



**WIDEBAND CURRENT AMPLIFIER**

# **SA-600 Series**

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**INSTRUCTION MANUAL**



DA00049389-002

**WIDEBAND CURRENT AMPLIFIER**

**SA-600 Series**

**INSTRUCTION MANUAL**



## Preface

Thank you for purchasing “SA-600 Series Wideband Current Amplifier”.

Please read "Safety Precautions" on the next page first to ensure the product is used in a correct and safe manner.

- Alert Symbols in this Manual

This manual uses the following alert symbols. The instructions by those alert symbols shall be carefully obeyed to ensure equipment operator's safety and prevent damage to equipment.

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### **WARNING**

Equipment handling could result in death or serious injury. This symbol contains information to avoid such risk.

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### **CAUTION**

Equipment handling could result in minor or moderate injury, or property damage. This symbol contains information to avoid such risk.

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- This manual consists of the following chapters.

If using this product for the first time, start from "1. Outline."

1. Outline

This chapter describes an overview and describes the features and applications of this product and the simple operating principle.

2. Preparation Before Use

This chapter describes important preparations before installation and operation.

3. Panels future and Basic Operations

This chapter explains the basic operations of the panels.

4. Maintenance

This chapter explains the simple operation inspection method.

5. Specifications

This chapter describes the specifications (functions and performance).

6. Typical Data

This chapter describes the typical characteristics as a supplementary.

## ———— Safety Precautions ————

For safe use, ensure to obey the following warnings and considerations.

We are not responsible for damage resulting from failure to obey these warnings and considerations.

- Ensure you obey the instructions in this instruction manual.

This instruction manual contains instructions for the safe operation and use of this product.

Before using the product, please read this manual first.

All the warning items contained in this instruction manual are intended for preventing risks that may lead to serious accidents. Ensure to obey them.

- Check the power supply voltage.

This product operates at a power supply voltage specified in "Power Supply" of this instruction manual.

Before connecting to the power supply, check that the voltage of the power supply matches the rated power supply voltage of this product.

- If you notice anything strange

If you notice smoke or a strange odor or sound being emitted from this product, promptly disconnect the DC power cable (accessory) and stop using the product.

Should you encounter any anomaly like above, immediately contact us or our agent. Never use it until the repair is completed.

- Do not use in a gaseous atmosphere.

This may pose a risk of explosion or other.

- Do not remove the cover.

Never remove the cover.

When inspection into the inside of the product is needed, never allow anybody to touch the innards except our certified service engineers.

## Safety Precautions

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- Safety symbols

The following shows the general definitions of the safety symbols used on the product main unit and in the instruction manual.



Refer to the instruction manual

This notifies the user of potential hazard and indicates that he/she must refer to the instruction manual.



Electric Shock Hazard

This indicates that an electric shock may occur under specific conditions.



Warning Symbol

This contains information to avoid risks in equipment handling that could result in death or serious injury.



Caution Symbol

This contains information to avoid risks in equipment handling that could result in minor or moderate injury, or property damage.

- Other Symbols



Indicates the ON position of the power switch.



Indicates the OFF position of the power switch.



Indicates that the external conductor of the connector is connected to the case.



Indicates that the external conductor of the connector is connected to the signal ground.

- Request about disposal

To protect the environment, follow the guidelines described below for the disposal of this product.

- a) Use the services of an industrial waste disposal contractor for disposal of the entire product.
- b) This product does not use batteries.
- c) This product does not contain mercury.

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# 1. Outline

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## 1.1 Overview

"SA-600 Series" is a wideband current amplifier (current to voltage converter) with a high gain and wide frequency band. There are the following five Models depending on the gain.

SA-604F2: Gain 10 MV/A, frequency band DC to 500 kHz

SA-605F2: Gain 100 MV/A, frequency band DC to 250 kHz

SA-606F2: Gain 1 GV/A, frequency band DC to 100 kHz

SA-607F2: Gain 10 GV/A, frequency band DC to 20 kHz

SA-608F2: Gain 100 GV/A, frequency band DC to 2 kHz

It operates stably for the added input capacitance despite a wide frequency band. It operates without oscillation with an added input capacitance of 1000 pF. The LPF cutoff frequency can be selected from four steps with a switch.

## 1.2 Features

- (1) SA-606F2 has achieved a wide frequency band of DC to 100 kHz with a gain of 1 G (V/A).  
The technology that realized SA-600 series has obtained the following patents.  
Patented: No. 6022262 (Japan), US 9024686 B2 (US), EP 2566048 B1 (Europe)
- (2) Even when the source capacitance of 1000 pF is added, it operates stably without any concerns of oscillations. Besides, overshoot and ringing will not occur in the pulse response.
- (3) The LPF cutoff frequency can be selected from four steps with a switch.
- (4) SMA connectors are used for the I/O connectors. SMA connector has a reputation for its high frequency characteristics and shielding ability.

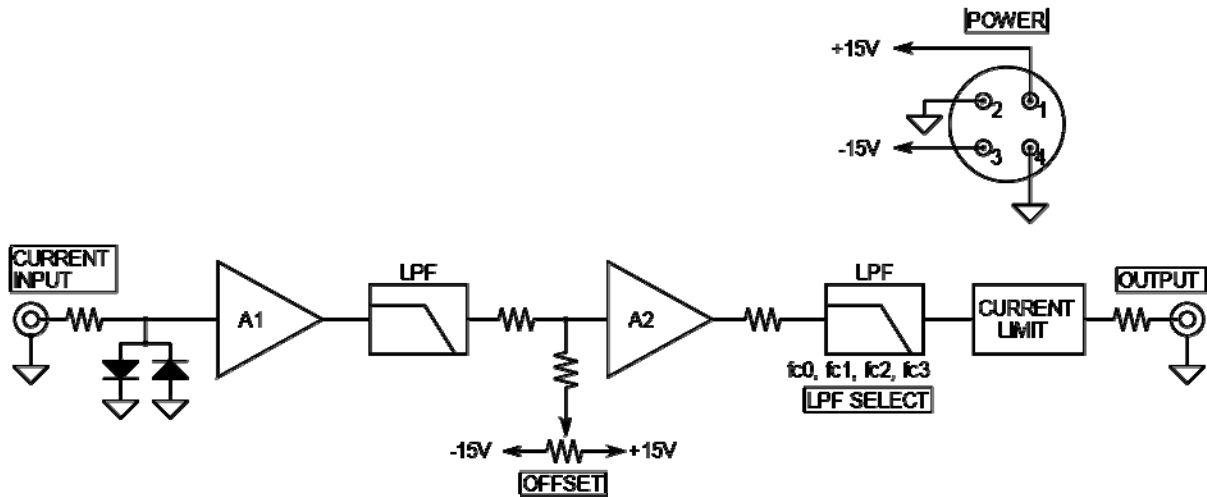
## 1.3 Applications

This current amplifier with a high gain and wide frequency band is stable for input capacitance and can be widely used to amplify small currents.

- (1) Wideband current to voltage converter for a current output sensor (e.g. optical device).
- (2) Expansion of the frequency band and improvement of noise for a current amplifier with a built-in lock-in amplifier.
- (3) Measurement of leakage current for insulating materials, etc.

## 1.4 Operating Principle

A1 is an inverting amplifier using a low noise FET for the first stage. SA-600 Series is designed so that the open loop gain is constant until the maximum operating frequency is reached, so the input impedance is a pure resistance and constant. This enables it to operate stably even if the input is loaded with a large capacitance (patented). A2 is an inverting amplifier for adding the output offset voltage, and the LPF (= low pass filter) upper cutoff frequency can be selected from four steps including THRU with a switch.



型式	fc0	fc1	fc2	fc3
SA-604F2	THRU	300 kHz	100 kHz	30 kHz
SA-605F2		100 kHz	30 kHz	10 kHz
SA-606F2		30 kHz	10 kHz	3 kHz
SA-607F2		10 kHz	3 kHz	1 kHz
SA-608F2		1 kHz	300 Hz	100 Hz

Figure 1-1 Block Diagram

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## 2. Preparation Before Use

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## 2.1 Check the Appearance and Accessories

If you notice something out of the order on the outside of the packing box (such as a scratch or dent), closely check that the product is not affected when you take out it from the box.

When you have took out the contents from the packing box, check them. If you find a scratch on the product or an accessory is missing, report the problem to NF Corporation or one of our representatives.

- Appearance Check

Check that there is no scratch or dent on the panel surfaces, connectors, etc.

- Product Configuration Check

The following shows the product configuration. Check that the quantities are correct and there is no scratch.

**Table 2-1 Configuration List**

● Wideband Current Amplifier .....	1
● Accessories	
Instruction manual .....	1
SMA open plug .....	1
BNC-SMA conversion connector .....	2
Bottom plate .....	1

The bottom plate is attached to the main unit by four plastic screws (M3×6 mm).



## 2.2 Conditions for Installation Location

- The installation location shall meet the following temperature and humidity conditions.

Performance guarantee: +23±5 °C, 5 %RH to 85 %RH

Operating conditions: 0 °C to +40 °C, 5 %RH to 85 %RH

Storage conditions: -10 °C to +50 °C, 5 %RH to 95 %RH

However, use the product with non-condensation. For the absolute humidity range, refer to the specifications.

