Keysight CX1100 Accessories for CX3300 Series

CX1101A Current Sensor, Single Channel
CX1102A Current Sensor, Dual Channel
CX1103A Current Sensor, Low Side
CX1104A Current Sensor, Selectable Resistive Sensor Head
CX1105A Differential Sensor, Single Channel
CX1151A Passive Probe Interface Adapter
CX1152A Digital Channel

KEYSIGHT TECHNOLOGIES

User's Guide

Notices

Copyright Notice

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1 General Information

KEYSIGHT TECHNOLOGIES

Introduction

Keysight CX1100 series provides accessories for Keysight CX3300 Device Current Waveform Analyzer. The following accessories are available for connecting a device under test (DUT).

- "CX1101A Current Sensor, Single Channel"
- "CX1102A Current Sensor, Dual Channel"
- "CX1103A Current Sensor, Low Side"
- "CX1104A Current Sensor, Selectable Resistive Sensor Head"
- "CX1105A Differential Sensor, Single Channel"
- "CX1151A Passive Probe Interface Adapter"
- "CX1152A Digital Channel"

For the specifications and more information on the accessories, refer to Keysight CX3300 *Data Sheet*. Go to www.keysight.com/find/cx3300a to get the latest documents.

CX1101A Current Sensor, Single Channel

Measurement current:

- 40 nA to 1 A
- Maximum 10 A using the CX1206A sensor head

Maximum common mode voltage: ±40 V

Maximum bandwidth: 100 MHz

Input: SMA jack connector or BNC jack connector using the furnished adapter

Furnished accessories:

- CX1203A sensor head, 1 ea.
- Ground lead, 1 ea.
- Adapter (SMA plug to BNC jack, 50 Ω), 1 ea.

Available sensor heads:

- CX1201A Sensor head, coaxial through
- CX1202A Sensor head, coaxial through with V monitor
- CX1203A Sensor head, coaxial termination
- CX1204A Sensor head, twisted pair adapter
- CX1205A Sensor head, test lead adapter
- CX1206A Sensor head, high current adapter with expander

Refer to "To Use the CX1101A/CX1102A" on page 31 for the sensor heads.

CX1102A Current Sensor, Dual Channel

Measurement current of primary channel: 1 μA to 1 A

Measurement current of secondary channel: 40 nA to 20 mA

Maximum common mode voltage: ±12 V

Maximum bandwidth: 100 MHz

Input: SMA jack connector or BNC jack connector using the furnished adapter

Furnished accessories:

- CX1203A sensor head, 1 ea.
- Ground lead, 1 ea.
- Adapter (SMA plug to BNC jack, 50 Ω), 1 ea.

Available sensor heads:

- CX1201A Sensor head, coaxial through
- CX1202A Sensor head, coaxial through with V monitor
- CX1203A Sensor head, coaxial termination
- CX1204A Sensor head, twisted pair adapter
- CX1205A Sensor head, test lead adapter

Refer to "To Use the CX1101A/CX1102A" on page 31 for the sensor heads.

CX1103A Current Sensor, Low Side

Measurement current: 150 pA to 20 mA

Maximum common mode voltage:

- ±1 V (50 Ω input ON)
- ±0.5 V (50 Ω input OFF)

Maximum bandwidth: 200 MHz

Input: SMA jack connector or BNC jack connector using the furnished adapter

Furnished accessories:

- Ground lead, 1 ea.
- Adapter (SMA plug to BNC jack, 50 Ω), 1 ea.

CX1104A Current Sensor, Selectable Resistive Sensor Head

Measurement current: approximately 1 μA to 15 A, depends on resistive sensor head

Maximum common mode voltage: ±40 V

Maximum bandwidth: 20 MHz

Input: Screw terminals or banana jack terminals using the furnished adapter

Furnished accessories:

- Extension cable, USB Type-C, 1 ea.
- Ground lead, 1 ea.
- Banana adapter, 1 ea.

Available sensor heads:

- CX1211A Resistive sensor head, 15 A, 5.5 mΩ
- CX1212A Resistive sensor head, 10 A, 8 mΩ
- CX1213A Resistive sensor head, 5 A, 23 mΩ
- CX1214A Resistive sensor head, 3 A, 53 mΩ
- CX1215A Resistive sensor head, 2 A, 103 mΩ
- CX1216A Resistive sensor head, 0.25 A, 1 Ω

CX1105A Differential Sensor, Single Channel

Measurement current: approximately 1 μA to 100 A, depends on bandwidth and sense resistance

Maximum common mode voltage:

- ±40 V (1 V range and above)
- ±6 V (250 mV range and below)

Maximum bandwidth: 100 MHz

Input: Mini jack terminals

Furnished accessories:

- Grabber clip micro SMD, 1 ea.
- Grabber mini, 2 ea.
- Test lead, 5 ea.
- Extension cable, shielded, twisted pair, mini jack, 100 mm, 1 ea.
- Extension cable, shielded, twisted pair, soldering, 100 mm, 1 ea.
- Adjustment tool, 1 ea.
- Test adapter, 1 ea.
- Ground lead, 1 ea.

CX1151A Passive Probe Interface Adapter

For 14/16-bit voltage measurement using passive voltage probe such as Keysight N2843A 500 MHz 10:1 Passive Probe.

Maximum input voltage: ±100 V peak (DC+AC)

Maximum bandwidth: 300 MHz

Input: BNC jack connector

CX1152A Digital Channel

Digital channel interface cable for digital signal monitoring.

Maximum input dynamic range: ±25 V

Input impedance: 10 MΩ

Number of channels: 8

Furnished accessories:

- Grabber, 10 ea.
- Probe ground lead, 5 ea.
- Adapter (BNC jack to probe tip), 1 ea.

Effective Measurement Bandwidth

The effective measurement bandwidth is determined by both the accessory's bandwidth and the CX3300's bandwidth. Table 1-1 shows the maximum effective bandwidth estimated by the following formula.

Effective bandwidth = $1/(1/A^2+1/B^2)^{1/2}$

Table 1-1 **Maximum Effective Bandwidth**

Accessories		CX3300 bandwidth option (B)		
Model No.	**Standalone bandwidth (A)**	**50 MHz**	**100 MHz**	**200 MHz**
CX1101A	100 MHz	45 MHz	70 MHz	90 MHz
CX1102A	100 MHz	45 MHz	70 MHz	90 MHz
CX1103A	200 MHz	50 MHz	90 MHz	140 MHz
CX1104A	20 MHz	19 MHz	20 MHz	20 MHz
CX1105A	100 MHz	45 MHz	70 MHz	90 MHz
CX1151A	300 MHz	50 MHz	95 MHz	165 MHz

- For the CX1101A/CX1102A, the values are effective for using the CX1201A, CX1202A, or CX1203A sensor head. If the CX1204A/CX1205A is used, it may be much worse than the above value. If the CX1206A is used, it will be approximately 3 MHz.
- For the CX1151A, the values are the voltage measurement bandwidth.
- Measurement bandwidth could be worse than the above value with the actual wiring to DUT from the sensor/adapter input.

NOTE

The bandwidth shown in the Channel summary on the CX3300 main screen is the approximate value automatically calculated by considering the measurement range, the sampling rate, and filters.

Inspection

- Inspect the shipping container for damage.

  Keep the shipping container and cushioning material until you have inspected the contents of the shipment for completeness and have checked the CX1100 mechanically and electrically.

  If the shipping container is damaged or the cushioning materials show signs of stress, notify the carrier as well as your Keysight Technologies sales office. Keep the shipping materials for the carrier's inspection. The Keysight Technologies office will arrange for repair or replacement at Keysight Technologies' option without waiting for claim settlement.

- Check the accessories.

  If the contents are incomplete or damaged, notify your Keysight Technologies sales office.

- Inspect the CX1100.

  If there is mechanical damage or defect, or if the CX1100 does not operate properly or pass diagnosis, notify your Keysight Technologies sales office.

  To perform diagnosis of the CX1100, see "Diagnosis" on page 17.

Maintenance

Maintenance should be performed periodically to keep the CX1100 in good condition. If problems arise, contact your Keysight Technologies sales office.

- "Cleaning"
- "Diagnosis"
- "Consumable Supplies"
- "Calibration"
- "Troubleshooting"
- "Servicing"

NOTE

For the precautions on connecting or disconnecting the CX1100, see "Using the CX1100" on page 27.

Cleaning

Disconnect the CX1100 from the CX3300 before cleaning.

Use a dry soft cloth or a soft cloth slightly dampened with a mild soap and water solution to clean the external case parts. Do not use detergents or chemical solvents. Do not attempt to clean internally.

Make sure that the CX1100 is completely dry before reconnecting to the CX3300.

Diagnosis

Perform the following procedure to start the diagnosis on the CX3300.

1. Connect the CX1100 to the CX3300.
2. Press the **Menu** key several times to open the Configuration dialog box.
3. Click Diagnosis to display the Configuration > Diagnosis screen.
4. Click Sensor Floating PS and follow the instruction.
5. Click Sensor DC Offset and follow the instruction.

Consumable Supplies

For the consumable supplies of the CX1100/CX1200, see Table 1-2.

The sensor head is also the consumable supply.

Calibration

For the following products, calibration and adjustments must be performed periodically so that the instruments satisfy the specifications, and keep a good condition. It is recommended to perform the calibration once a year at least. For the calibration and adjustments, contact your Keysight Technologies sales office. Trained service personnel will perform the calibration and adjustments.

- CX3322A
- CX3324A
- CX1101A
- CX1102A
- CX1103A
- CX1104A
- CX1105A
- CX1151A
- CX1211A
- CX1212A
- CX1213A
- CX1214A
- CX1215A
- CX1216A

Troubleshooting

Perform the following procedure to isolate the trouble between the CX3300 and the CX1100.

1. If you find the CX1100 which is not detected by the CX3300, disconnect it and connect it to another normal channel.

   If it is not detected by the CX3300, contact your nearest Keysight Technologies sales office. The CX1100 will be defective.

2. Perform the Self-Test.

   If the CX3300 fails the Self-Test, contact your nearest Keysight Technologies sales office. The CX3300 will be defective.

   For the Self-Test, refer to *Keysight CX3300 User's Guide*.

3. Perform the Sensor Floating PS test and the Sensor DC Offset Control test.

   If you find the CX1100 which fails the test, disconnect it and connect it to another normal channel. If it fails the test, contact your nearest Keysight Technologies sales office. The CX1100 will be defective.

   For how to perform diagnosis of the CX1100, refer to "Diagnosis" on page 17.

For more troubleshooting, refer to *Keysight CX3300 User's Guide*.

NOTE

For troubleshooting the CX1101A or the CX1102A, if you have multiple CX1101A/CX1102A and/or CX1203A sensor head, it will be useful to swap the troublesome one with the "working" one to isolate the problem.

NOTE

For troubleshooting the CX1104A, if you have multiple CX1104A and/or CX1211A, CX1212A, CX1213A, CX1214A, CX1215A, CX1216A resistive sensor head, it will be useful to swap the troublesome one with the "working" one to isolate the problem.

Servicing

If the CX3300 is confirmed as defective, send it to an authorized service center for repair.

If the CX1100 is found to be defective, you can order the replacement part or you can send it to an authorized service center for repair.

If you are shipping the product to Keysight Technologies for service, perform the following steps before shipping.

1. Contact your nearest Keysight Technologies sales office for information on obtaining an RMA number and return address.
2. Write the following information on a tag and attach it to the malfunctioning equipment.
   - Name and address of owner
   - Product model number (for example, CX1101A)
   - Product serial number (for example, MYXXXXXXXX)
   - Description of failure or service required
3. Pack the product in the original carrying case or fungible.
4. Pack it in the original shipping container and cushioning material, or fungible.

   Seal the container closely and mark it as “FRAGILE”.

NOTE

If any correspondence is required, refer to the product by serial number and model number.

For servicing the CX3300 mainframe, you do not need to send the CX1100 and the sensor heads.

For servicing the CX1101A or the CX1102A, send it with the CX3300 and the CX1203A.

For servicing the CX1103A or the CX1151A, send it with the CX3300.

For servicing the CX1104A, send it with the CX3300. You do not need to send the resistive sensor head.

For servicing the CX1105A, send it with the CX3300. You do not need to send the test adapter.

Table 1-2 CX1100/CX1200 Consumable Supplies

Description	Part number
Cable, coaxial, 50 Ω, BNC plug to BNC plug, 24 inch, 1 ea.	8121-2850
Ground lead, 1 ea.	C1101-61711
Adapter, coaxial, straight, 50 Ω, SMA plug to BNC jack, 1 ea.	1250-3975
Cable, USB Type-C, 1 ea., for CX1104A	C1104-61701
Banana adapter, 1 ea., for CX1104A	C1210-60001
Wire, 18 AWG, 20 mm, red 5 ea. and black 5 ea., for resistive sensor head	C1104-68001
Test lead, 2 inch, 5 ea., for CX1105A	5959-9334
Grabber mini, 1 ea., for CX1105A	1400-1422
Grabber clip micro SMD, 60 VDC, 1 A, 6 mΩ, 1 ea., for CX1105A	1400-3652
Adjustment tool, 1 ea., for CX1105A phase compensation	8710-2831
Test adapter, 1 ea., for CX1105A phase compensation	C1105-66602
Cable, shielded, twisted pair, mini jack, 100 mm, 1 ea., for CX1105A	C1105-61701
Cable, shielded, twisted pair, soldering, 100 mm, 1 ea., for CX1105A	C1105-61702
Cable, high heat resistant, –50 to +150 °C, shielded, twisted pair, soldering, 1 m, 1 ea., for CX1105A	C1105-61703
User-defined resistor tip, 10 ea., for CX1105A	C1210-61003
Cable, coaxial, 50 Ω, SMA plug to open, 100 mm, 1 ea.	8121-2773
Cable, coaxial, 50 Ω, SMA plug to open, 300 mm, 1 ea.	8121-2854
Cable, coaxial, 50 Ω, SMA plug to MHF plug, 100 mm, 1 ea.	8121-2774
Cable, coaxial, 50 Ω, SMA plug to MHF plug, 300 mm, 1 ea.	8121-2853
Cable, coaxial, 50 Ω, MHF plug, shorted, 21 mm, 1 ea.	8121-2780
Connector, RF, 50 Ω, MHF jack straight SMT, 6 GHz, ∅2 mm, 1 ea.	1250-3656
MHF pulling tool, 1 ea.	8710-2791

Description	Part number
Cable, shielded, twisted pair, 100 mm, 1 ea., for CX1204A	C1101-61712
Cable, shielded, twisted pair, 300 mm, 1 ea., for CX1204A	C1101-61713
Test lead, 2 inch, 5 ea., for CX1205A	5959-9334
Cable, mini USB plug to mini USB plug, 28 AWG, 5 V, 1 A, 500 mm, 1 ea., for CX1206A	8121-2779
Cable, flat, 1 ea., for CX1152A	C1152-61701
Probe lead, 10 MΩ, 1 ea., for CX1152A	C1152-61702
Grabber, 1 ea., for CX1152A	5090-4832
Probe ground lead, 2 inch, 5 ea., for CX1152A	5959-9334
Pod ground lead, 5 ea., for CX1152A	5959-9335
Adapter, BNC to probe tip, 1 ea., for CX1152A	C1152-60001
Label, probe, 1 sheet, for CX1152A	C1152-87101

Safety Information

This product has been designed and tested in accordance with accepted industry standards, and has been supplied in a safe condition. This manual contains information and warnings that must be followed by users to ensure safe operation and to maintain the product in a safe condition.

