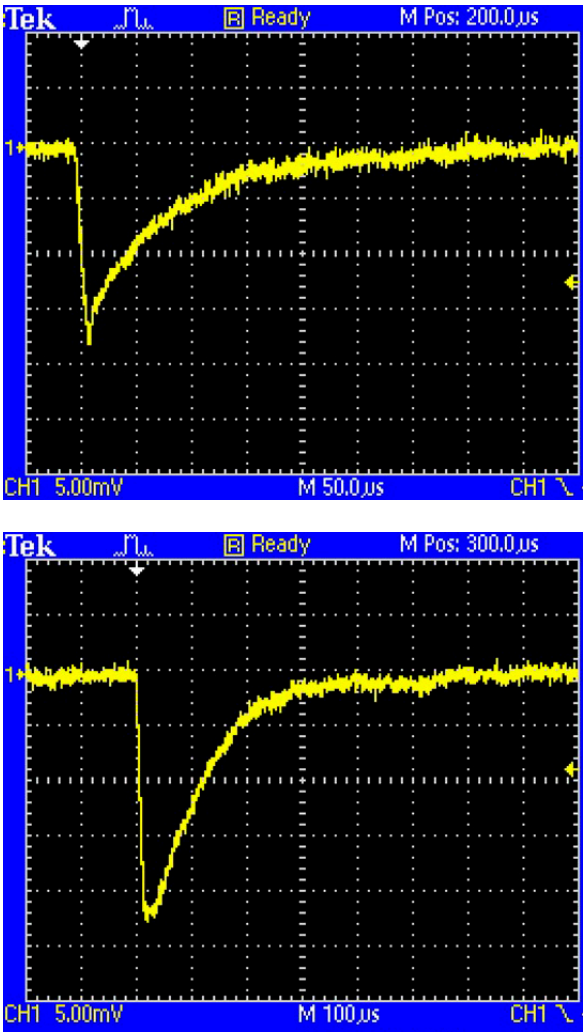

Fig. 3. Typical output voltage waveforms.

SAMPLE SPECTRUM

Figure 4 shows a gamma-ray spectrum obtained with the CSA-250 connected to a scintillator–photodiode detector and a shaping amplifier.

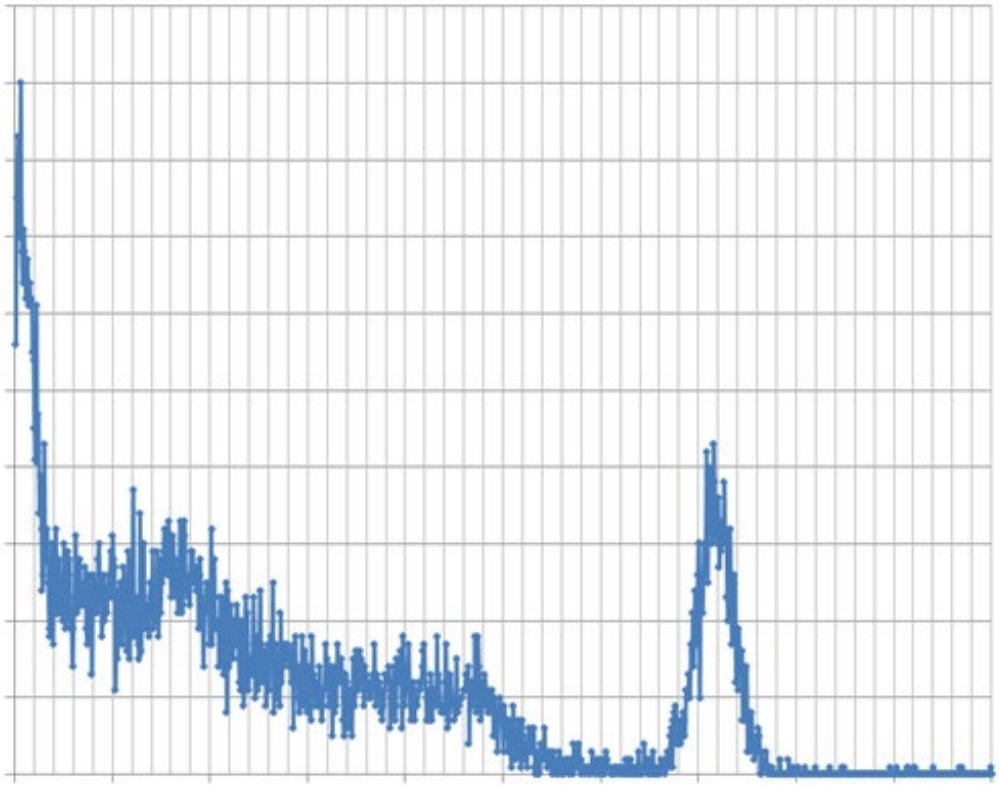

Fig. 4. Cs-137 gamma-ray spectrum.

CONNECTION DIAGRAMS

Figures 5 and 6 show connection diagrams for an amplification channel using a scintillator–photodiode detector or a silicon detector. The channel consists of the CSA-250 charge-sensitive amplifier and the SA-25 shaping amplifier. Figure 5 shows the standard connection diagram. Figure 6 shows an optional connection diagram for an alternative bias-voltage circuit configuration.