- Use the product indoors, at altitude up to 2000 m.
- Do not install the product in the following locations.
  - Location where flammable gases may be present  
There is danger of explosion. Never install or use it in such a location.
  - Outdoors or location exposed to direct sunlight, or near a fire or heat source  
The expected performance of this product may not be exhibited, or a malfunction may result.
  - Location where corrosive gases, water vapor, or dust may be present or humid location  
This product may become corroded, or a malfunction may result.
  - Near an electromagnetic field source, high-voltage device, or power line  
Noise may increase.
  - Location where there is a lot of vibration  
Noise may increase or a malfunction may result.

## 2.3 Power Supply

This device operates under the following power supply conditions.

- Stabilized DC power supply with DC ±15±1 V, ±40 mA or more, and ripple noise 1 mVrms or lower (a switching power supply is not recommended).

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### **⚠ CAUTION**

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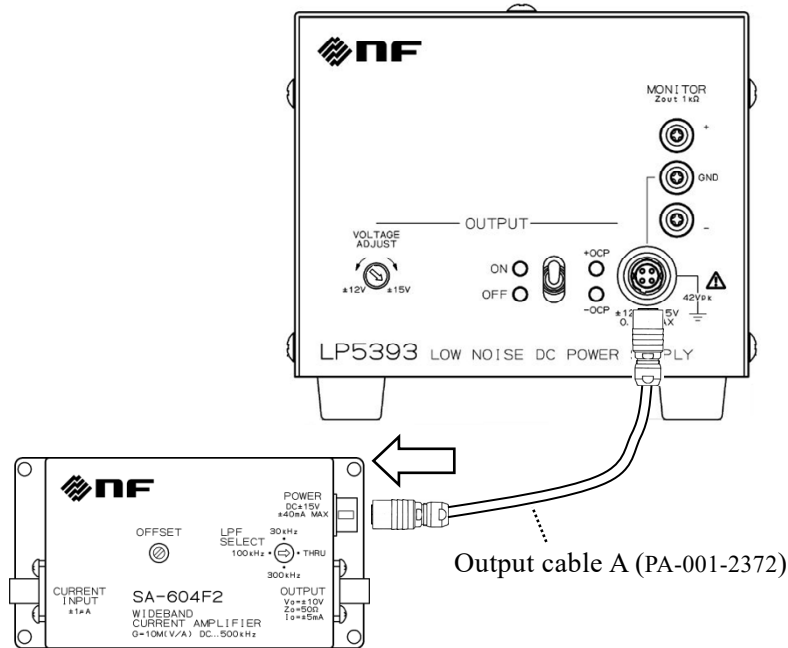
- This device operates at DC ±15 V, and Low Noise DC Power Supply LP Series is provided so that it can obtain the best noise characteristics.
  - A reverse connection of the power supply or supplying a voltage greater than ±18 V or more will damage the internal circuit of this device.
-

## 2.4 Connecting with Low Noise DC Power Supply LP Series

The output cable A (PA-001-2372) is available to connect this product to LP Series.

Contact us or our agent.

The following figure shows connection using the output cable A. Output of LP Series is set as  $\pm 15$  V.



**Figure 2-1 Connecting with LP Series**

### ⚠ CAUTION

- Connect this device with the power supply while the power supply is off.
- Do not disconnect and connect a cable for power supply when the power supply is on. This product may be damaged.

## 3. Panel Futures and Basic Operations

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## 3.1 Panel Component Names and Functions

See Figure 3-1 Front and Rear Panel Views.

### ① CURRENT INPUT

This is the current input terminal of this device, which uses an SMA connector.

The input impedance varies depending on the model; for example, the input impedance of SA-607F2 is approximately 30 k $\Omega$ . The maximum input current is  $\pm 30$  mA. Do not apply an electrical current greater than this. The input stage of this device may be damaged or deteriorated.

### ② OFFSET

This is a variable resistor for adjusting the output offset voltage of this device.

Use a screwdriver with a thin tip for adjustment. Using a screwdriver whose tip does not match or applying excessive force may cause damage.

### ③ LPF SELECT

This is a switch for selecting the upper cutoff frequency for the low pass filter of this device. Use a screwdriver with a thin tip for switching. Using a screwdriver whose tip does not match or applying excessive force may cause damage.

### ④ OUTPUT

This is the output connector of this device, which uses an SMA connector. The output impedance is 50  $\Omega$  and the maximum output current is  $\pm 5$  mA ( $\pm 10$  V for a 2 k $\Omega$  load).

Note that the output of this device cannot drive the 50  $\Omega$  load directly.

### ⑤ POWER

This is the power input connector of this device, which uses a HR10-7R-4P (73). DC  $\pm 15$  V is supplied by connecting the DC cable with this connector.

### ⑥ (Mounting holes)

These holes (M3) are used to mount this device to the chassis, etc. with the bottom plate mounted to it. This device can be mounted to the chassis while they are electrically insulated.

### ⑦ (Holes to mount this device)

To remove the bottom plate and mount this device directly to the chassis, etc., use these screw holes (M3) (The internal insertion length of the screw should be 6 mm or less).

Note that if the bottom plate is removed, this device and the object to which this device is mounted are electrically connected. The bottom plate is mounted to this device using 6 mm plastic screws (M3).

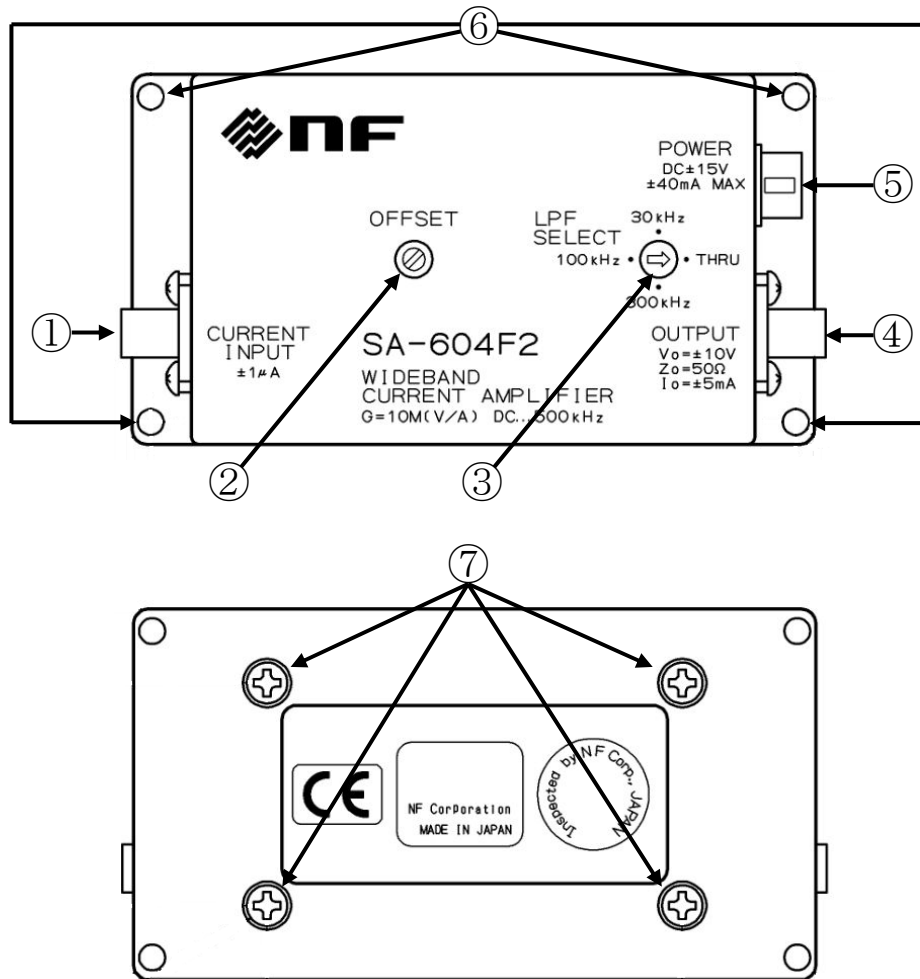


Figure 3-1 Front and Rear Panel Views

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## 3.2 Input Connection and Installation

Shielding of the input cable and the connection and installation method are important to use this device with the best noise characteristics. Follow the instructions below to connect and install this device.

- Install this device as near the sensor or signal source as possible, and make the input cable as short as possible.
- Use of an SMA connector and semi-rigid cable is useful to reduce disturbance and noise from outside.
- Installing this device with the bottom plate connected to it on conductors such as metals insulates the device from the object to which it is connected, so GND loop noise can be reduced.
- If there is a device including a transformer such as a DC power supply nearby, install the sensor and this device as far as possible from it.
- Install this device in a location where there is as little vibration as possible. When a small signal is detected, it may be subject to the influence of microphonic noise generated by the vibration of the cable.
- Be sure to use shielded cables such as coaxial cables for input and output. Furthermore, install the input cable and output cable as far away from each other as possible (an input and output coupling may cause oscillation and instability).
- Secure this device in a stable location.
- Do not connect this device to an AC outlet, because doing so is dangerous.
- The signal GND and case have the same electric potential. Caution is required when giving a potential to the case or signal GND, because doing so may cause electric shock.