- “Safety Summary”
- “Safety Symbols”
- “Product Stewardship”

Safety Summary

To avoid personal injury and to prevent fire or damage to this product or products connected to it, review and comply with the following safety precautions. Failure to comply with these precautions or with specific warnings elsewhere in this manual may impair the protections provided by the product. In addition, it violates safety standards of design, manufacture, and intended use of the product. Keysight Technologies assumes no liability for the customer’s failure to comply with these requirements.

NOTE

Do not use this product which is cracked, damaged or has defective leads.

Do not use this product in any manner not specified by the manufacturer. The protective features of this product may be impaired if it is used in a manner not specified in the operation instructions.

Safety of any system incorporating the equipment is the responsibility of the assembler of the system.

- *DANGEROUS PROCEDURE WARNINGS*

  Warnings, indicated by red WARNING mark, shall be complied. Procedures throughout in this manual prevent you from potentially hazard. Their instructions contained in the warnings must be followed.

- *USE ONLY GROUNDED INSTRUMENTS*

Do not connect the CX1100 ground lead to a potential other than earth ground. Always make sure the CX1100 and the CX3300 are grounded properly.

- *KEEP AWAY FROM LIVE CIRCUITS*

  Avoid open circuitry. Do not touch connections or components when power is present.

- *INDOOR USE ONLY*

  Do not operate in wet/damp environments. Keep product surfaces dry and clean.

  Do not operate in the presence of flammable gases, corrosive gases, or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

- *DO NOT REMOVE COVERS*

  No operator serviceable parts inside. Refer servicing to qualified personnel. To prevent electrical shock, do not remove covers.

- *IN CASE OF DAMAGE OR SUSPECTED FAILURES*

  Instruments that appear damaged or defective should be made inoperative and secured against unintended operation until they can be repaired by qualified service personnel. Return the instrument to a Keysight Technologies sales or service office for services and repair to ensure that safety features are maintained.

- *USE ONLY THE SPECIFIC ACCESSORIES*

  Specific accessories satisfy the requirements for specific characteristics for using the instrument. Use the specific accessories, cables, adapters, and so on for safety reasons.

Safety Symbols

The general definitions of safety symbols used on the CX1100 or in this manual are listed below.

Frame or chassis terminal. A connection to the frame (chassis) of the equipment which normally includes all exposed metal structures.

Caution, refer to accompanying documentation. The equipment will be marked with this symbol when it is necessary for the user to refer to the instruction manual.

Read operator's manual. To indicate that the operator's manual or card should be read before continuing the operation.

The CE mark shows that the product complies with all applicable European Directives.

China RoHS - Product with Toxic Substance 40 yr EPUP

WARNING

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

CAUTION

A CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

Product Stewardship

Waste Electrical and Electronic Equipment (WEEE) Directive 2002/96/EC

This product complies with the WEEE Directive (2002/96/EC) marking requirements. The affixed label indicates that you must not discard this electrical/ electronic product in domestic household waste.

Product Category: With reference to the equipment types in the WEEE directive Annex 1, this product is classified as a “Monitoring and Control instrumentation” product.

Do not dispose in domestic household waste.

To return unwanted products, contact your local Keysight office or visit the following website for more information.

http://about.keysight.com/en/companyinfo/environment/

2 Using the CX1100

NOTE

Do not use the CX1100 which is cracked, damaged or has defective leads.

CAUTION

The sensor cable is a sensitive part of the sensor and, therefore, you should be careful not to damage it through excessive bending or pulling. Avoid any mechanical shocks to this product in order to guarantee accurate performance and protection.

CAUTION

To prevent damage on the sensor, do not apply any electrical potential and/or current to the sensor input when the CX3300 has been turned off or the sensor has been disconnected from the CX3300.

To Connect Sensor to the CX3300

Connect a sensor to the CX3300 as shown below before connecting DUT.

1. Turn the CX3300 on by pressing the Standby switch located in the lower left corner of the CX3300 front panel.

   Even though the CX3300 has turned on, you can connect or disconnect the sensors.

2. Attach the connector of a sensor to the desired analog input channel on the CX3300. For the CX1102A current sensor, also see NOTE below.
3. Fasten the screws on the connector to assure the contact.
4. If a sensor head has not been connected to the CX1101A/CX1102A/CX1104A current sensor yet, attach or connect it to the current sensor. See Figure 2-1.

If the CX3300 does not detect the sensor or the sensor head:

- Disable and enable the analog input channel connected to the sensor by pressing the **1** (yellow), **2** (green), **3** (blue), or **4** (red) key associated with the channel. When the channel is disabled, the key does not light.
- Or, disconnect the sensor or the sensor head and connect it again.

NOTE

Connecting the CX1102A Current Sensor to the CX3324A

Connect the Primary and Secondary connectors to the contiguous channels 1 and 2, 2 and 3, or 3 and 4. Both connectors must be connected properly.

Figure 2-1 **CX1101A/CX1102A/CX1104A and Sensor Head**

To Connect Sensor to DUT

Turn the CX3300 on and connect a sensor to the CX3300. After that, connect the sensor to DUT (device under test) as shown below.

1. If voltage is applied to DUT, shut off the power to DUT.
2. Connect the ground lead furnished with the sensor to the chassis ground terminal of the sensor. See Figure 2-1 for the location of the chassis ground terminal.
3. Connect the ground lead of the sensor to earth ground near DUT.
4. Connect the sensor input to DUT by using the SMA cable, the furnished accessories, or your desired cable and accessories.

   Refer to the section *"To Use the CX110xA"* for information specific to the sensor to be used.

When the sensor has been connected to DUT:

- Do not apply any electrical potential and/or current to the sensor input which exceeds the maximum rating of the sensor. For the maximum rating, refer to Keysight CX3300 *Data Sheet*.
- Do not turn the CX3300 off.
- Do not disconnect the sensor from the CX3300.
- Do not remove the sensor head from the sensor.

WARNING

IF YOU CONNECT FUSES TO THE SENSOR INPUT

Use fuses with the required rated current, voltage, and specified type (normal blow, time delay, etc.). Do not use repaired fuses or short-circuited fuse holders. To do so could cause a shock or fire hazard.

To Disconnect Sensor from DUT

Before disconnecting DUT:

- Do not turn the CX3300 off.
- Do not disconnect the sensor from the CX3300.
- Do not remove the sensor head from the sensor.

If you want to disconnect DUT along with the sensor head:

- Shut off the power to DUT, then remove the sensor head from the sensor, to prevent damage on DUT.

After the measurement is completed, disconnect the sensor from DUT as shown below.

1. If voltage is applied to DUT, shut off the power to DUT.
2. Disconnect the sensor input from DUT.
3. Disconnect the ground lead of the sensor.

After disconnecting DUT:

- Isolate the sensor input conductor and do not contact it with DUT to prevent damage on DUT.

To Use the CX1101A/CX1102A

The following sensor heads are available for the CX1101A/CX1102A current sensor.

- "CX1201A Sensor Head, Coaxial Through"
- "CX1202A Sensor Head, Coaxial Through with V Monitor"
- "CX1203A Sensor Head, Coaxial Termination"
- "CX1204A Sensor Head, Twisted Pair Adapter"
- "CX1205A Sensor Head, Test Lead Adapter"
- "CX1206A Sensor Head, High Current Adapter with Expander"

This section provides the description, the simplified circuit diagram, and the connection image of each sensor head.

CX1201A Sensor Head, Coaxial Through

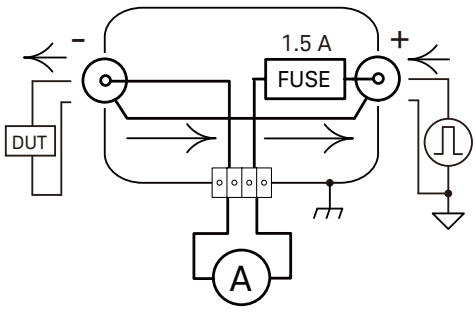
Has two SMA connectors for connecting ammeter + and – terminals to a source instrument and DUT.

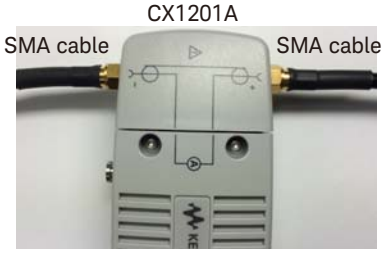
Maximum current: 1 A

Input: SMA jack connectors

To connect DUT, use SMA cables as shown in Figure 2-2. Also see Figure 2-4.

Figure 2-2 CX1201A Simplified Circuit Diagram and Connection Image





CX1202A Sensor Head, Coaxial Through with V Monitor

Has two SMA connectors for connecting ammeter + and – terminals to a source instrument and DUT. Also has a SMA connector for monitoring voltage.

Maximum current: 1 A

Input: SMA jack connectors

To connect DUT, use SMA cables as shown in Figure 2-3. This example also uses a passive probe, a probe tip-BNC plug adapter, and a BNC jack-SMA plug adapter for voltage monitor. The passive probe may be connected to the CX1151A Passive Probe Interface Adapter attached on a CX3300 analog input channel. Also see Figure 2-4.

Figure 2-3 **CX1202A Simplified Circuit Diagram and Connection Image**

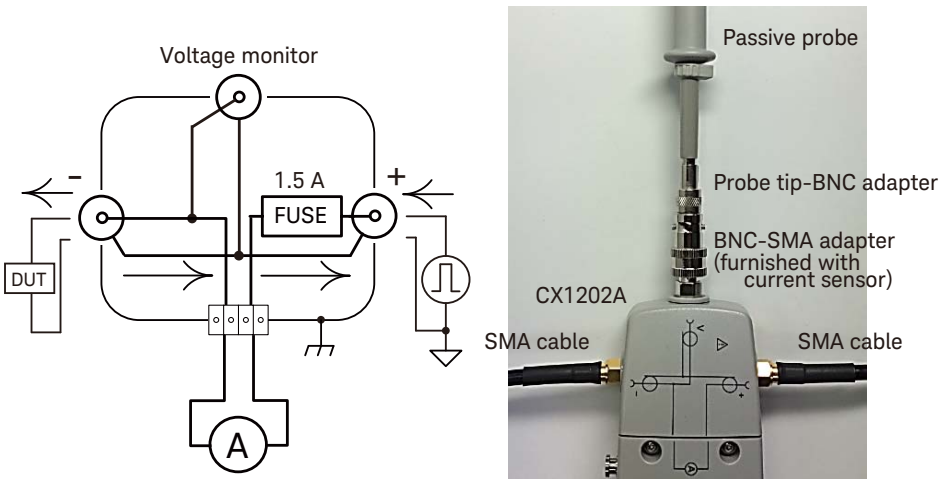
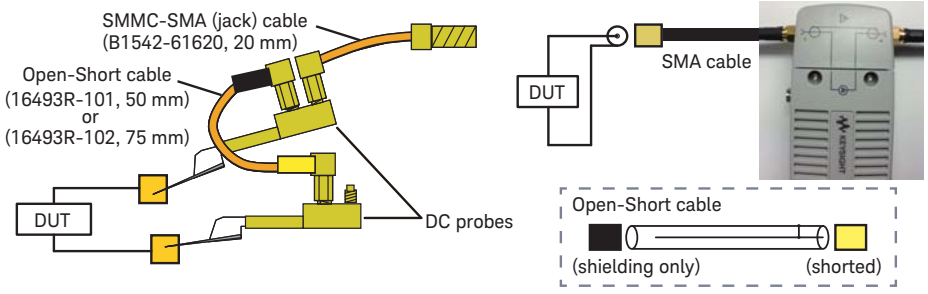


Figure 2-4 **On Wafer Device Connection Example using DC Probes**



CX1203A Sensor Head, Coaxial Termination

Has a SMA connector for connecting ammeter + and – terminals to DUT. Also has a built-in series resistor, 50 Ω.

Maximum current: 1 A with 0 Ω, 70 mA with 50 Ω series resistor

Input: SMA jack connector (center: +, outer: –)

Furnished accessories (see Table 1-2 on page 21 for the part number):

- SMA plug to open cable, 50 Ω, 100 mm, 1 ea.

  Use this cable to solder DUT directly. See Figure 2-7.

  Do not connect this cable to the sensor input when you do soldering.

- MHF connection kit

  Used for mounting MHF connector on DUT and connecting it to the sensor input. See Figures 2-8 and 2-9.

  - MHF jack straight connector for surface mount, 50 Ω, ∅2 mm, 5 ea.

    This is Samtec Inc. RSP-122811-01 or equivalent. Create the pads for this connector on DUT and solder this connector on there.

  - SMA plug to MHF plug cable, 50 Ω, 100 mm, 1 ea.

    Use this cable to connect DUT.

  - MHF plug short cable, 50 Ω, 21 mm, 5 ea.

    Use this cable to short the pads.

  - MHF pulling tool, 1 ea.

