



Overview

SE4102 is a high-frequency dual-channel low-noise current pre-amplifier. As shown in Fig.1(SE4102 schematic diagram), the current between the positive and negative input terminals is measured by measuring the voltage drop across the shunt resistor between the input terminals, with a bandwidth of up to 100 MHz. Featuring a JFET low-noise operational amplifier, the SE4102 boasts a very high input impedance to minimize loading effects on the input signal source.

The input resistance of the SE4102 is adjustable from 10Ω to 1MΩ across six ranges, with an input leakage current as low as 2pA. It can stable detection of current signals from pA to mA. The SE4102 can be conveniently placed near the device under test, amplifying weak current signals to reduce interference during long-distance transmission. It can be used alongside high-precision measurement instruments such as the SE2041 lock-in amplifier.

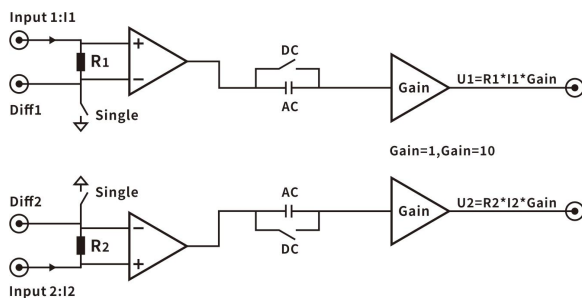


Fig.1 SE4102 Schematic Diagram

Product Features

- 100 MHz bandwidth for high capacitance sources
- Extremely low noise, low input leakage
- Variable precision input impedance for accurate source matching
- 2 independent amplification channels
- Differential inputs for improved signal integrity
- Easy and convenient switching control

Equipment Photos and Descriptions

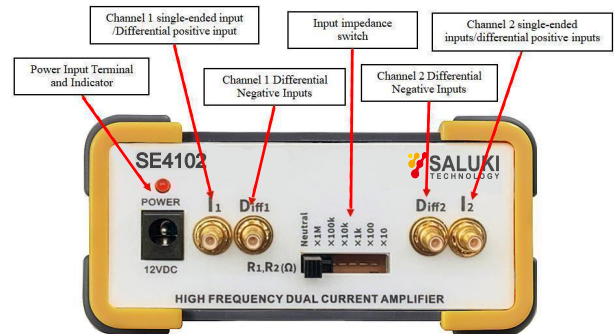


Fig.2 SE4102 Main View

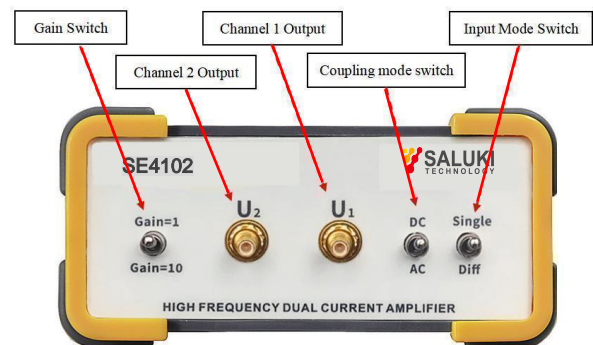


Fig.3 SE4102 Back View

Fields of Application

1. Low noise and high speed current amplification
2. Large capacitive load
3. Photodiode measurement
4. Accelerometers, pressure sensors and other current signal measurement
5. Impedance, impedance spectrum measurement

Typical Characterisation Tests

Testing conditions: Power supply voltage = 12V, ambient temperature = 25° C; Input current 14mA - 0.5μA; SE4102 gain ranges from 10V/A to 1MV/A, DC coupling, single-ended input, Gain = 1.

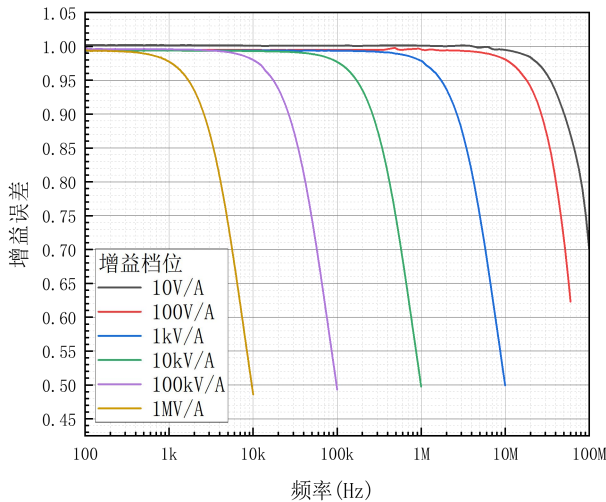


Fig.4 Gain Error-Frequency Curve^[1]

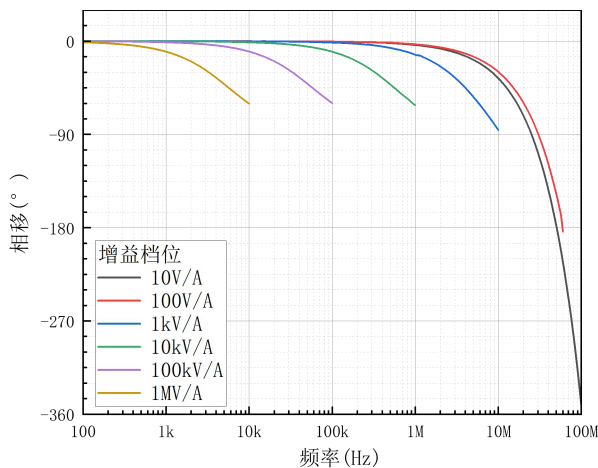


Fig.5 Phase Shift-Frequency Curve

Caution:

[1]. Input capacitance Cs = 100pF at 10V/A

Instructions for use

1. SAppropriate Gain Resistance

In the measurement process, select the correct SE4102 gain resistance R1, R2, through the impedance matching, you can optimise the power transfer efficiency, which can avoid reflections between the signal and the amplifier and the mismatch of fluctuations brought by the enhancement of the system stability. The SE4102 is equipped with six gain settings ranging from 10 V/A to 1 MV/A, along with a "Neutral" setting that removes all internal input resistance

and supports any externally connected custom resistance, providing flexibility for impedance matching. When the "Neutral" setting is selected, the SE4102 functions as a voltage amplifier with selectable gains of 1 and 10.