### 3.3 Connecting Optical Sensor (Photo Diode), Etc.

- Be sure to install the sensor in a shielded box.

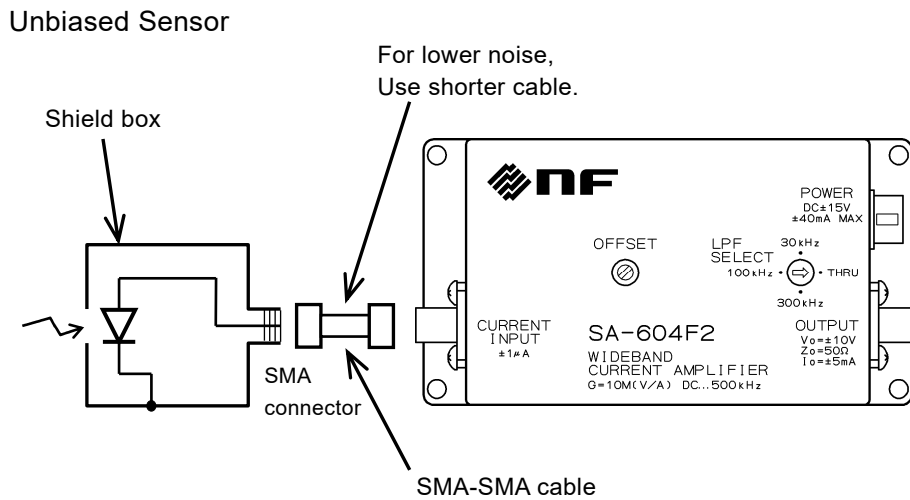


Figure 3-2 Connecting Unbiased Sensor

#### Reverse Biased Sensor

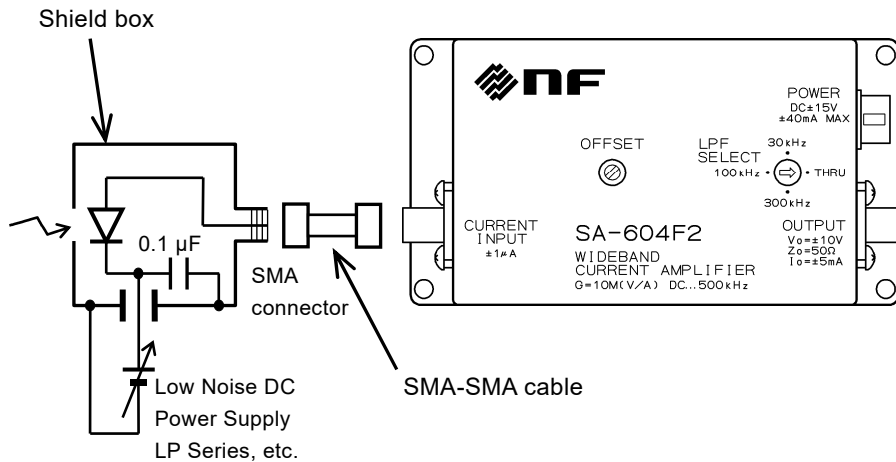


Figure 3-3 Connecting Reverse Biased Sensor

#### Note

If dark current is large when using a reverse biased sensor, this device cannot be used because the output of the device will be saturated. The maximum allowable dark current is approximately one-tenth of the full scale (refer to below).

SA-604F2	±100 nA
SA-605F2	±10 nA
SA-606F2	±1 nA
SA-607F2	±100 pA
SA-608F2	±10 pA

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### 3.4 Output Connection

The output impedance of this device is  $50\ \Omega$  and the maximum output current is 5 mA. If you need  $\pm 10\ \text{V}$  output, use a load resistance greater than  $2\ \text{k}\Omega$ .

Note that if the output of this device is terminated with a  $50\ \Omega$ , the rated output voltage cannot be obtained.

### 3.5 Turning On Power and Warm-up Time

This device exhibits the specified performance immediately after the power is turned on, but if you need highly accurate measurement, allow the device to warm up for at least 5 minutes (preferably 20 minutes) before use.

### 3.6 Operating Temperature and Input Bias Current

This device uses a high-performance FET for the first stage, but the input bias current approximately doubles every time the temperature increases by  $7\ ^\circ\text{C}$ . It is recommended to use this device at  $28\ ^\circ\text{C}$  or less to obtain the best performance.

### 3.7 Humidity condition

If the instrument is left in a humid place for a long period of time, the internal high impedance circuit may be adversely affected and the gain may decrease. Avoid operating and storing in a humid place for a long period of time. If it has been left in a humid place for a long time, it is recommended to dry it for at least 24 hours before use.

Be careful when using the SA-607F2 ( $10\ \text{GV} / \text{A}$ ) or SA-608F2 ( $100\ \text{GV} / \text{A}$ ), as models with larger gains are more susceptible to the effects.

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#### CAUTION

- Connect this device with the power supply while the power of the power supply is off.
  - Do not disconnect and connect a cable for power supply when the power supply is on. This product may be damaged.
-



## 4. Maintenance

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## 4.1 Preface

Performance tests are conducted to check that there is no abnormality of this product.

Testing is done for acceptance inspection, periodic inspections, and whenever it is necessary to check performance, such as after repair.

This section describes a test that can be conducted with general measurement instruments.

Calibration is available at charge and can be requested from NF Corporation or an authorized agent.

If the performance test indicates that this product does not comply with the specifications, re-adjustment or repair is required. In such a case, contact NF Corporation or an authorized agent.

## 4.2 Daily maintenance

If the surface of the panel or other parts becomes dirty, wipe it with a soft cloth. To remove persistent contamination, wipe with a soft cloth soaked with neutral detergent and wrung out. Do not use any organic solvents such as thinners or benzene, or any chemical cleaning cloth, as they may cause the surface finish to deteriorate, tarnish, or come off.

## 4.3 Storage, repacking and transportation

This product should be stored in a location that satisfies the storage conditions (refer to “2.2 Conditions for Installation Location”). And be careful with humidity condition (refer to “3.7 Humidity condition”).

When repacking this product for transportation, use a box that is sufficiently strong and large enough to provide a surplus of space. To fully protect this product, fill the box with packing material that can withstand its weight.

Make sure that the package is handled with care to avoid strong shocks during transport.

## 4.4 Performance testing

Performance tests are conducted to check that there is no abnormality of this product.

Testing is done for acceptance inspection, periodic inspections, and whenever it is necessary to check performance, such as after repair.

This section describes a test that can be conducted with general measurement instruments.

Calibration is available at charge and can be requested from NF Corporation or an authorized agent.

If the performance test indicates that this product does not comply with the specifications, re-adjustment or repair is required. In such a case, contact NF Corporation or an authorized agent.

### ● Test conditions

This product should be tested under the following conditions.

- Power supply  $\pm 15\text{ V} \pm 1\text{ V}$
- Temperature  $23\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$
- Humidity 5 to 85 %RH, no condensation
- Warm-up 5 minutes or more

● Measurement instruments

The required measurement instruments are listed below.

a) Digital multimeter

At least 4 and half digits

b) DC power supply

$\pm 15$  V,  $\pm 0.1$  A, with current measurement function

c) DC current meter (Source meter, Picoammeter)

Accuracy within  $\pm 0.2$  % for a current of 100 pA, 1 nA, 10 nA, 100 nA, or 1  $\mu$ A

d) DC voltage generator (DC voltage calibrator)

10 V accuracy within  $\pm 0.1$  %

e) Tools

Resistance tool (for checking the DC gain): Shielded BNC Box (Pomona 2391) with 10 M $\Omega$ , 100 M $\Omega$ , 1 G $\Omega$ , 10 G $\Omega$  and 100 G $\Omega$ .

10 M $\Omega$  ..... SA-604F2

100 M $\Omega$  ..... SA-605F2

1 G $\Omega$  ..... SA-606F2

10 G $\Omega$  ..... SA-607F2

100 G $\Omega$  ..... SA-608F2

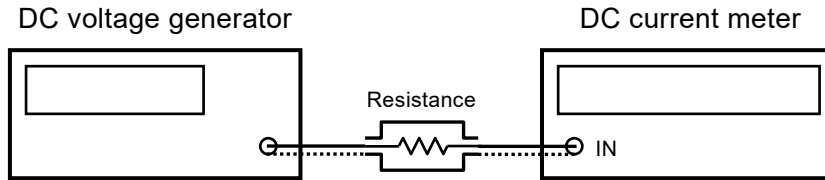
Resistance accuracy within  $\pm 2$  %

#### 4.4.1 Checking Current Consumption with No Signal

Insert an open plug into the input terminal of this device. If the current consumption is within  $\pm 40$  mA, the device is normal

### 4.4.2 Checking DC Gain

Connect the cables as shown in the figure below, output +10 V with the DC voltage generator, measure the current with the DC current meter, and call this value A (unit: [A]).



**Figure 4-1 Calibration of Resistance Tool**

Use any one of the following resistance tools depending on the gain.