    Use this tool to remove the MHF cable from the MHF connector on DUT.

Available accessories (see Table 1-2 on page 21 for the part number):

- SMA plug to open cable, 50 Ω, 300 mm

  Use this cable to solder DUT directly.

- SMA plug to MHF plug cable, 50 Ω, 300 mm

  Use this cable to connect the MHF connector on DUT.

To connect DUT, use the furnished accessories, the available accessories, or your desired cable and accessories. See Figures 2-5 to 2-8 for connection examples.

Figure 2-5 **CX1203A Simplified Circuit Diagram and Connection Image**

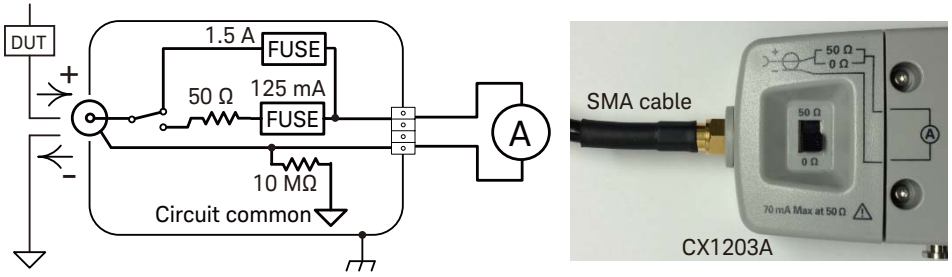


Figure 2-6 **Using BNC Cable**

Figure 2-7 **Using SMA Plug to Open Cable**

CAUTION

Do not connect the SMA plug to open cable to the sensor head when you do soldering.

Figure 2-8 **Using MHF Connection Kit**

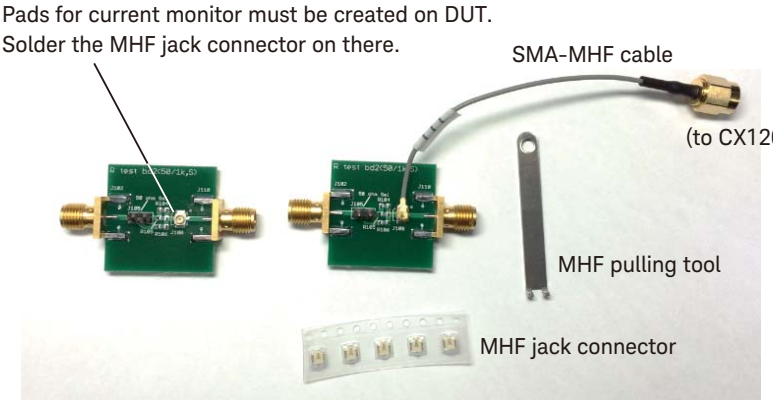
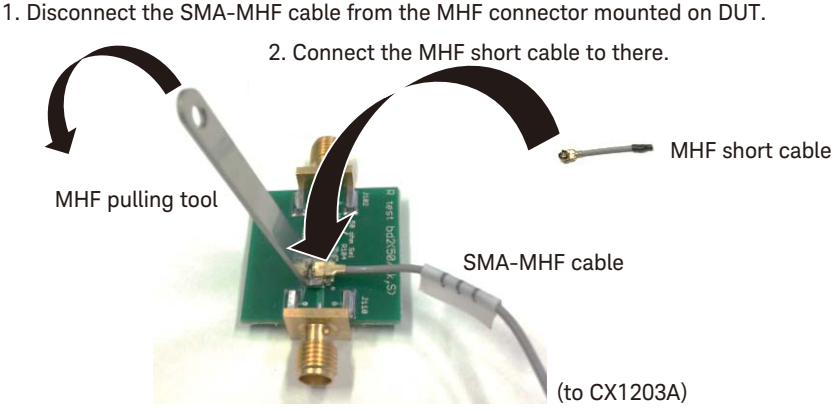


Figure 2-9 **Disconnecting SMA-MHF Cable and Connecting MHF Short Cable**



CX1204A Sensor Head, Twisted Pair Adapter

Sensor head with extension cables for soldering DUT

Maximum current: 1 A

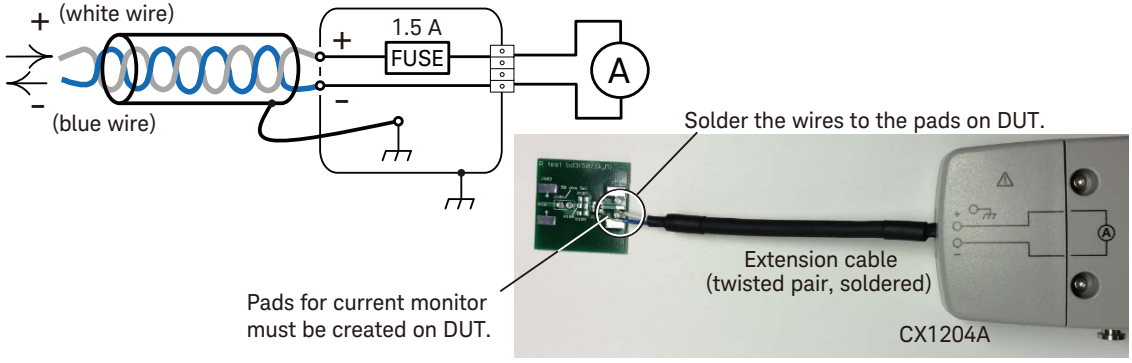
Furnished accessories (see Table 1-2 on page 21 for the part number):

- Extension cable, shielded, twisted pair, 100 mm, 1 ea.
- Extension cable, shielded, twisted pair, 300 mm, 1 ea.

Initially, a 100 mm cable has been soldered on the sensor head. If you want to replace the extension cable, see "Replacing the extension cable" on page 37.

To connect DUT, solder the wires of the sensor head extension cable as shown in Figure 2-10.

Figure 2-10 CX1204A Simplified Circuit Diagram and Connection Image



CAUTION

Do not attach the sensor head to the current sensor when you do soldering or replace the extension cable.

Replacing the extension cable

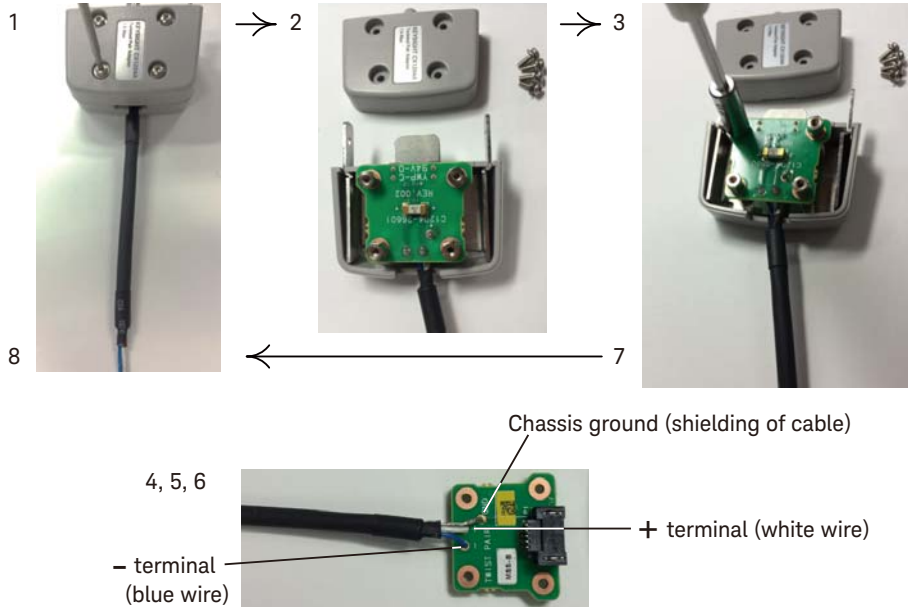
To replace the extension cable, remove the sensor head cover and the internal PC board by using the following tools.

- T6 Torx screwdriver
- 4 mm box driver

Procedure:

1. Unscrew and remove four screws from the bottom cover.
2. Remove the bottom cover.
3. Unscrew and remove four standoff screws from the PC board.
4. Remove the PC board.
5. Unsolder the wires from the PC board, and remove the extension cable.
6. Prepare a new extension cable and solder the wires.
7. Replace the PC board on the top cover using the standoff screws.
8. Replace the bottom cover by using the screws.

Figure 2-11 **Removing Bottom Cover and PC Board**



CX1205A Sensor Head, Test Lead Adapter

Has two mini jack terminals for connecting ammeter + and – terminals to DUT.

Maximum current: 1 A

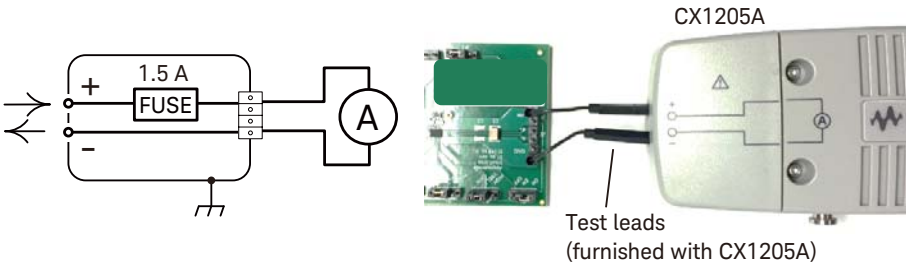
Input: Mini jack terminals

Furnished accessories (see Table 1-2 on page 21 for the part number):

- Test lead, mini plug to mini jack, 2 inch, 10 ea.

To connect DUT, use the test leads as shown in Figure 2-12. The test leads can be used for connecting the mini plug terminals (connection posts) on DUT directly.

Figure 2-12 CX1205A Simplified Circuit Diagram and Connection Image



CX1206A Sensor Head, High Current Adapter with Expander

Accessory for the CX1101A current sensor. Expands the maximum measurement current up to 10 A. Has two banana jack terminals for connecting ammeter + and – terminals to DUT.

Maximum current: 10 A

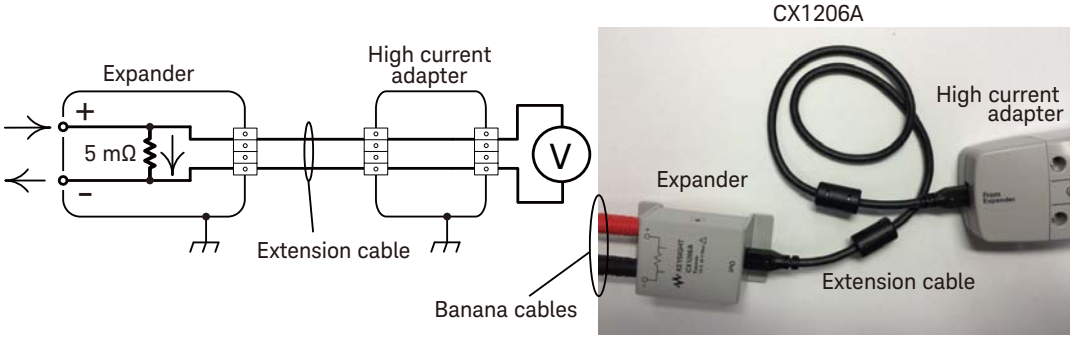
Input: Banana jack terminals

Contents:

- High current adapter, 1 ea.
- Expander, 1 ea.
- Extension cable, 1 ea.

To connect DUT, use banana cables as shown in Figure 2-13.

Figure 2-13 CX1206A Simplified Circuit Diagram and Connection Image



To Use the CX1103A

The CX1103A current sensor has a SMA connector for connecting ammeter + and – terminals to DUT.

Maximum current: 20 mA

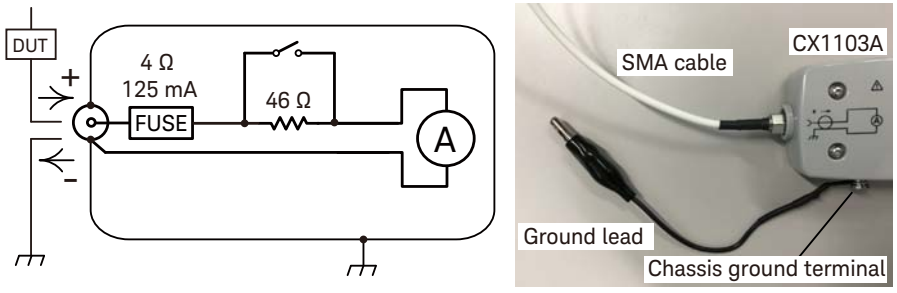
Input: SMA jack connector (center: +, outer: –)

Furnished accessories (see Table 1-2 on page 21 for the part number):

- Ground lead, 1 ea.
- BNC jack to SMA plug adapter, 1 ea.

To connect DUT, use a SMA cable as shown in Figure 2-14 or a BNC cable and the BNC to SMA adapter furnished with the CX1103A.

Figure 2-14 **CX1103A Simplified Circuit Diagram and Connection Image**



To Use the CX1104A

The CX1104A current sensor requires one of the resistive sensor heads listed below to perform measurement. Connect the sensor head by using the extension cable furnished with the CX1104A. The sensor head has two screw terminals for connecting ammeter + and – terminals to DUT.

- CX1211A Resistive sensor head, 15 A, 5.5 mΩ
- CX1212A Resistive sensor head, 10 A, 8 mΩ
- CX1213A Resistive sensor head, 5 A, 23 mΩ
- CX1214A Resistive sensor head, 3 A, 53 mΩ
- CX1215A Resistive sensor head, 2 A, 103 mΩ
- CX1216A Resistive sensor head, 0.25 A, 1 Ω

Maximum current: Depends on resistive sensor head.