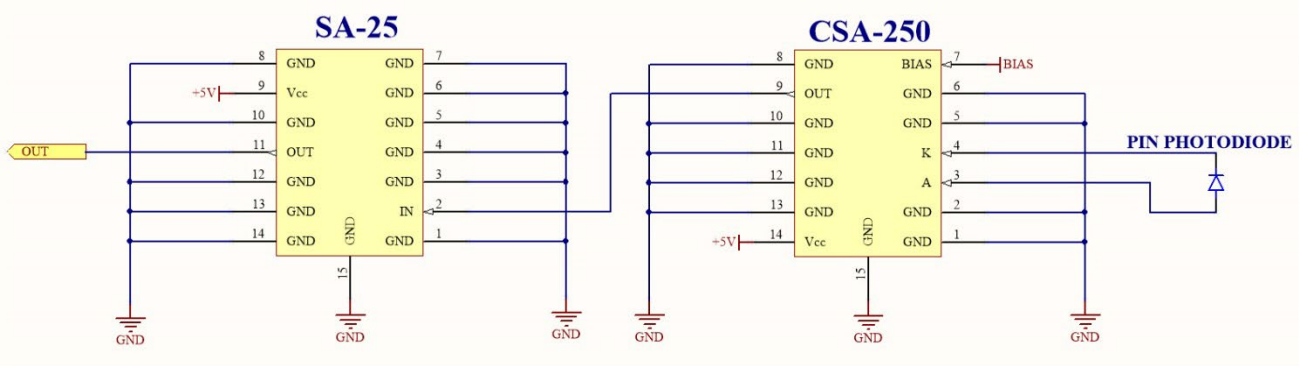

Fig. 5. Standard connection diagram.

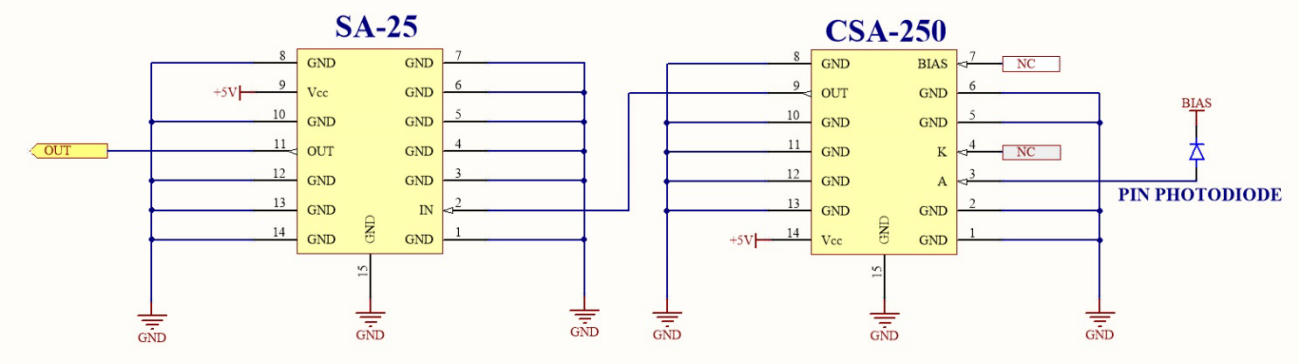

Fig. 6. Optional connection diagram.

DIMENSIONS AND MARKING

Figure 7 shows the amplifier package dimensions. All dimensions are in millimetres. Package: 153.15-2 hermetic glass-to-metal package.

Case material: Fe 53%, Ni 29%, Co 17%; nickel-plated.
Lead material: Fe 53%, Ni 29%, Co 17%; nickel-plated.
Insulator: glass.

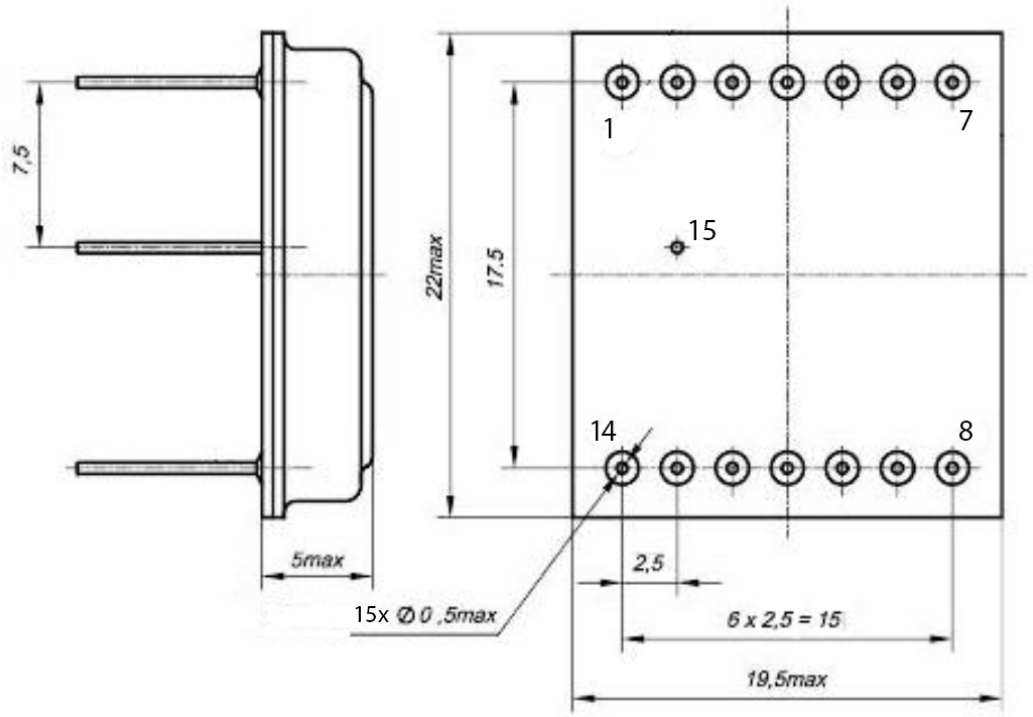

Fig. 7. Package outline drawing.

Product marking: product name, country of origin, and manufacturer.

CONDITIONS OF PURCHASE AND USE FOR OEM PRODUCTS

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