10 M $\Omega$  .....SA-604F2

100 M $\Omega$  .....SA-605F2

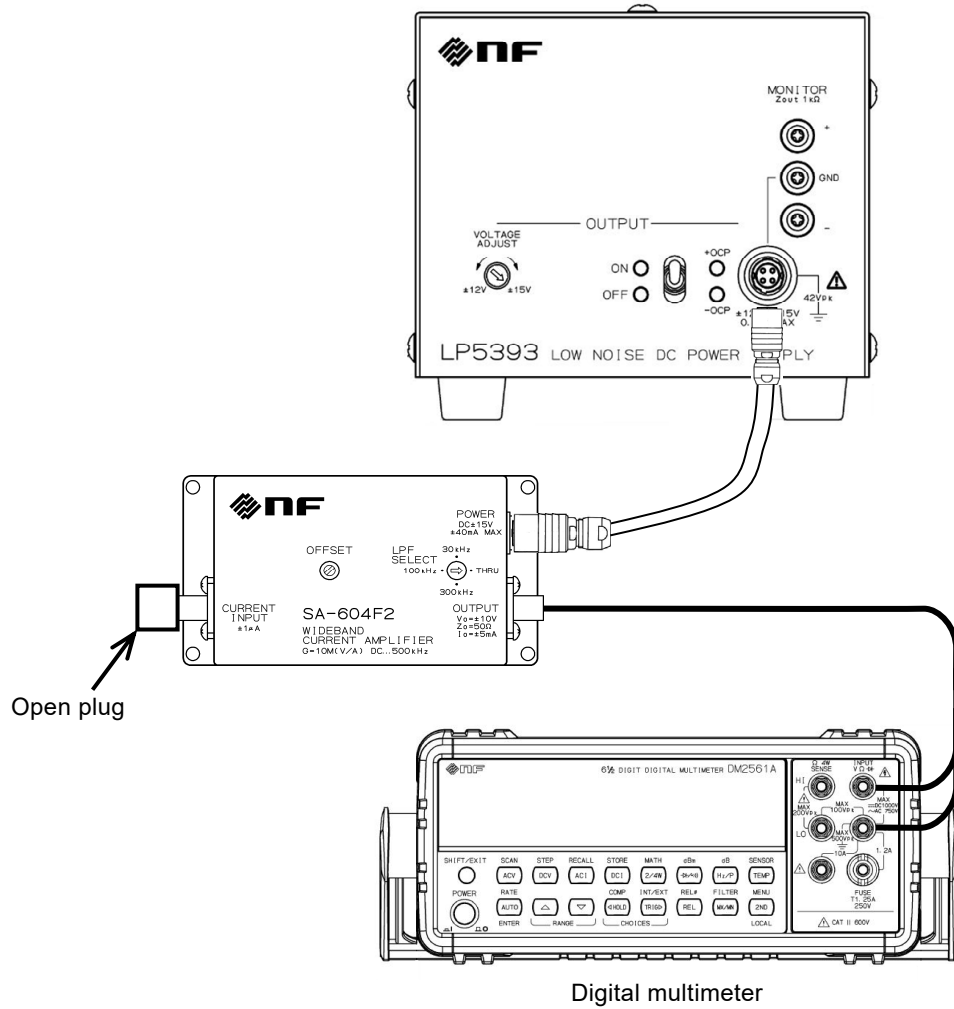
1 G $\Omega$  .....SA-606F2

10 G $\Omega$  .....SA-607F2

100 G $\Omega$  .....SA-608F2

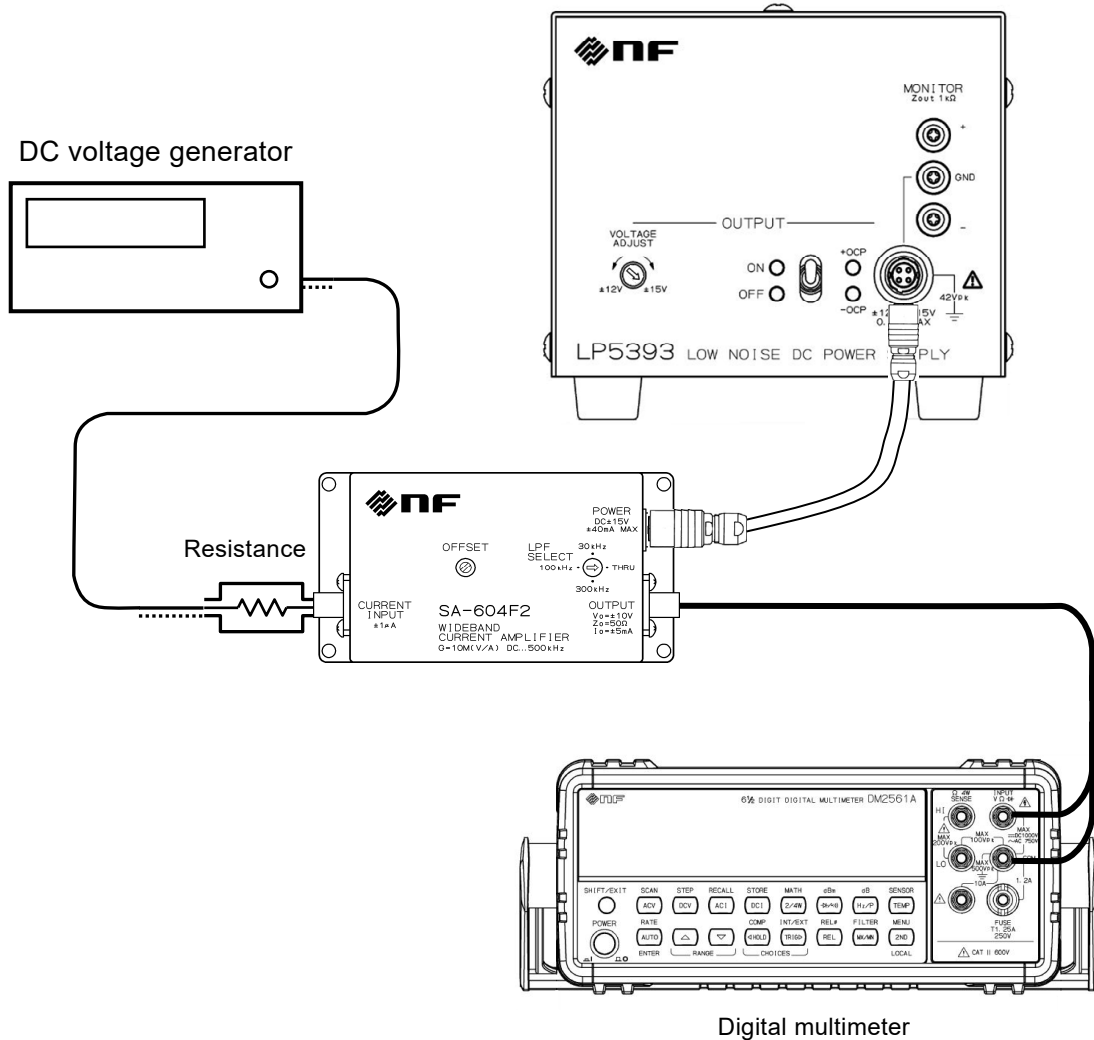
## 4.4 Performance testing

Connect the cables as shown in the figure below and measure the output DC voltage of SA-600 Series with the digital multimeter. Read the indicated value on the multimeter and call it B (unit: [V]).



**Figure 4-2 Measurement with No Signal**

Connect the resistance tool as shown in the figure below and measure the output DC voltage of SA-600 Series with the digital multimeter. Read the indicated value on the multimeter and call it C (unit: [V]).



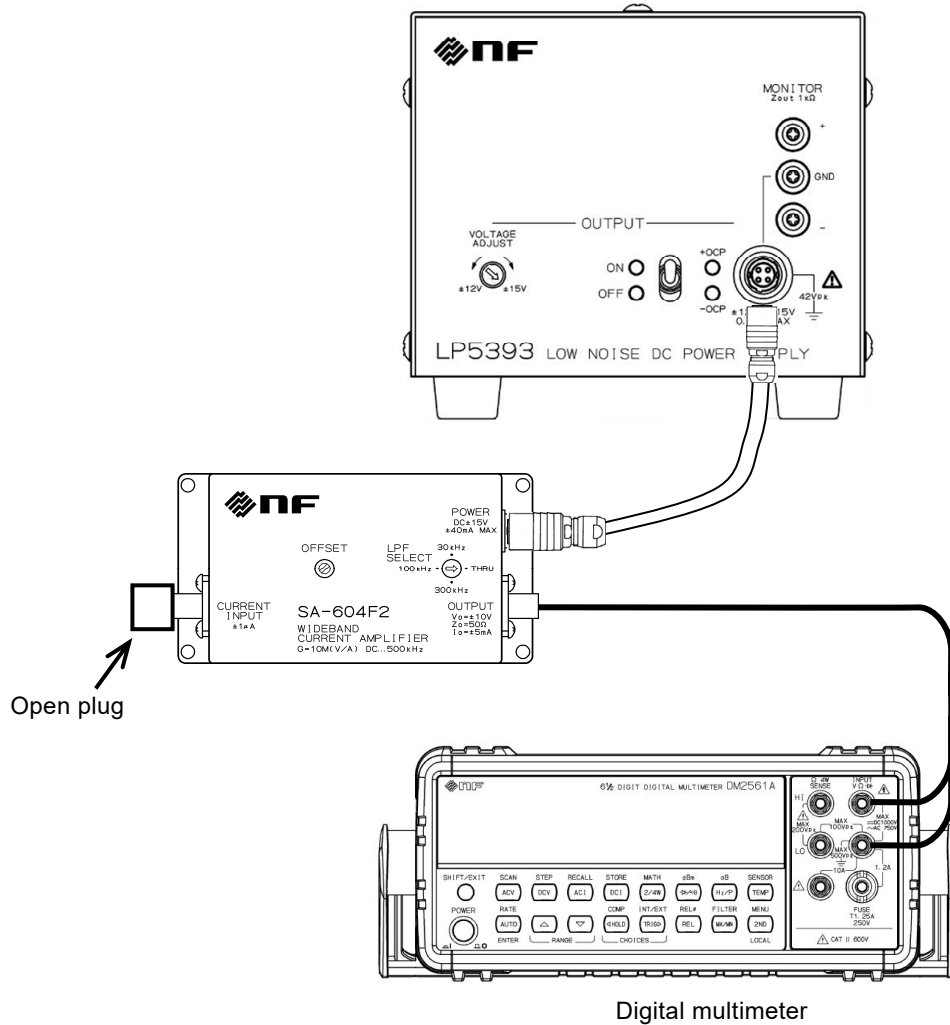
**Figure 4-3 Measurement when Standard Current Is Input**