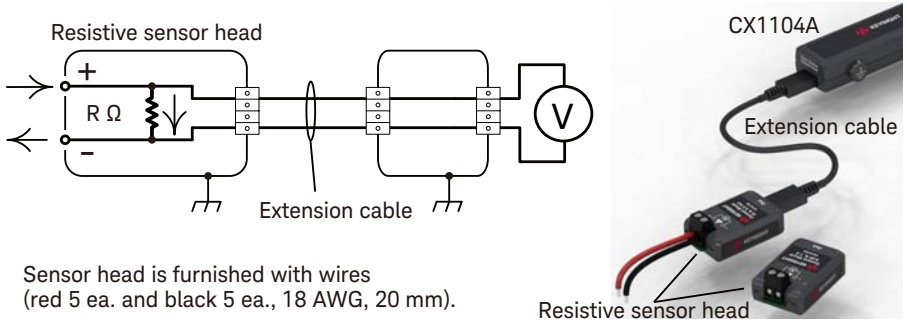
Input: Screw terminals or banana jack terminals using the furnished adapter

Furnished accessories (see Table 1-2 on page 21 for the part number):

- Extension cable, USB Type-C, 1 ea.
- Ground lead, 1 ea.
- Banana adapter, 1 ea., for changing terminal type from screw to banana

To connect DUT, just connect the wires connected to DUT to the screw terminals on the sensor head. Then, fasten the screws to assure the contact.

Figure 2-15 **CX1104A Simplified Circuit Diagram and Connection Image**



Sensor head is furnished with wires
(red 5 ea. and black 5 ea., 18 AWG, 20 mm).

To Use the CX1105A

The CX1105A differential sensor has two mini jack terminals for connecting voltmeter + and – terminals to DUT. Also the CX1105A has a mini banana jack terminal for connecting chassis ground to shielding of the extension cable or earth ground near DUT.

Maximum current: approximately 100 A, depends on bandwidth and sense resistance

Input: Mini jack terminals

Furnished accessories (see Table 1-2 on page 21 for the part number):

- Grabber clip micro SMD, 1 ea.
- Grabber mini, 2 ea.
- Test lead, mini plug to mini jack, 2 inch, 5 ea.

  Use the test leads and the grabbers to connect DUT. Their use images are shown in Figure 2-16. Or connect the test leads directly to the mini plug terminals (connection posts) on DUT.
- Extension cable, shielded, twisted pair, mini jack, 100 mm, 1 ea.

  Use this cable and the grabbers to connect DUT. Or connect the cable directly to the mini plug terminals (connection posts) on DUT.
- Extension cable, shielded, twisted pair, soldering, 100 mm, 1 ea.

  Use this cable to solder DUT directly. Do not connect the cable to the sensor input when you do soldering.
- Ground lead, 1 ea.
- Adjustment tool, 1 ea.
- Test adapter, 1 ea.

  Use the test adapter and the adjustment tool to perform the phase compensation of the CX1105A. See “To Perform Phase Compensation” on page 44.

Available accessories (see Table 1-2 on page 21 for the part number):

- Extension cable, shielded, twisted pair, –50 to +150 ˚C, 1 m

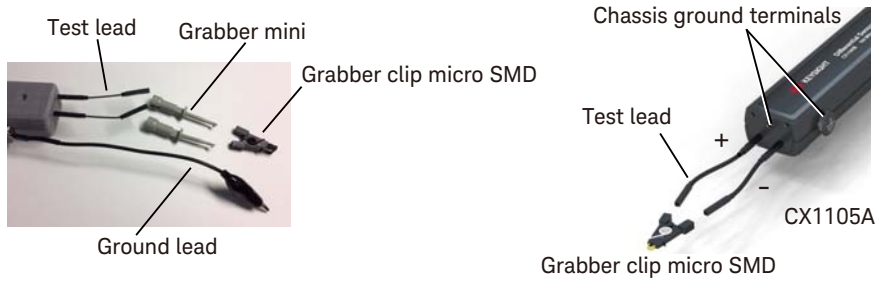
  This high heat resistant cable is available for the measurement of DUT placed in a chamber. Use this cable to solder DUT directly. Do not connect the cable to the sensor input when you do soldering.

- User-defined resistor tip

  This part is available for making your sense resistor tip. If you want to specify by yourself the sense resistor through which measurement current flows or try various values of the sense resistor, prepare chip resistors and solder one on this part. See “To Make Your Sense Resistor Tip” on page 47.

To connect DUT, use the furnished accessories, the available accessories, or your desired cable and accessories. It is not necessary to cut off the circuit on DUT. Connect the CX1105A + and – terminals to both terminals of a resistor on the DUT.

Figure 2-16 **CX1105A Connection Images**



To Perform Phase Compensation

This section describes how to perform the phase compensation of the CX1105A. The compensation should be performed to acquire real and clear pulse waveforms. This function is effective for the 1 V range and the 2.5 V range.

- "Required accessories"
- "Preparation"
- "Setting up the CX3300"
- "Adjustment"

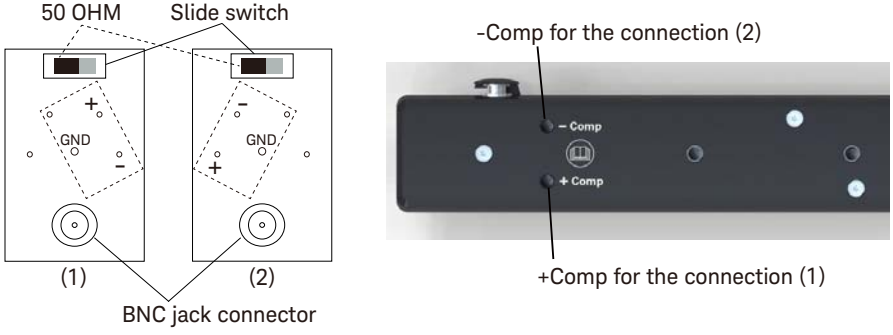
Required accessories

- Test adapter, 1 ea., furnished with the CX1105A
- Adjustment tool, 1 ea., furnished with the CX1105A
- Coaxial cable (BNC plug to BNC plug), 1 ea., furnished with the CX3300

Preparation

1. Connect the CX1105A to a channel on the CX3300 front panel. And warm up the CX1105A for 30 minutes before starting the phase compensation.
2. Set the slide switch on the test adapter to the 50 OHM. See Figure 2-17.
3. Connect the BNC cable between the BNC jack connector on the test adapter and the Aux Out terminal on the CX3300 front panel.

Figure 2-17 Test Adapter and Adjustment Locations (+Comp and -Comp)



Setting up the CX3300

1. Press the **1** (yellow), **2** (green), **3** (blue), or **4** (red) key associated with the channel connected to the CX1105A and enable the channel.
2. Set the Range to 2.5 V by using the Channel *N* mini dialog box.

   Where *N* is the channel number 1, 2, 3, or 4 of the channel connected to the CX1105A. The Channel *N* mini dialog box is opened by clicking the channel *N* summary on the summary bar located bottom of the CX3300 screen.
3. Press the **Menu** key several times to open the Configuration dialog box. The **Menu** key is located above the Horizontal control on the front panel.
4. Set the following conditions on the dialog box (Configuration > Calibration Output).

   - Output State: ON
   - Source Shape: Square

   The +5 V square pulse (1 kHz, 50% duty cycle) is applied from the Aux Out terminal which has 50 Ω output impedance.
5. Click the close (x) button located in the upper right corner on the Configuration dialog box to close the dialog box.
6. Press the **Run** key to start waveform acquisition.

Adjustment

1. Connect the CX1105A to the connection posts on the test adapter as shown in (1) of Figure 2-17. You will see +2.5 V square pulse divided by two 50 Ω.
2. Adjust the +Comp for best overall pulse response, the flattest pulse top, by using the adjustment tool. See Figure 2-17 for the adjustment locations. Also see Figure 2-18 for the waveform examples.
3. Disconnect the CX1105A from the test adapter.
4. Connect the CX1105A to the connection posts on the test adapter as shown in (2) of Figure 2-17. You will see –2.5 V square pulse divided by two 50 Ω.
5. Adjust the –Comp for best overall pulse response, the flattest pulse top, by using the adjustment tool. See Figure 2-17 for the adjustment locations. Also see Figure 2-19 for the waveform examples.

Figure 2-18 **Waveform Examples to Adjust +Comp**

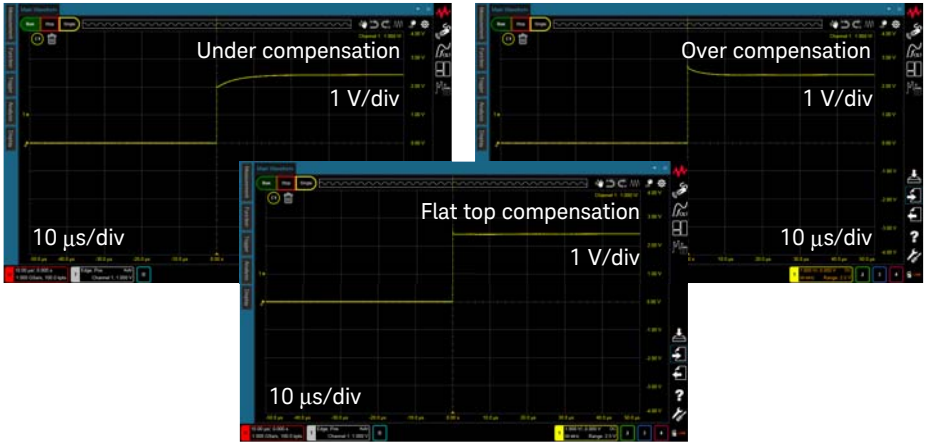
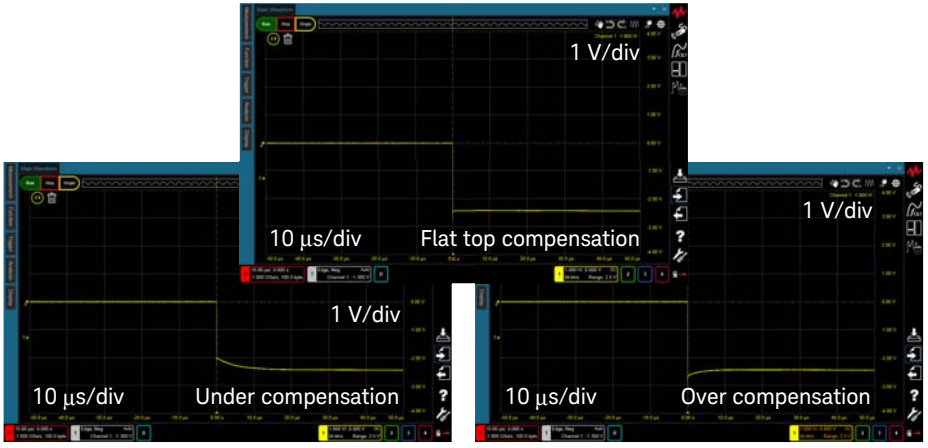


Figure 2-19 **Waveform Examples to Adjust –Comp**



To Make Your Sense Resistor Tip

If you want to specify by yourself the sense resistor through which measurement current flows or try various values of the sense resistor, use the user-defined resistor tip (Keysight part number C1210-61003). You can insert your desired resistor between the CX1105A + and – terminals. See Figure 2-20.

1. Prepare your desired resistor. Chip size must be 0603 (EIA) or 1608 (JIS).
2. Solder the resistor between the pads on the user-defined resistor tip.
3. Solder the wires connected to DUT to the input terminals (Ø1 mm through hole) on the tip.

   If the wires connected to DUT have a mini jack terminal, prepare connection posts (0.64 mm square) and solder them to the input terminals on the tip.

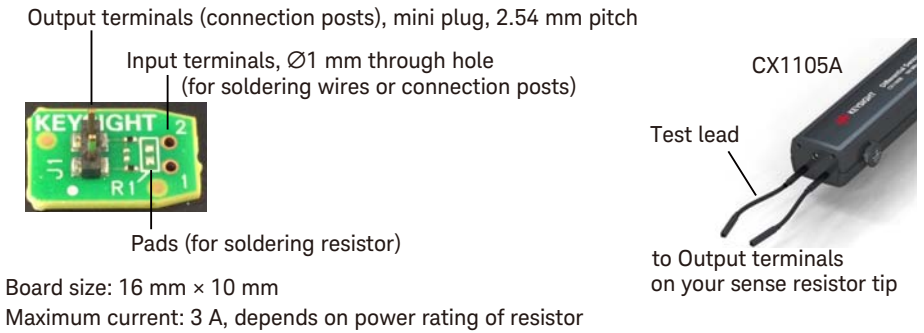
   Where, the wiring length should be as short as possible to reduce the parasitic inductance.

CAUTION

When doing soldering

Do not connect the CX1105A to the output terminals on the user-defined resistor tip when you solder the resistor, the wires or the connection posts.

Figure 2-20 User-defined Resistor Tip



To connect the CX1105A to your sense resistor tip, connect the test leads to the output terminals on the resistor tip, and then connect them to the CX1105A + and – terminals.

To Use the CX1151A

To monitor voltage, connect the CX1151A to the CX3300 as shown below.

1. Turn the CX3300 on by pressing the Standby switch located in the lower left corner of the CX3300 front panel.

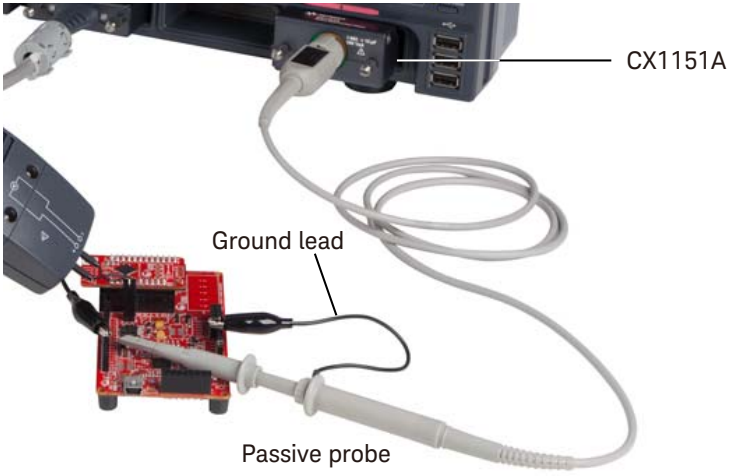
   Even though the CX3300 has turned on, you can connect or disconnect the CX1151A.

2. Attach the CX1151A to the desired analog input channel on the CX3300.
3. Fasten the screws on the CX1151A to assure the contact.