As indicated by the P3 gain parameters, each gain setting has a maximum input current range. Users can calculate the output voltage based on the gain value, selecting the appropriate gain setting and bandwidth range while ensuring that the output voltage does not exceed 9.5V. Generally, it is recommended to choose a higher gain setting for the first-stage amplifier to achieve optimal signal-to-noise ratio.

$$V_{OUT} = I_{IN} \times R_{1,2} \times Gain$$

2. Second Stage Voltage Gain

The second-stage amplifier of the SE4102 offers a choice of voltage gains of 1 or 10. When the input signal is small, if you want to maintain a low input impedance and high signal bandwidth, the second-stage amplification can use a 10x voltage gain to amplify the input signal to a higher level, bringing it within the detectable range of the measuring instrument. Additionally, while amplifying the input signal, noise will also be amplified, and extra noise may be introduced. It's important to be mindful of issues such as signal distortion caused by excessive amplification during use.

3. Single-ended And Differential Modes

The SE4102 offers a switchable option for single-ended or differential inputs, allowing control over the input mode for both channels simultaneously. In single-ended mode, the SMB connector links the signal negative terminal to the internal ground of the amplifier, making it suitable for simple connections and single-ended signals.

Differential mode requires two wires to be connected to the differential connector of the signal source to detect the differential pressure at the source. Differential mode offers higher immunity to interference and better signal quality for long distance connections or high EMI environments. In addition, the symmetrical dual-channel design of the SE4102 allows two single-ended outputs to be combined into a single differential output.

4. AC and DC Modes

The SE4102 allows for optional AC or DC coupling between the first and second stage amplifiers. DC coupling does not block any input signals, and it is recommended for lower frequency signals, though care must be taken to avoid signal overflow due to the input signal's offset. AC coupling is used to block the DC component of the input signal and filter out low-frequency signals, with a cutoff frequency at 290 kHz.

Caveat

1.Ensure that a stable and low interference power supply system is provided. An unstable or noisy power supply will directly affect the performance and output quality of the amplifier.

2.Know the input signal range. If the input signal is outside the amplifier's operating range, it may cause distortion or damage the amplifier.

3.When the SE4102 is not in use for a long time, be sure to unplug it from the power supply.

4.The operating temperature of the amplifier may affect its performance. It is recommended that the amplifier be warmed up for 30 minutes. Also ensure that the amplifier operates within the specified temperature range and that proper heat dissipation measures are provided to avoid overheating.

5.For electrostatic sensitive current pre-amplifier, appropriate anti-static measures should be taken.

6.The amplifier should be placed in a dry, clean environment to avoid the accumulation of dust and moisture to prevent problems that could lead to failure or corrosion.

7.Avoid mechanical damage, such as collision, vibration or pressure, and avoid incorrectly plugging and unplugging connectors to ensure its long-term reliability and performance stability.

8.If the equipment fails, please do not disassemble the case by yourself to repair it, and contact us as soon as possible.

Pre-Amplifiers

SE4102 Pre-Amplifiers

Specification

Size	102*162*49(mm)
Weights	0.3kg
Storage Temp.	-20° C to 65 ° C
Work Temp.	5° C to 40° C
Specification Temp.	25° C
Using Power	12V/1A
Power Wastage	7.9W max
Connection Ports	4 SMB inputs 2 SMB outputs DC 5.5-2.1 mm input terminals

Caution:

Unless otherwise noted, all specifications apply only to units **after 30 minutes** of preheating.

Performance Parameters

Scope of supply

MIN	9V
RATED	12V
MAX	15V

Inputs

Input Mode	Single-ended or Differential
Current Range	±160 mA
Current Noise	100 fA/√Hz
Voltage Noise	7 nV/√Hz (10kHz)
Bias Voltage	<±1mV
Leakage Current	2 pA
Impedance Range	10 V/A-1 MV/A (Z//12pF)
Coupling Method	
DC coupling	DC-100 MHz
AC coupling	290 kHz-100 MHz

Common-mode ±9.5V

Outputs

Output Mode	Single-ended
Voltage Gain	Gain=1, Gain=10
Output Voltage	±9.5V max
Frequency Response	DC-100 MHz
Impedance	50Ω
Gain Accuracy	1% typical, 5% max

Gain parameters

Input Impedance	Bandwidth/-3dB Cut-off Frequency	Max. Input Current Noise	Max. Input Current Range (Gain=1)
10 V/A	100 MHz	520pA/√Hz (300kHz)	±160 mA
1 kV/A	5 MHz	5.3 pA/√Hz (100kHz)	±9.5 mA
10 kV/A	500 kHz	720 fA/√Hz (100kHz)	±950 μA
100 kV/A	50 kHz	265 fA/√Hz (129kHz)	±95 μA
1 MV/A	5 kHz	100 fA/√Hz (1.248kHz)	±9.5 μA

Caution:

All parameter values in the table are typical and will vary depending on the source capacitance, input signal swing, and capacitive loading at the output of the amplifier.

Accessories

1. One 12V, 1A power adapter
2. Two SMB-BNC cables