If the gain (G) of the current amplifier calculated with the following formula is within  $\pm 1\%$  ( $\pm 3\%$  for SA-608F2), this device is normal.

$$G = (C - B) / A \text{ [V/A]}$$

### 4.4.3 Checking Output Offset Voltage

Connect the cables as shown in the figure below and measure the output DC voltage of SA-600 Series with the digital multimeter.



**Figure 4-4 Offset Voltage Measurement**

If the output voltage is within the values shown below, this device is normal.

- SA-604F2.....±3 mV
- SA-605F2.....±3 mV
- SA-606F2.....±5 mV
- SA-607F2..... ±15 mV
- SA-608F2..... ±15 mV

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## 5. Specifications

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## 5.1 Non-destructive Maximum Rating

Power supply voltage ( $\pm V_s$ )	$\pm 18.0$ V
Input current	$\pm 30$ mA

## 5.2 Electrical Characteristics

Power supply  $\pm 15$  V, Temperature  $23 \pm 5$  °C, Output load  $R_L = 1$  M $\Omega$ , unless otherwise noted.

### 5.2.1 Input Section

No.	Item \ Model (Gain)	SA-604F2 (10 MV/A)	SA-605F2 (100 MV/A)	SA-606F2 (1 GV/A)	SA-607F2 (10 GV/A)	SA-608F2 (100 GV/A)
1.1	Input form	DC coupled unbalanced grounded input. SMA connector				
1.2	Maximum input current *1	$\pm 1$ $\mu$ A	$\pm 100$ nA	$\pm 10$ nA	$\pm 1$ nA	$\pm 100$ pA
1.3	Input impedance *1	1 k $\Omega$	3 k $\Omega$	10 k $\Omega$	30 k $\Omega$	100 k $\Omega$
1.4	Recommended signal source resistance	1 M $\Omega$ or more	10 M $\Omega$ or more	100 M $\Omega$ or more	1 G $\Omega$ or more	10 G $\Omega$ or more
1.5	Input bias current *2	1 pA typ.				0.1 pA typ.
1.6	Equivalent input current noise density *3*4	45 fA/ $\sqrt{\text{Hz}}$ typ.	15 fA/ $\sqrt{\text{Hz}}$ typ.	6 fA/ $\sqrt{\text{Hz}}$ typ.	2.5 fA/ $\sqrt{\text{Hz}}$ typ.	0.6 fA/ $\sqrt{\text{Hz}}$ typ.

### 5.2.2 Output Section

No.	Item \ Model (Gain)	SA-604F2 (10 MV/A)	SA-605F2 (100 MV/A)	SA-606F2 (1 GV/A)	SA-607F2 (10 GV/A)	SA-608F2 (100 GV/A)
2.1	Output form	DC coupled unbalanced grounded Output. SMA connector				
2.2	Maximum output voltage *5	$\pm 10$ V				
2.3	Maximum output current *5*6	$\pm 5$ mA				
2.4	Output impedance *1	50 $\Omega$				
2.5	Output offset voltage *4	$\pm 3$ mV		$\pm 5$ mV		$\pm 15$ mV
2.6	Output offset voltage adjust range*4*7	$\pm 15$ mV			$\pm 20$ mV	

## 5.2.3 Amplification Section

No.	Item \ Model (Gain)	SA-604F2 (10 MV/A)	SA-605F2 (100 MV/A)	SA-606F2 (1 GV/A)	SA-607F2 (10 GV/A)	SA-608F2 (100 GV/A)
3.1	Gain *8	$1 \times 10^7$ V/A $\pm 1$ %	$1 \times 10^8$ V/A $\pm 1$ %	$1 \times 10^9$ V/A $\pm 1$ %	$1 \times 10^{10}$ V/A $\pm 1$ %	$1 \times 10^{11}$ V/A $\pm 3$ %
3.2	Gain flatness *9 (when setting $f_{c0}$ , within $\pm 0.5$ dB)	DC to 50 kHz	DC to 25 kHz	DC to 10 kHz	DC to 2 kHz	DC to 200 Hz
3.3	Frequency characteristics $f_{c0}$ , $C_s = 10$ pF *9 *10 *11 *12	DC to 500 kHz	DC to 250 kHz	DC to 100 kHz	DC to 20 kHz	DC to 2 kHz
	Frequency characteristics $f_{c0}$ , $C_s = 100$ pF *9 *10 *11 *12	DC to 350 kHz	DC to 175 kHz	DC to 70 kHz	DC to 14 kHz	DC to 1.4 kHz
3.4	Upper cutoff frequency $f_{c1}$ , $C_s = 10$ pF *7 *9 *11 *12 *13	300 kHz	100 kHz	30 kHz	10 kHz	1 kHz
	Upper cutoff frequency $f_{c2}$ , $C_s = 10$ pF *7 *9 *11 *12 *13	100 kHz	30 kHz	10 kHz	3 kHz	300 Hz
	Upper cutoff frequency $f_{c3}$ , $C_s = 10$ pF *7 *9 *11 *12 *13	30 kHz	10 kHz	3 kHz	1 kHz	100 Hz
3.5	I/O polarity *14	Non-inverted				

\*1 Typical values. SA-604F2, SA-605F2 and SA-606F2 at 1 kHz, SA-607F2 and SA-608F2 at 100 Hz.

\*2 The input bias current approximately doubles as the temperature increases by  $+7$  °C. The output changes in the positive direction when the input bias current increases. The output offset voltage is calculated by input bias current  $\times$  current gain.

\*3 Measured with the 89410A (Keysight) or equivalent. SA-604F2, SA-605F2 and SA-606F2 at 1 kHz, SA-607F2 at 100 Hz, SA-608F2 at 10 Hz.

\*4 Input is opened.

\*5 Tolerance for distortion (THD) is 0.3 % or lower. SA-604F2, SA-605F2 and SA-606F2 at 1 kHz, SA-607F2 and SA-608F2 at 100 Hz.

\*6 Do not short the output terminal to GND. Output shorted or overloaded may damage the internal circuit and deteriorate the performance.

\*7 These are not guaranteed values but typical values.

\*8 Measured at DC.

\*9 The reference frequency for SA-604F2, SA-605F2 and SA-606F2 is 10 Hz. It is 1 Hz for SA-607F2. It is 10 mHz for SA-608F2.

\*10 Frequency band within  $+0.5$  dB /  $-3$  dB based on the gain at the reference frequency

\*11 Refer to table 5-1.

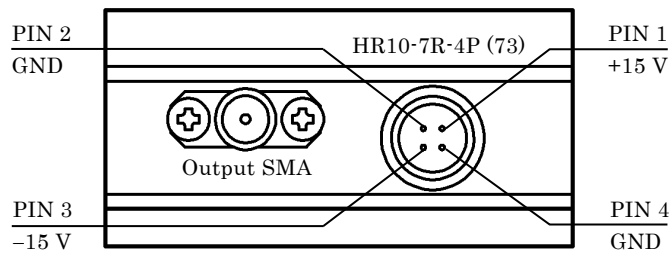
\*12  $C_s$  is the added input capacitance (between input and GND).

\*13 The frequency that is  $-3$  dB based on the gain at the reference frequency.

\*14 When current flows into the input, the output becomes a positive voltage.