If the CX3300 does not detect the CX1151A:

- Disable and enable the analog input channel connected to the CX1151A by pressing the **1** (yellow), **2** (green), **3** (blue), or **4** (red) key associated with the channel. When the channel is disabled, the key does not light.
- Or, disconnect the CX1151A and connect it again.

Figure 2-21 **CX1151A Connection Example**



To Connect DUT

Use a passive probe or a BNC cable and accessories, and connect DUT as shown below. For the supported probes, see Table 2-1 on page 49.

1. Connect a probe or a cable to the CX1151A.
2. If voltage is applied to DUT, shut off the power to DUT.
3. Connect the ground lead to earth ground near DUT if the probe is used.
4. Connect the probe or the cable to DUT.

When the probe/cable has been connected to DUT:

- Do not apply any electrical potential and/or current to the probe input which exceeds the maximum rating of the probe. For the maximum rating, refer to the probe's manual, data sheet, or selection guide.

Table 2-1 **Supported Passive Probes**

Attenuation ratio	Keysight model number
1:1	10070D, N2870A
10:1	10073D, 10074D, N2862B, N2863B, N2871A, N2872A, N2873A, N2890A, N2894A, N2853A, N2843A, N2842A, N2841A, N2840A
20:1	N2875A
100:1	10076C

Some of Keysight passive probes can be used, but the skew adjustment with the CX3300 is made by the N2843A 500 MHz 10:1 Passive Probe. Other probes can be used as well if you don't care much about the skew optimization.

If you use the probe other than the N2843A and you want to adjust the skew, enter the Skew value on the Channel mini dialog box or the Setting dialog box (Setting > Channels > Skew).

You may use a probe which is not listed in Table 2-1. Or you may insert an attenuator between the CX1151A and DUT. Then, the CX3300 cannot detect it automatically. So you need to specify its attenuation ratio as follows.

1. Press the **Menu** key to open the Setting dialog box.

2. Set the following conditions on the Setting dialog box (Setting > Sensor / Probe > Channel *N*). Where, *N* is 1, 2, 3, or 4 associated with the channel connected to the CX1151A.

   - Channel *N*: ON
   - Attenuation:

     Set 1.000 for a 1:1 probe, 10.00 for a 10:1 probe, 100.0 for a 100:1 probe, or the attenuation value of the used probe or the inserted attenuator.

To Disconnect DUT

After the measurement is completed, disconnect the probe/cable from DUT as shown below.

1. If voltage is applied to DUT, shut off the power to DUT.
2. Disconnect the probe or the cable from DUT.
3. Disconnect the ground lead if the probe is used.
4. Disconnect the probe or the cable from the CX1151A.

To Use the CX1152A

The CX1152A is the accessory for the CX3324A. To monitor digital signal, connect the CX1152A to the CX3324A and set the CX3324A as shown below.

CAUTION

Be sure to orient the flat cable and the Digital D7-D0 connector. Inserting the cable incorrectly could bend pins and/or cause errors.

1. Turn the CX3324A on by pressing the Standby switch located in the lower left corner of the CX3324A front panel.

   Even though the CX3324A has turned on, you can connect or disconnect the CX1152A.

2. Connect the flat cable of the CX1152A to the Digital D7-D0 connector on the CX3324A rear panel.
3. Press the **Menu** key to open the Setting dialog box.
4. Set the following conditions on the Setting dialog box (Setting > Digital Channels).

   - Digital Channels: ON
   - Channels:

     Check the D7, D6, D5, D4, D3, D2, D1, and/or D0 check box associated with the digital channel used for the measurement.
   - Graph scale:

     Small, medium, or large
   - Display order from top to bottom on the graph:

     D0-D7 (D0 to D7) or D7-D0 (D7 to D0)
   - Threshold Voltage:

     Set the voltage for judging the logic level high or low.

Furnished accessories (see Table 1-2 on page 21 for the part number):

- Grabber, 10 ea.
- Probe ground lead, 5 ea.
- BNC adapter (BNC jack to probe tip), 1 ea.

To connect DUT, use these accessories as shown in Figure 2-23.

CAUTION

Do not apply voltage to the digital channel input which exceeds ±40 V.

Figure 2-22 **CX1152A Digital Channel**

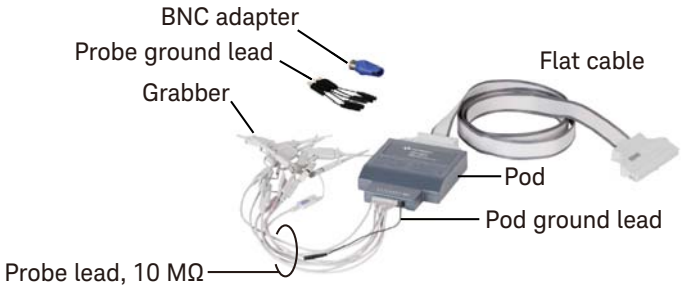
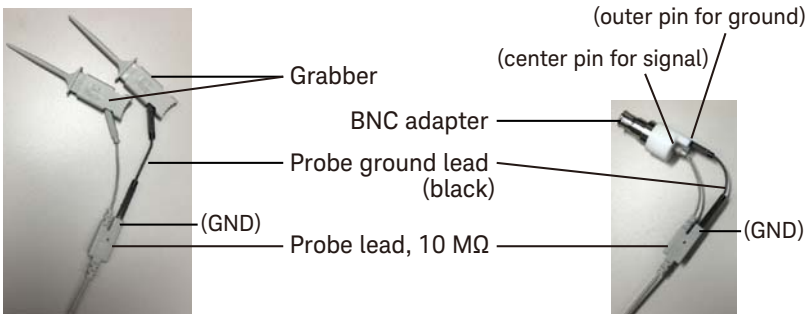


Figure 2-23 **Connecting Grabber or BNC Adapter**

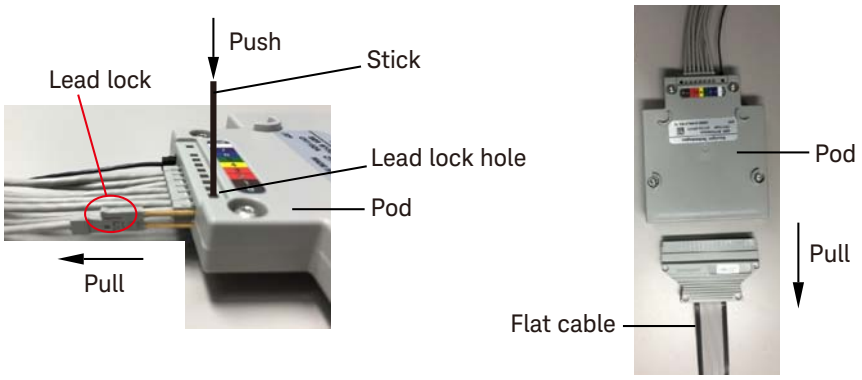


To Replace Probe Lead, Pod Ground Lead, and Flat Cable

To replace the lead or the flat cable, remove it as follows and install a new one. See Figure 2-24.

- To remove the lead from the pod, prepare a stick with an appropriate thickness for the lead lock hole. Push the lock using the stick and pull out the lead gently.
- To remove the flat cable from the pod, carefully pull out the connector of the flat cable.

Figure 2-24 **Removing Probe Lead and Flat Cable**



Precautions for Measurements

- Let the CX1100 connected to the CX3300 warm up for 30 minutes.
- Do not connect the ground lead to a potential other than earth ground.
- Keep away DUT from the CX3300.
- Avoid, if possible, the proximity of something which may create noise.
- During the measurement, do not touch connectors and components in the measurement path.
- The CX3300 provides the user calibration capability for making more accurate measurements. To perform the user calibration, refer to *Keysight CX3300 User's Guide*.

CAUTION

OBSERVE THE CX1100 RATINGS

Do not apply any electrical potential and/or current to the CX1100 input which exceeds the maximum rating of the CX1100. For the maximum rating, refer to Keysight CX3300 *Data Sheet*.

NOTE

About Measurement Accuracy

Measurement accuracy can be affected by RF electro-magnetic field having the strengths greater than 3 V/m in the frequency range of 80 MHz to 2 GHz or 1 V/m in the frequency range of 2 GHz to 2.7 GHz. The extent of this effect depends upon how the instrument is positioned and shielded.

3 Performance Data Plots

This chapter provides the following performance plots for the CX1100 sensors.

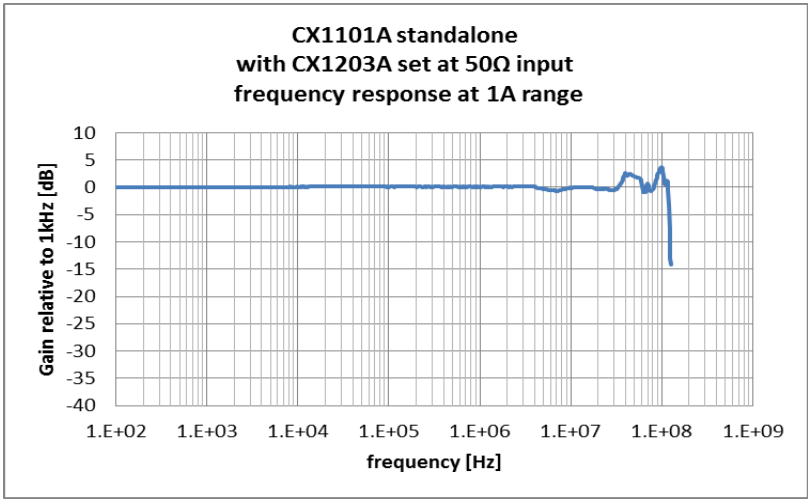
- Frequency response
- Step response
- RMS noise
- Input impedance
- Input equivalent circuit (for CX1101A, CX1102A, CX1104A and CX1105A)
- CMRR (for CX1104A and CX1105A)

This chapter also provides the following performance plots for the CX1151A adapter.