5.2.4 Others

No.	Item \ Model (Gain)	SA-604F2 (10 MV/A)	SA-605F2 (100 MV/A)	SA-606F2 (1 GV/A)	SA-607F2 (10 GV/A)	SA-608F2 (100 GV/A)
4.1	Power supply connector	HR10-7R-4P(73) connector				
4.2	Operating power supply voltage range	±15 V ±1 V				
4.3	Current consumption (with no signal)	±40 mA or lower Approx. ±37 mA		±40 mA or lower Approx. ±32 mA		±40 mA or lower Approx. ±35 mA
4.4	Performance guarantee temperature range	23 °C ±5 °C				
4.5	Temperature and humidity range	Operating 0 to +40 °C 5 to 85 %RH absolute humidity 1 g/m <sup>3</sup> to 25 g/m <sup>3</sup> (non-condensation)				
		Storage -10 to +50 °C 5 to 95 %RH absolute humidity 1 g/m <sup>3</sup> to 29 g/m <sup>3</sup> (non-condensation)				
4.6	Pollution degree	2 (Indoor use)				
4.7	Altitude	2000 m or lower				
4.8	External dimensions (Without bottom plate)	76(W)×50(D)×21.1(H) mm, without protrusions				
	External dimensions (With bottom plate)	92(W)×50(D)×25.1(H) mm, without protrusions				
4.9	Weight (With bottom plate)	Approx. 135 g				
5.0	RoHS	Directive 2011/65/EU				
5.1	EMC	EN61326-1 EN61326-2-1				



\* The mating plug is HR10-7P-4S

Figure 5-1 Power Connector

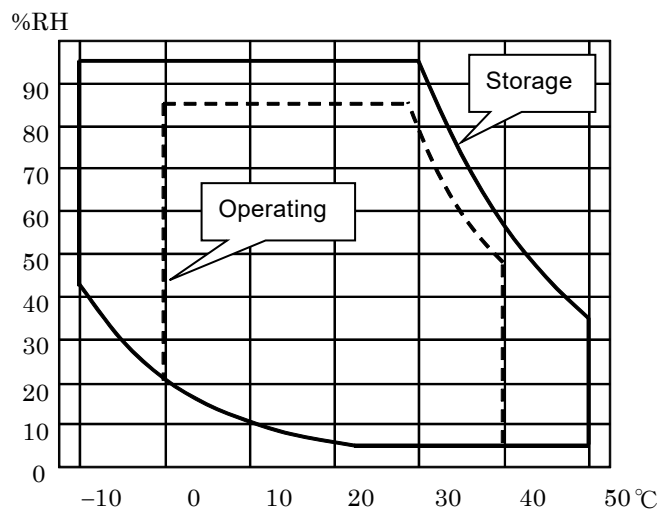


Figure 5-2 Temperature and Humidity Range Explanatory Graph

### 5.3 External Dimensions

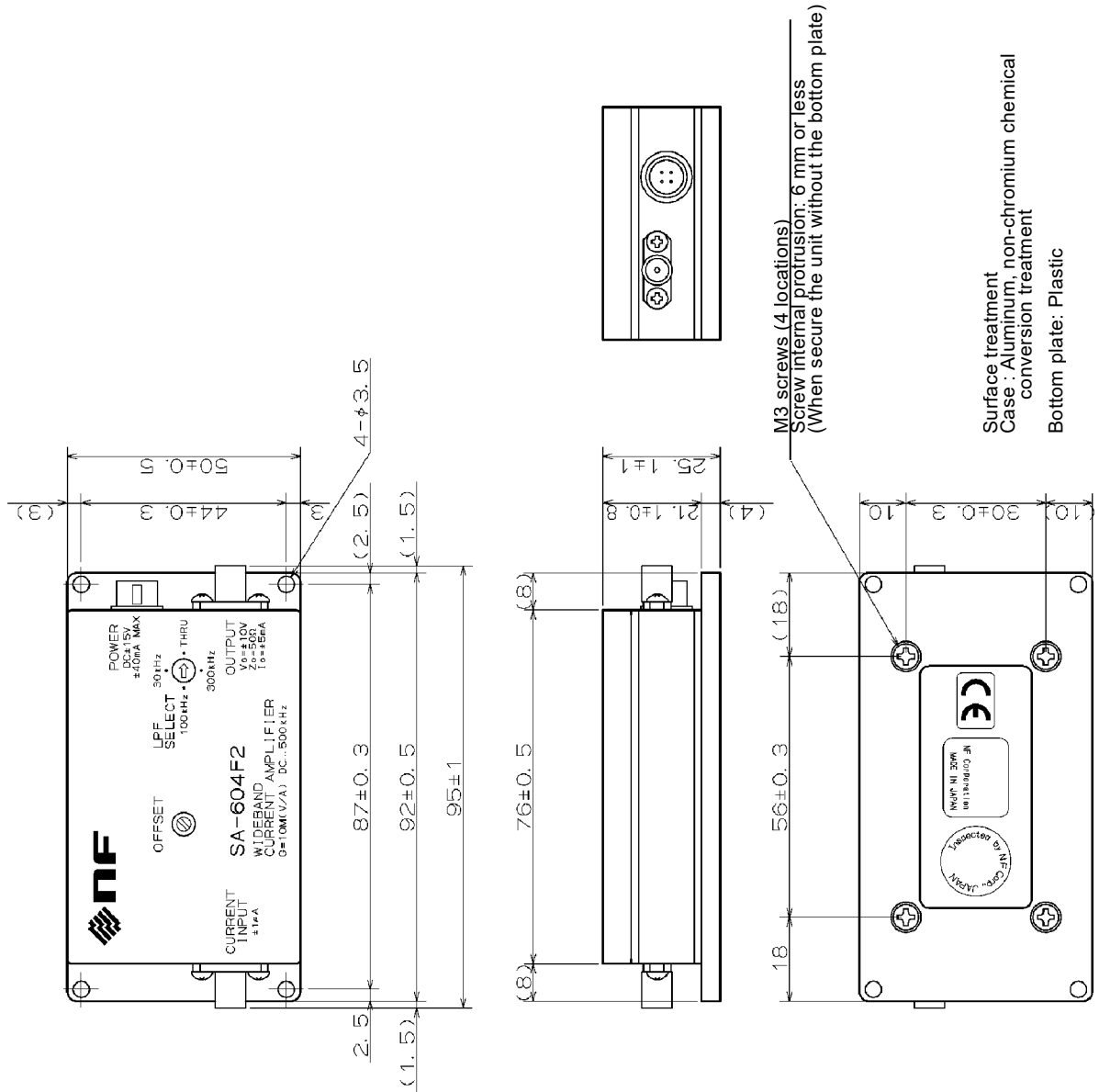


Figure 5-3 External Dimensions

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## 6. Typical Data

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<b>6.2</b>	Equivalent Input Noise Current Density Frequency Characteristics .....	6-1
<b>6.3</b>	Output Noise Voltage Density by LPF settings Frequency Characteristics ..	6-1
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<b>6.5</b>	Pulse Response Characteristics When Adding Capacitance .....	6-5

## 6.1 Typical Data

This chapter describes the typical data as a reference. This data shows the average values obtained by measuring the performance of individual products. The performance of this product may not achieve the level of this data, but all products have been strictly tested before shipment to check that they meet the specifications.

## 6.2 Equivalent Input Noise Current Density Frequency Characteristics

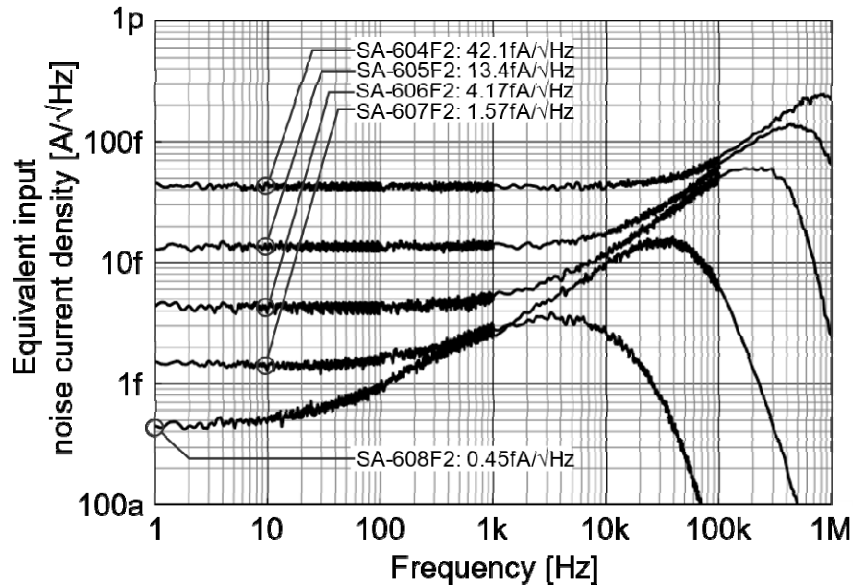


Figure 6-1 Equivalent Input Noise Current Density Frequency Characteristics

## 6.3 Output Noise Voltage Density by LPF settings Frequency Characteristics

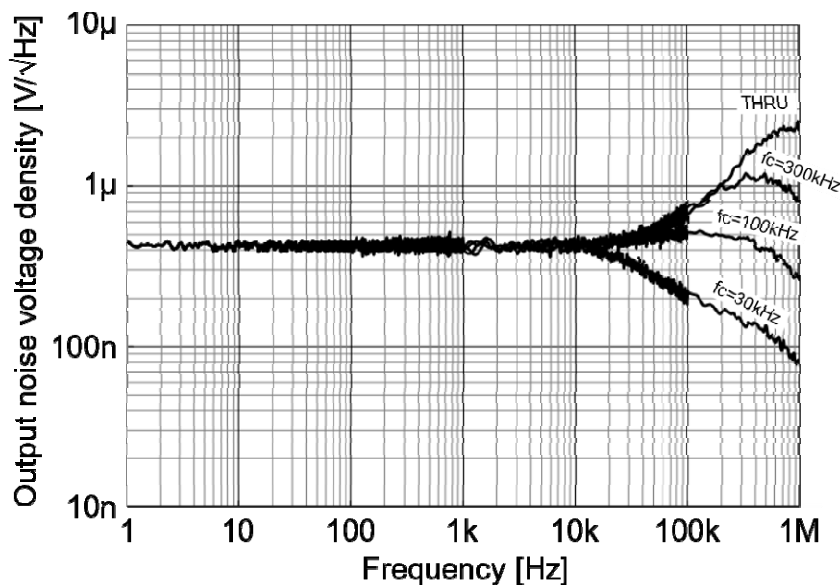


Figure 6-2 Output Noise Voltage Density of SA-604F2 by LPF settings Frequency Characteristics