- Frequency response
- Step response

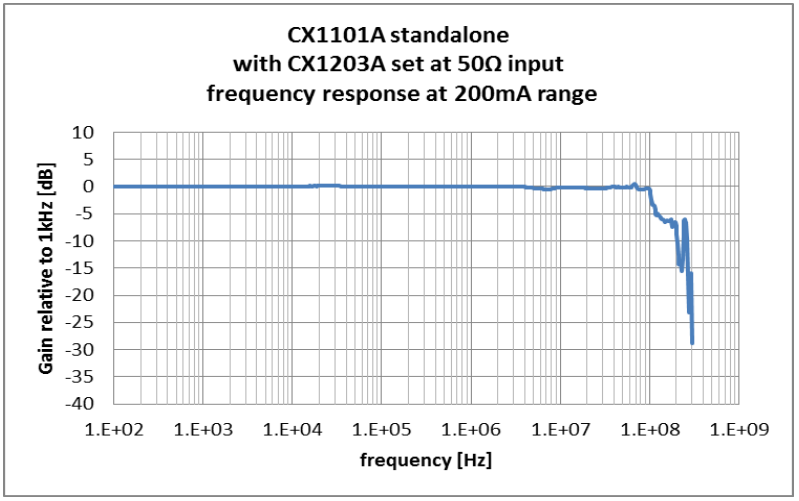
CX1101A

Figure 3-1 **Frequency Response, 1 A Range**



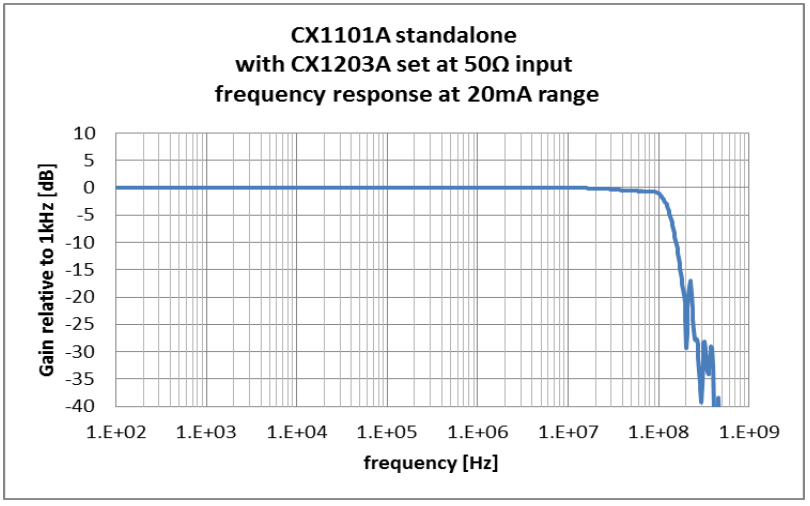
- -3 dB bandwidth: 120 MHz

Figure 3-2 **Frequency Response, 200 mA Range**



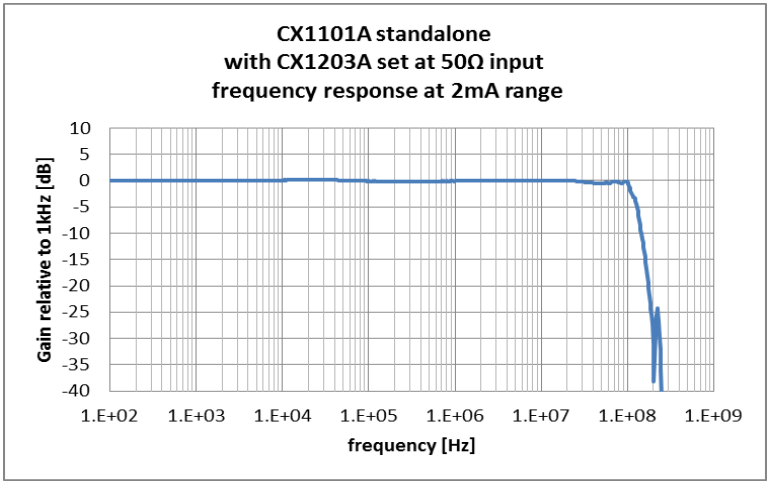
- -3 dB bandwidth: 105 MHz

Figure 3-3 **Frequency Response, 20 mA Range**



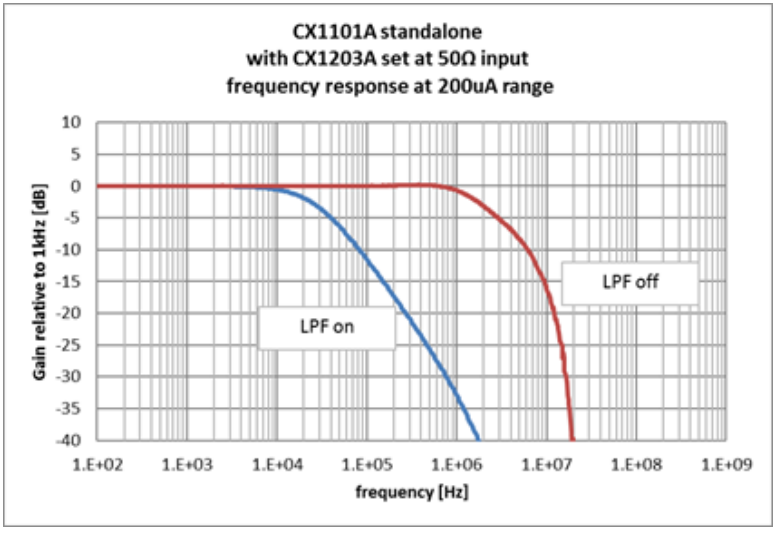
- -3 dB bandwidth: 120 MHz

Figure 3-4 **Frequency Response, 2 mA Range**



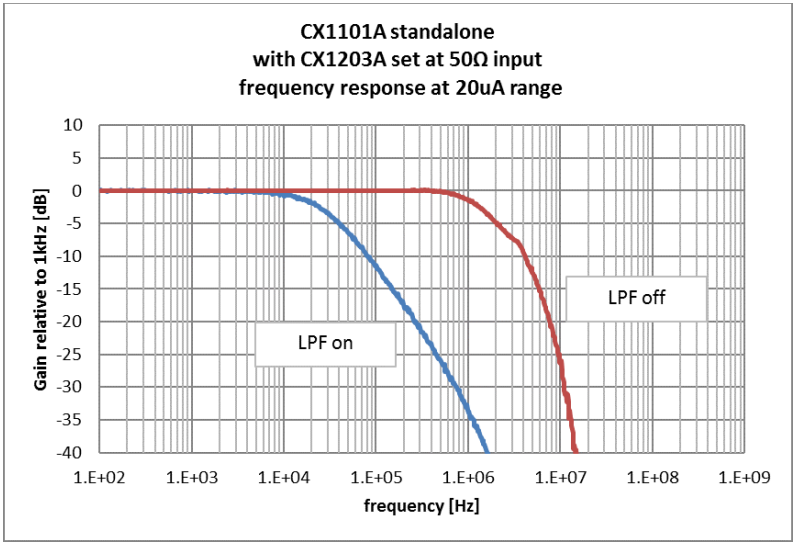
- -3 dB bandwidth: 115 MHz

Figure 3-5 **Frequency Response, 200 μA Range**



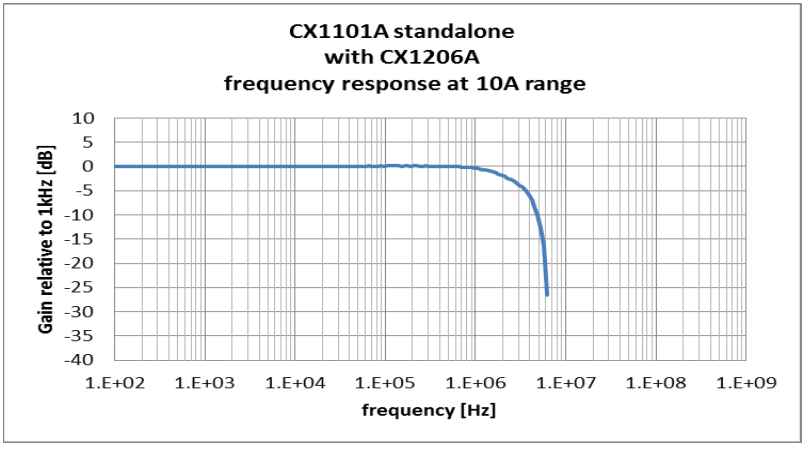
- -3 dB bandwidth (Low Pass Filter (LPF) off): 1.9 MHz
- -3 dB bandwidth (Low Pass Filter (LPF) on): 27 kHz

Figure 3-6 **Frequency Response, 20 μA Range**



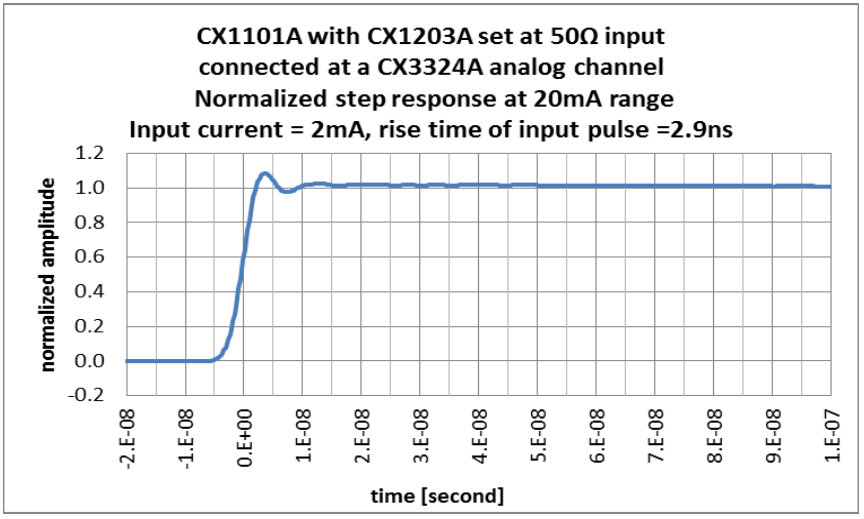
- -3 dB bandwidth (Low Pass Filter (LPF) off): 1.4 MHz
- -3 dB bandwidth (Low Pass Filter (LPF) on): 26.8 kHz

Figure 3-7 **Frequency Response, 10 A Range**



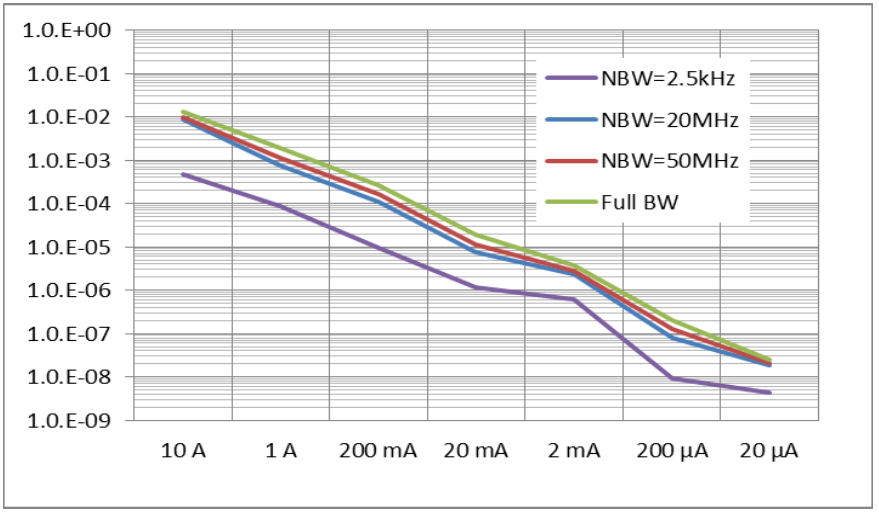
- -4 dB bandwidth: 3.3 MHz

Figure 3-8 **Step Response, 20 mA Range**



- 10-90% rise time: 4 ns
- 10-90% rise time of CX1101A: 2.7 ns = sqrt (4^2-2.9^2)

Figure 3-9 **RMS Noise [A] vs Current Range, with CX3300 and Sensor Input Open**



NBW: Bandwidth limit

Full BW: Bandwidth limit off

Figure 3-10 **Input Common Mode Impedance**

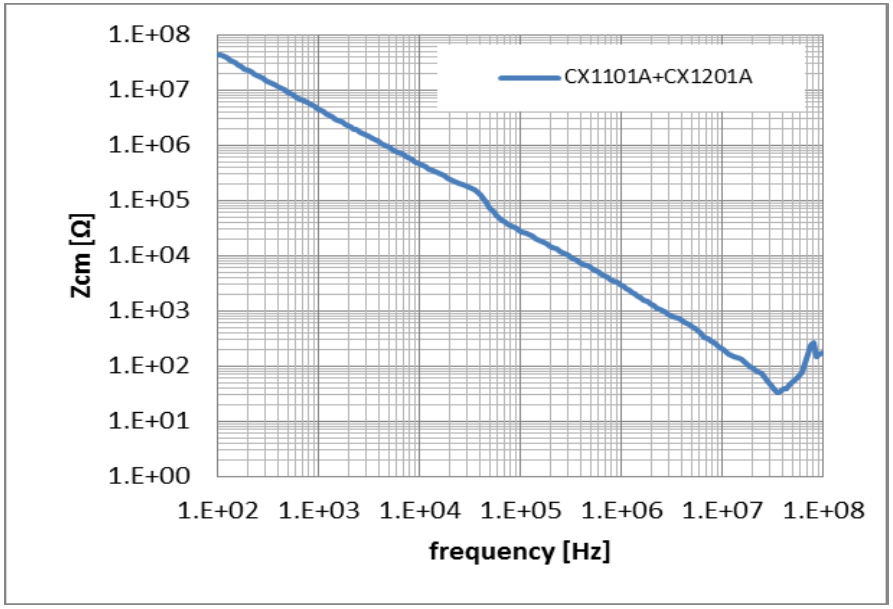


Figure 3-11 **Input Insertion Impedance**

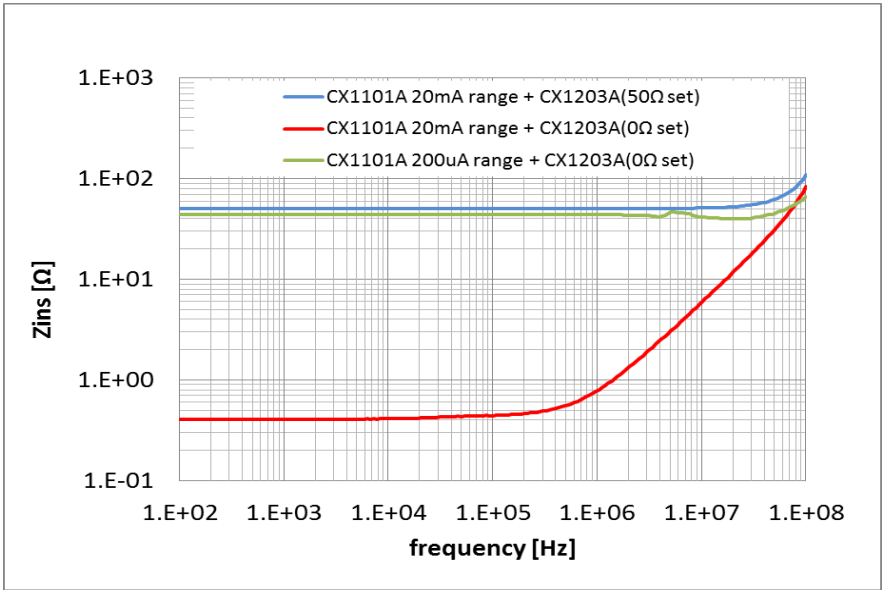
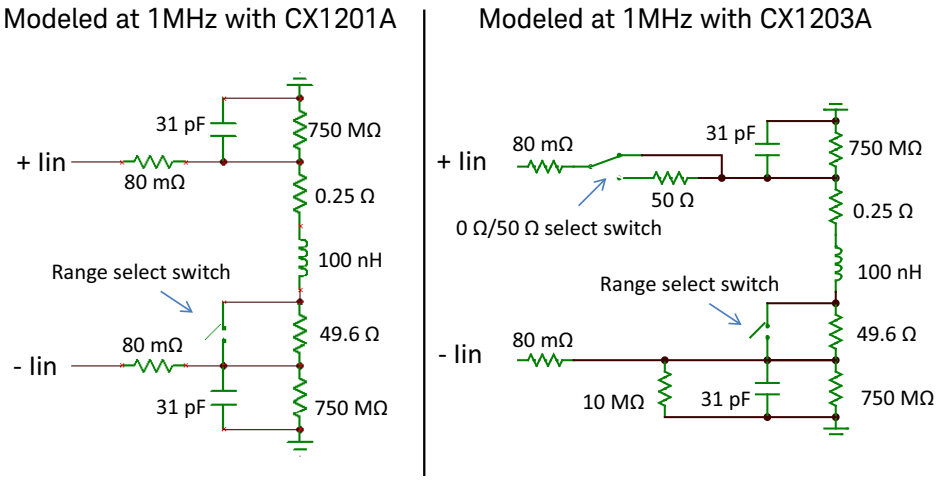


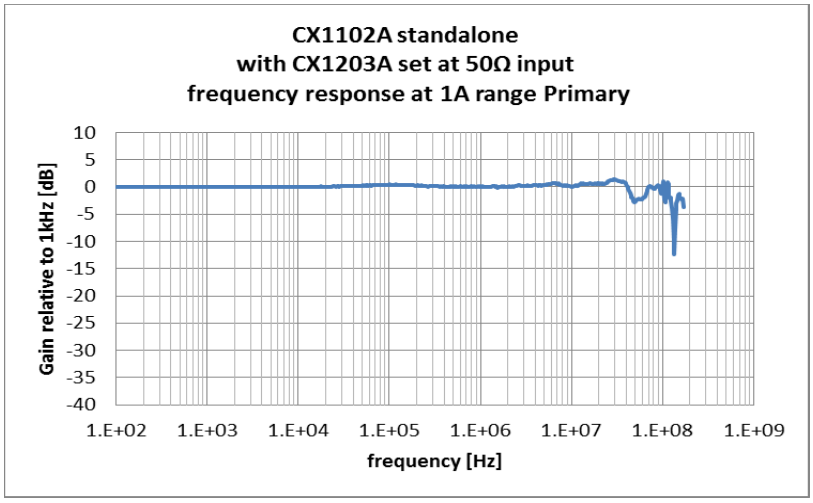
Figure 3-12 **Input Equivalent Circuit**



The range select switch opens for the 20 µA and 200 µA ranges and closes for the other ranges.