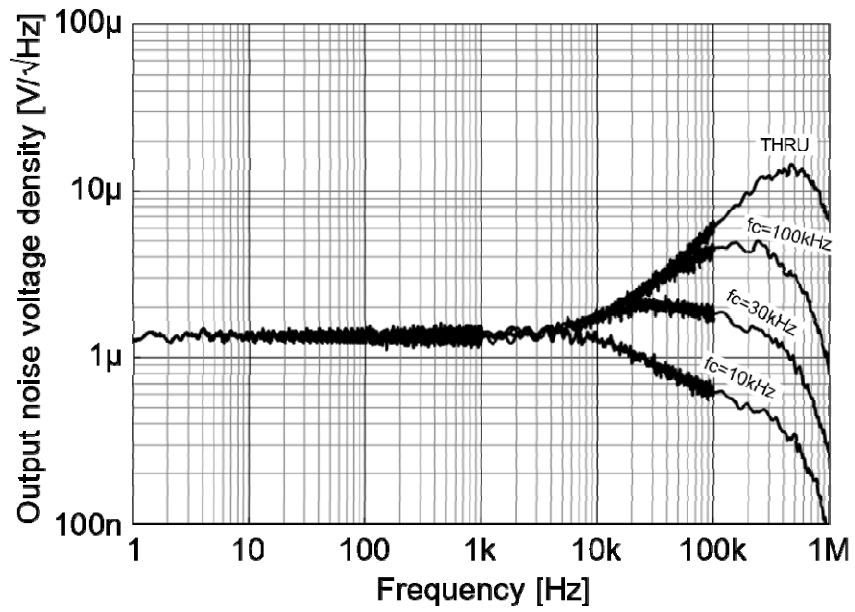


Figure 6-3 Output Noise Voltage Density of SA-605F2 by LPF settings Frequency Characteristics

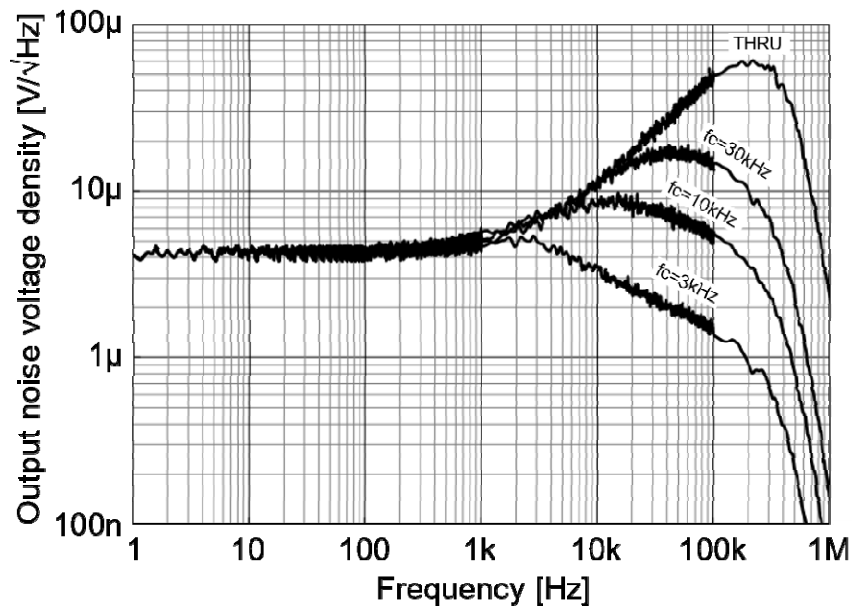


Figure 6-4 Output Noise Voltage Density of SA-606F2 by LPF settings Frequency Characteristics

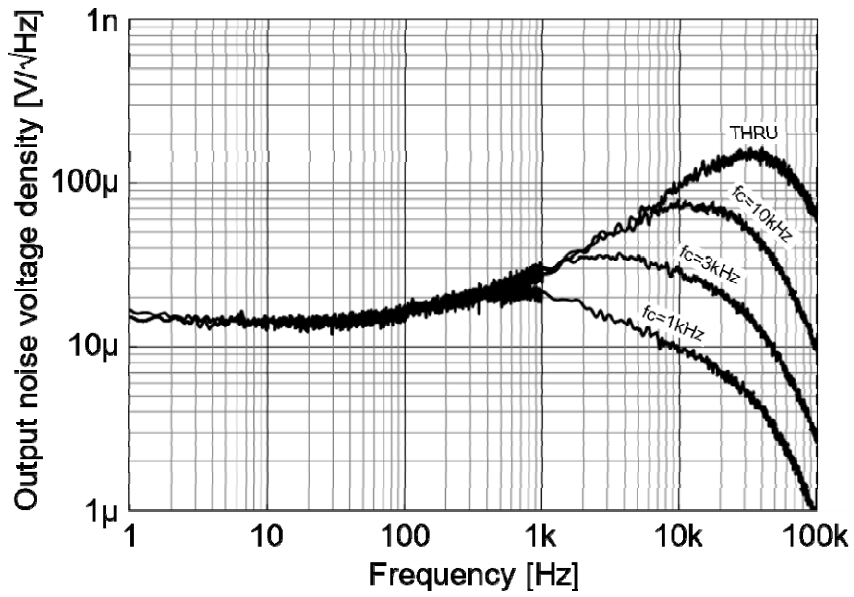


Figure 6-5 Output Noise Voltage Density of SA-607F2 by LPF settings Frequency Characteristics

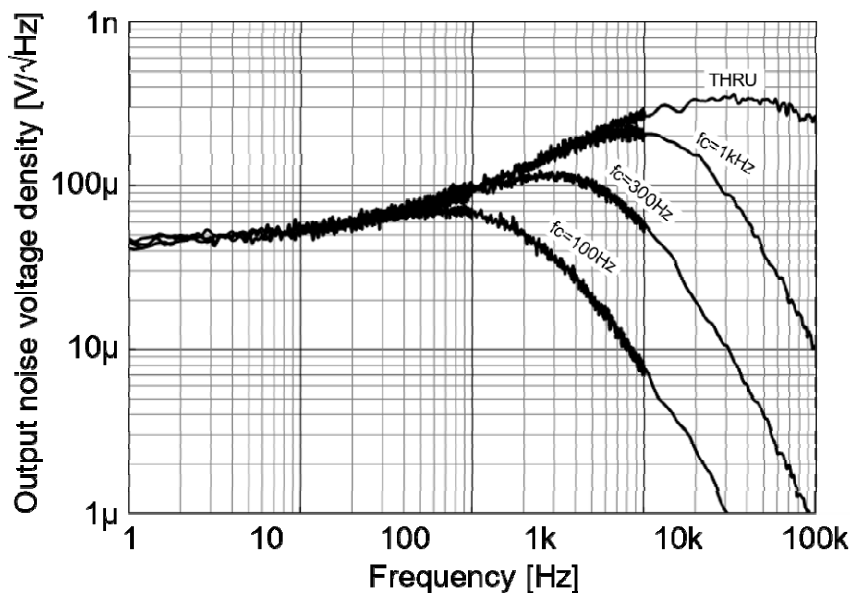


Figure 6-6 Output Noise Voltage Density of SA-608F2 by LPF settings Frequency Characteristics