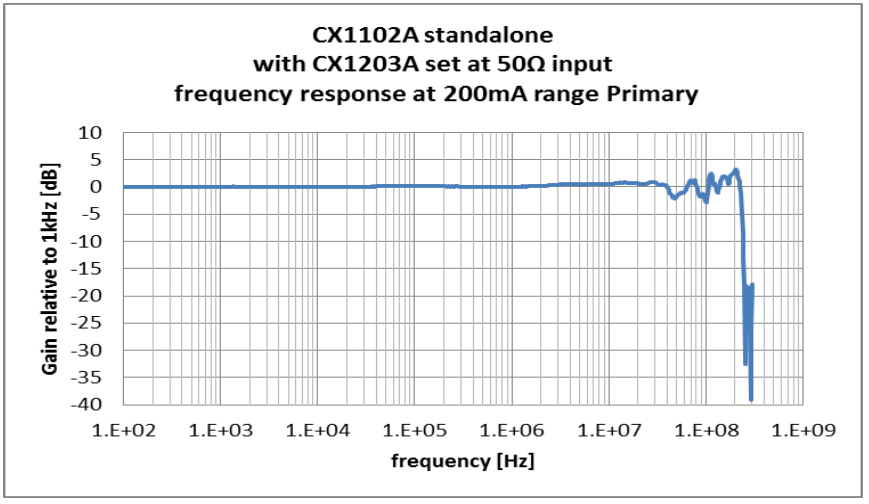
CX1102A

Figure 3-13 **Frequency Response, Primary 1 A Range**



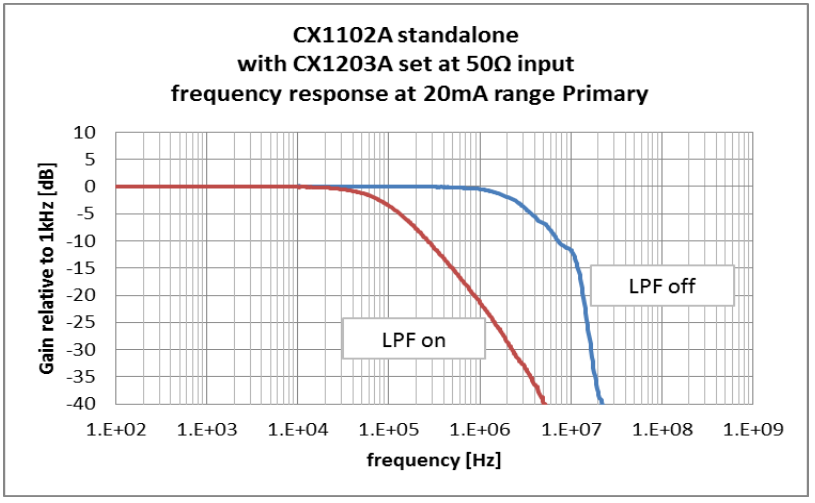
- -3 dB bandwidth: 127 MHz

Figure 3-14 **Frequency Response, Primary 200 mA Range**



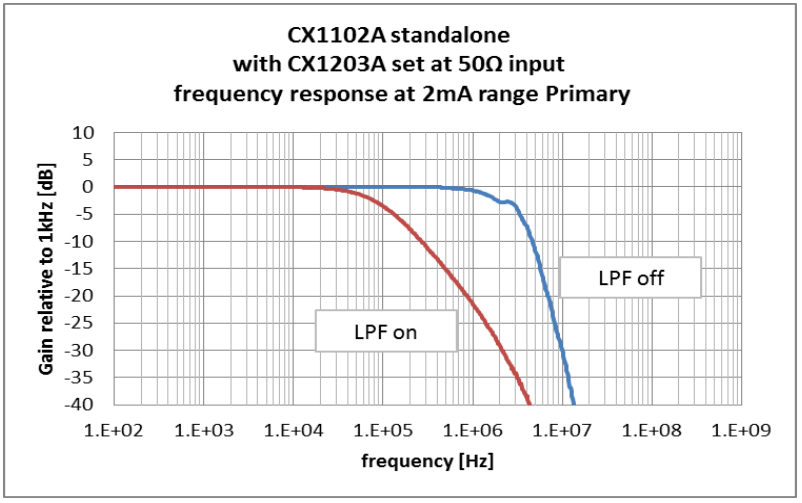
- -3 dB bandwidth: 231 MHz

Figure 3-15 **Frequency Response, Primary 20 mA Range**



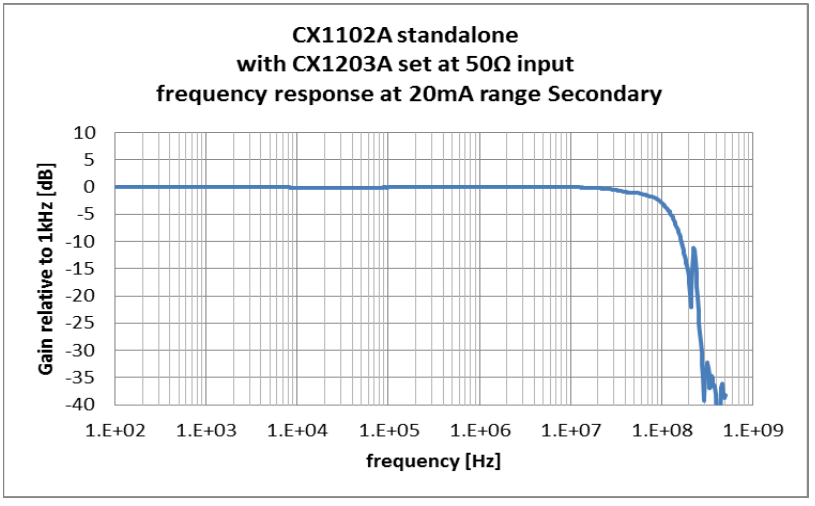
- -3 dB bandwidth (Low Pass Filter (LPF) off): 2.6 MHz
- -3 dB bandwidth (Low Pass Filter (LPF) on): 90 kHz

Figure 3-16 **Frequency Response, Primary 2 mA Range**



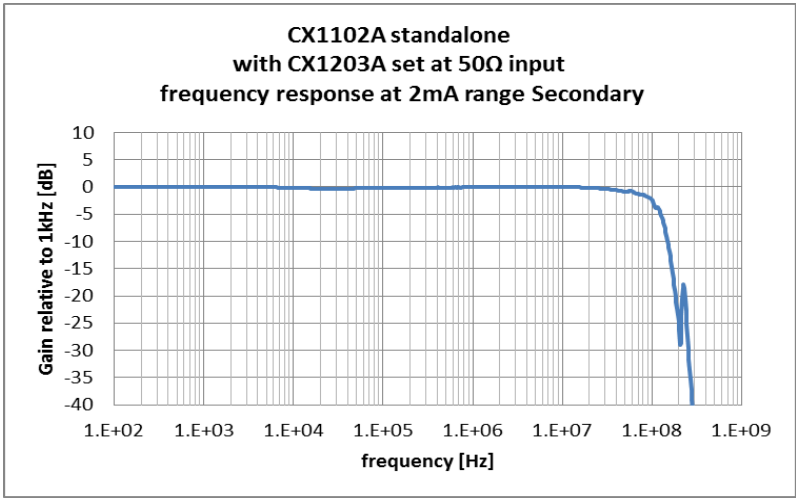
- -3 dB bandwidth (Low Pass Filter (LPF) off): 2.7 MHz
- -3 dB bandwidth (Low Pass Filter (LPF) on): 90 kHz

Figure 3-17 **Frequency Response, Secondary 20 mA Range**



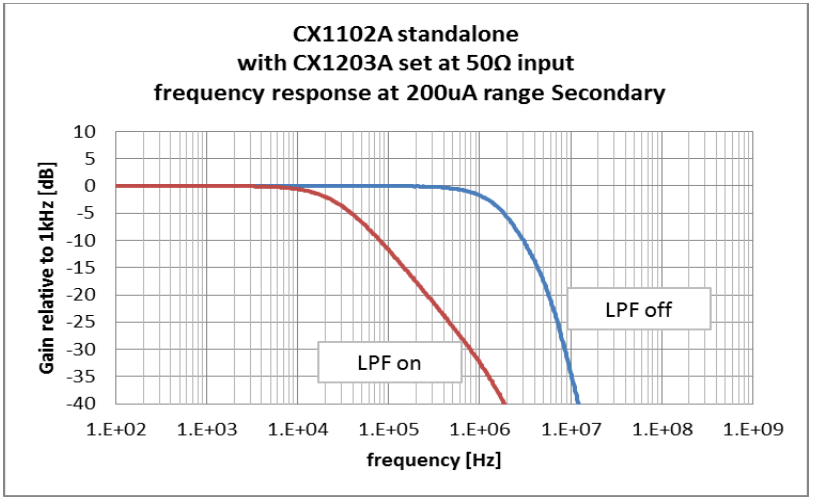
- -3 dB bandwidth: 101 MHz

Figure 3-18 **Frequency Response, Secondary 2 mA Range**



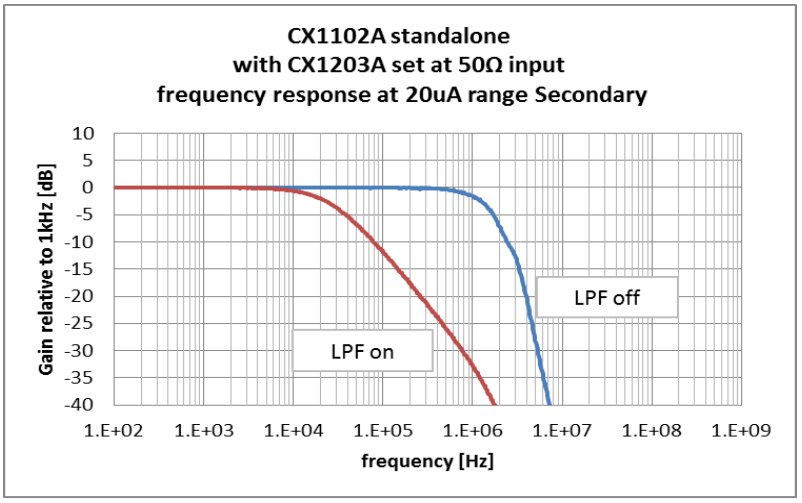
- -3 dB bandwidth: 103 MHz

Figure 3-19 **Frequency Response, Secondary 200 μA Range**



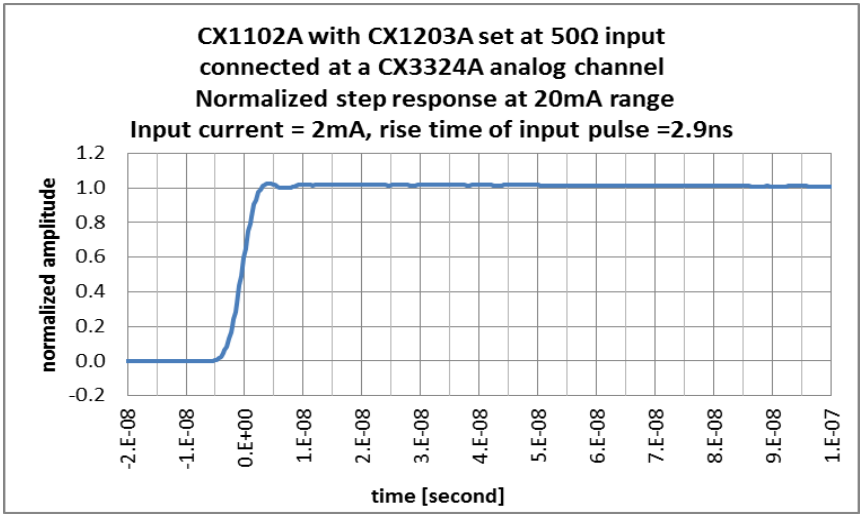
- -3 dB bandwidth (Low Pass Filter (LPF) off): 1.3 MHz
- -3 dB bandwidth (Low Pass Filter (LPF) on): 26 kHz

Figure 3-20 **Frequency Response, Secondary 20 μA Range**



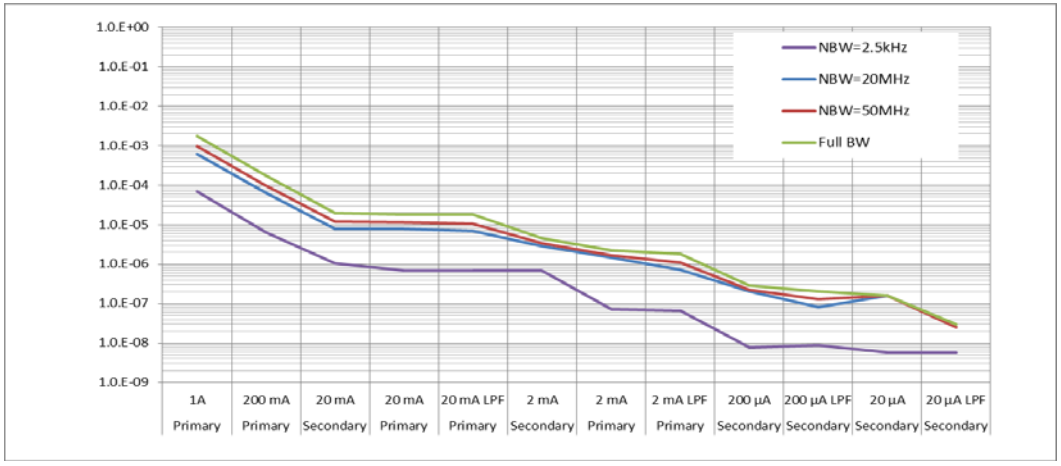
- -3 dB bandwidth (Low Pass Filter (LPF) off): 1.3 MHz
- -3 dB bandwidth (Low Pass Filter (LPF) on): 26 kHz

Figure 3-21 **Step Response, 20 mA Range**



- 10-90% rise time: 4.26 ns
- 10-90% rise time of CX1102A: 3.1 ns = sqrt (4.26^2-2.9^2)