## 6.4 Current Gain Frequency Characteristics When Adding Capacitance

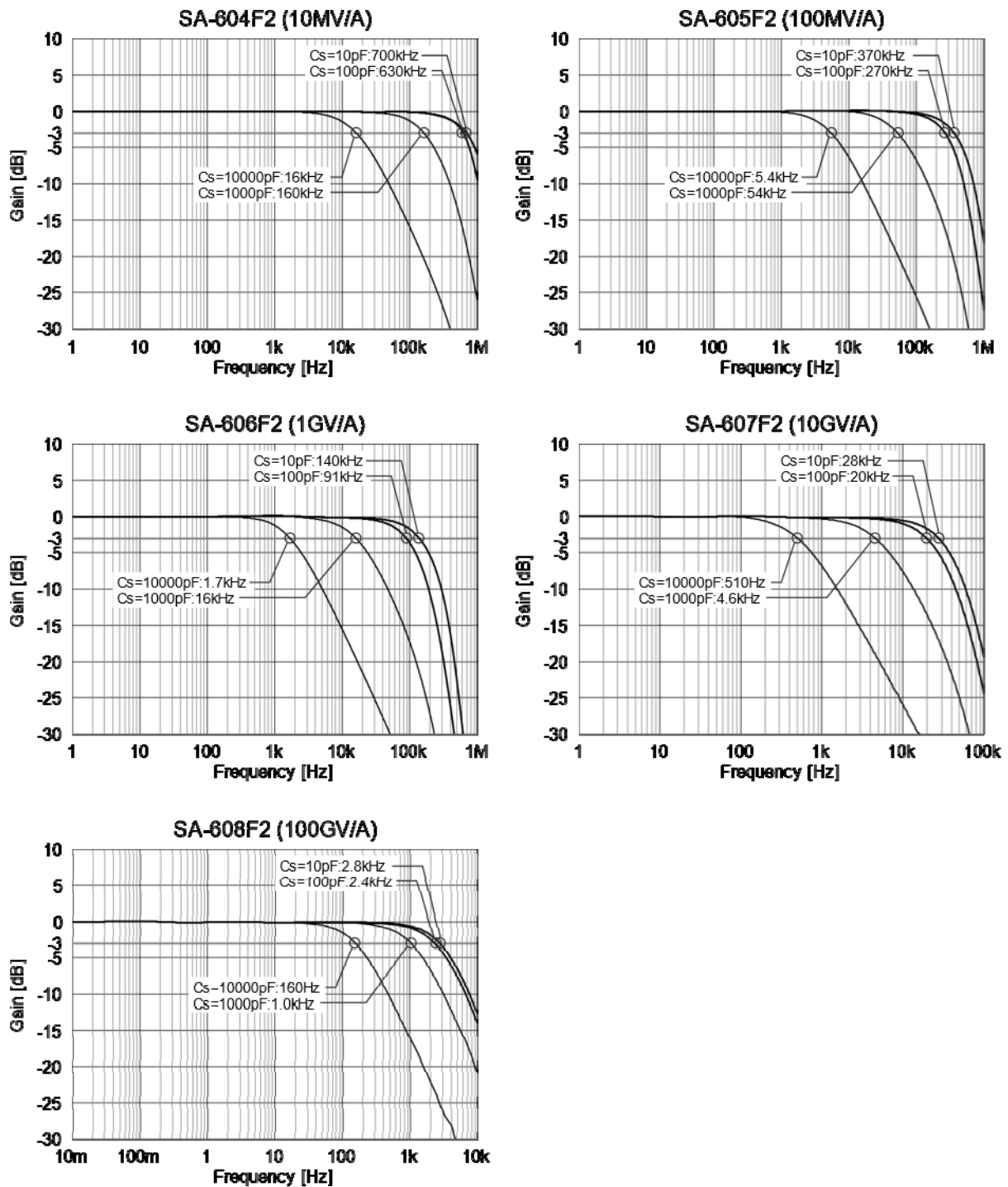


Figure 6-7 Current Gain Frequency Characteristics When Adding Capacitance

## 6.5 Pulse Response Characteristics When Adding Capacitance

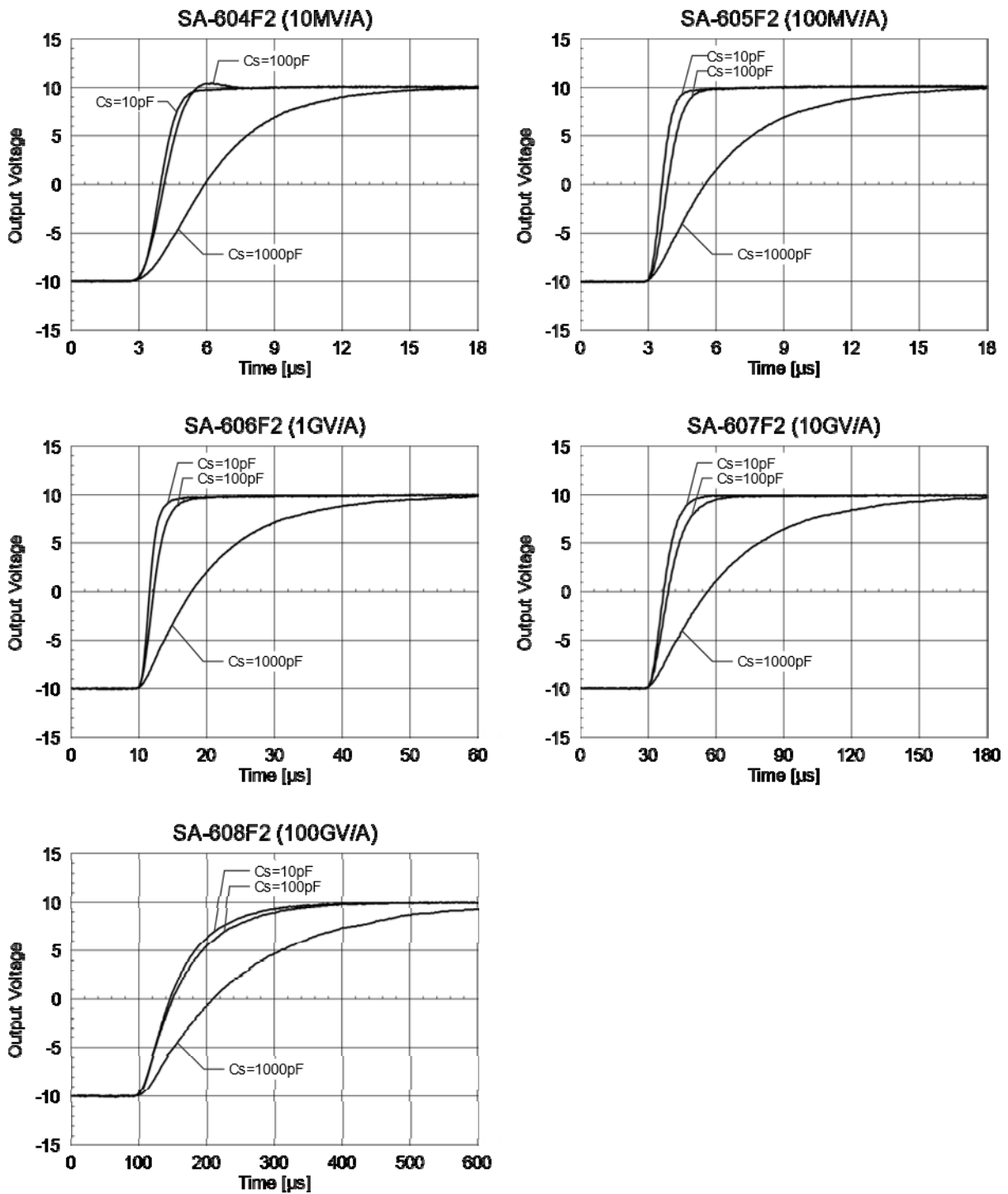


Figure 6-8 Pulse Response Characteristics When Adding Capacitance

# WARRANTY

NF Corporation certifies that this product was thoroughly tested and inspected and found to comply with its published specifications when it was shipped from our factory. In the unlikely event that you experience an issue during use, please contact our company or an authorized agency from which you purchased the product.

All NF Corporation products are warranted against defects in materials and workmanship for a period of one year from the date of shipment. During the warranty period, NF Corporation will repair the defective product without any charge for the parts and labor.

For repair service under warranty, the product must be returned to either NF Corporation or an authorized agent. The Purchaser shall prepay all shipping costs, duties, and taxes for the product to NF Corporation from another country, and NF Corporation shall pay shipping charges to return the product to the purchaser.

This warranty shall not apply when corresponding to the following particulars.

- A) Failure caused by improper handling or use of the product in a manner that does not conform with the provisions of the Instruction Manual.
- B) Failure or damage caused by transport, dropping, or other handling of the product after purchase.
- C) Failure caused by repair, adjustment, or modification of the product by a company, organization, or individual not approved by NF Corporation.
- D) Failure caused by abnormal voltage or the effect of equipment connected to this product.
- E) Failure caused by the effect of supply parts from the customer.
- F) Failure caused by such as corrosion from the use of caustic gases, organic solvents, and chemicals.
- G) Failure caused by insects or small animal that invaded from the outside.
- H) Failure or damage caused by fire, earthquakes, flood damage, lightning, war, or other uncontrollable events.
- I) Failure caused by unforeseen reasons due to the limits of the technology when shipped from our company.

**NF Corporation**

## Request for Repair

When a failure occurred and the product was found to be defective or you have any uncertainty, please contact NF Corporation or an authorized agent.

In such a case, let us know the model name (or product name), serial number (SERIAL No. given on the nomenclature plate), and symptoms and operating conditions in as much detail as possible.

Though we will make efforts to reduce the repair period, when five or more years have passed since you purchased the product, it may take time due to, for instance, repair parts being out of stock.

Also, if the production of repair parts is discontinued, the product is seriously damaged, or the product is modified, we may decline the repair.

If there are any misplaced or missing pages, we will replace the manual. Contact the sales representative.

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#### SA-600 Series INSTRUCTION MANUAL

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