Figure 3-22 **RMS Noise [A] vs Current Range, with CX3300 and Sensor Input Open**



NBW: Bandwidth limit

Full BW: Bandwidth limit off

Figure 3-23 **Input Common Mode Impedance**

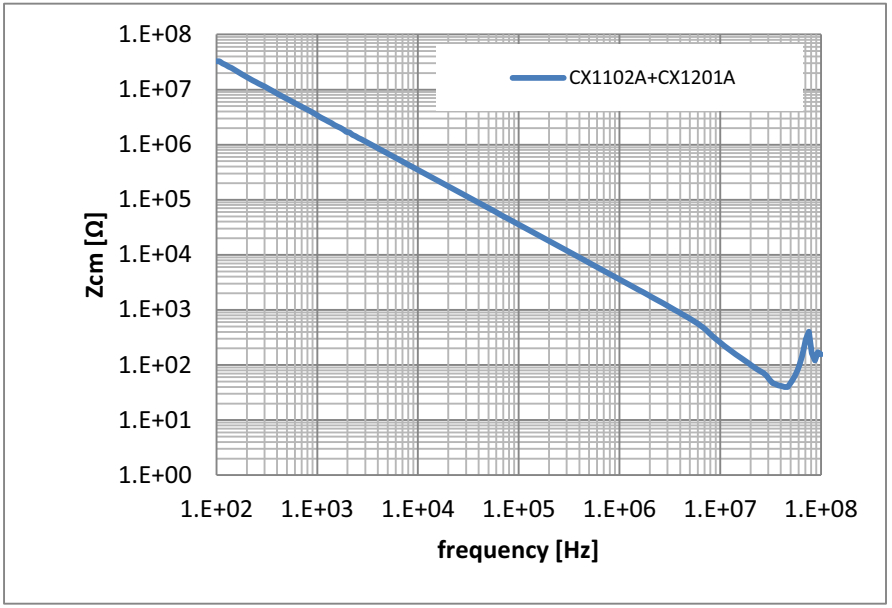


Figure 3-24 **Input Insertion Impedance**

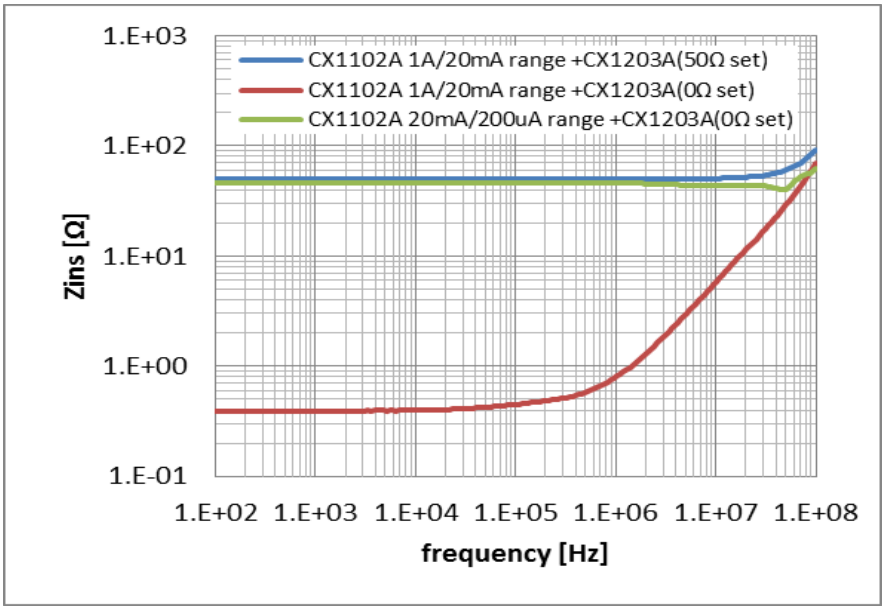
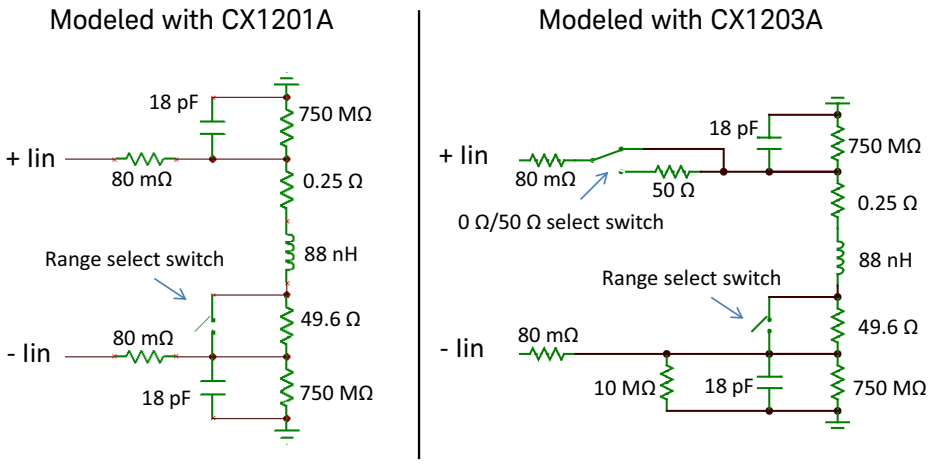


Figure 3-25 **Input Equivalent Circuit**



The range select switch opens in the following conditions. It closes in the other condition.
- If the primary channel uses the 2 mA range and the secondary channel uses the 20 µA range.
- If the primary channel uses the 20 mA range and the secondary channel uses the 200 µA range.

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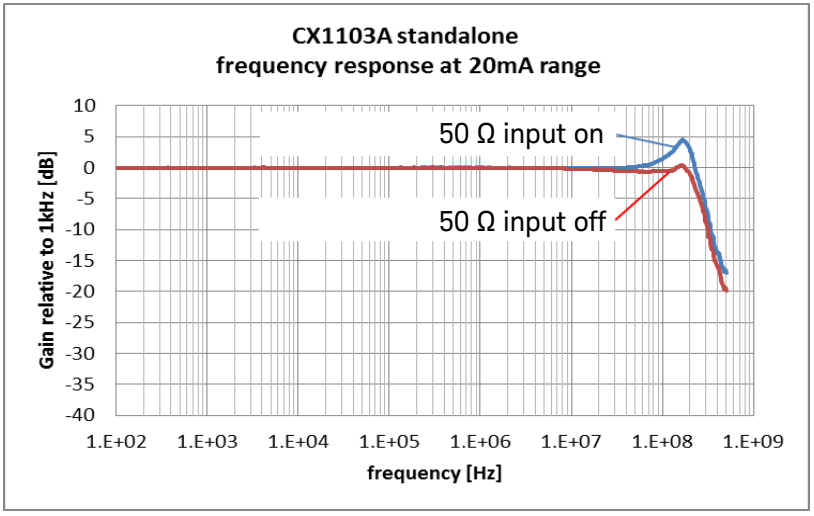
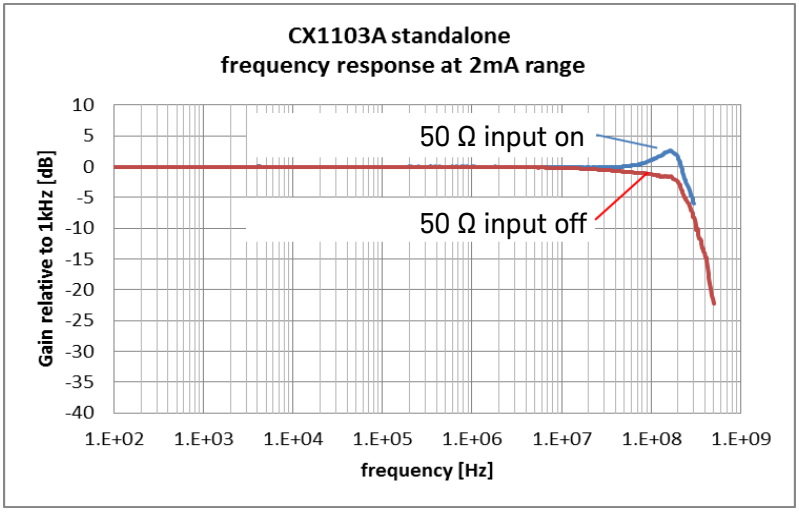
Figure 3-26 **Frequency Response, 20 mA Range**



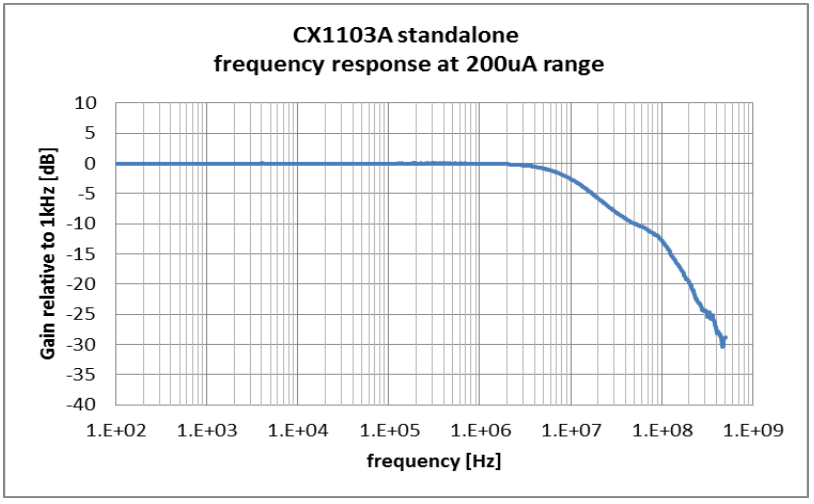
- -3 dB bandwidth (50 Ω input on): 260 MHz
- -3 dB bandwidth (50 Ω input off): 227 MHz

Figure 3-27 **Frequency Response, 2 mA Range**



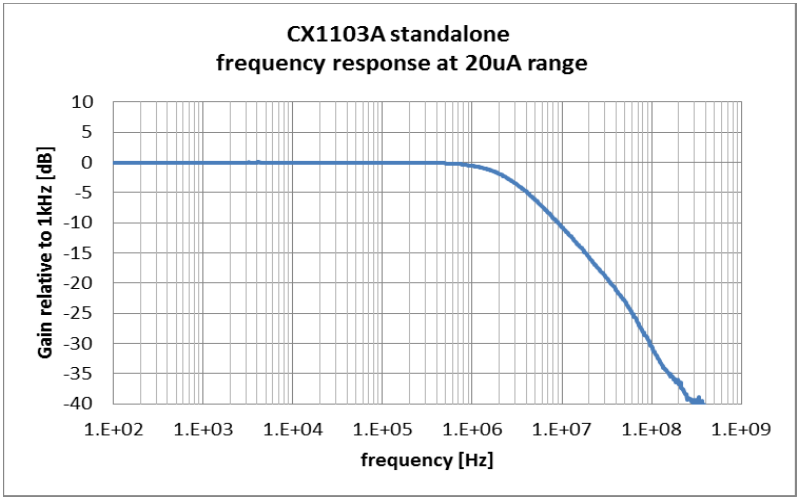
- -3 dB bandwidth (50 Ω input on): 250 MHz
- -3 dB bandwidth (50 Ω input off): 210 MHz

Figure 3-28 **Frequency Response, 200 μA Range**



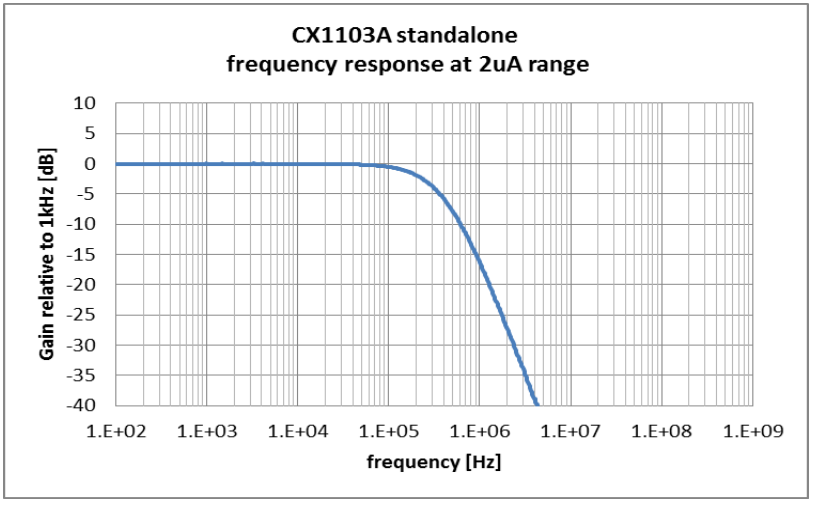
- -3 dB bandwidth: 11 MHz

Figure 3-29 **Frequency Response, 20 μA Range**



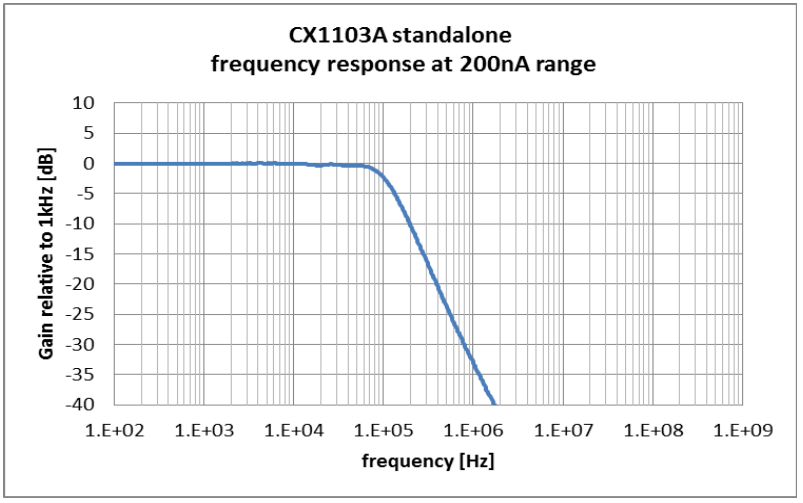
- -3 dB bandwidth: 2.7 MHz

Figure 3-30 **Frequency Response, 2 μA Range**



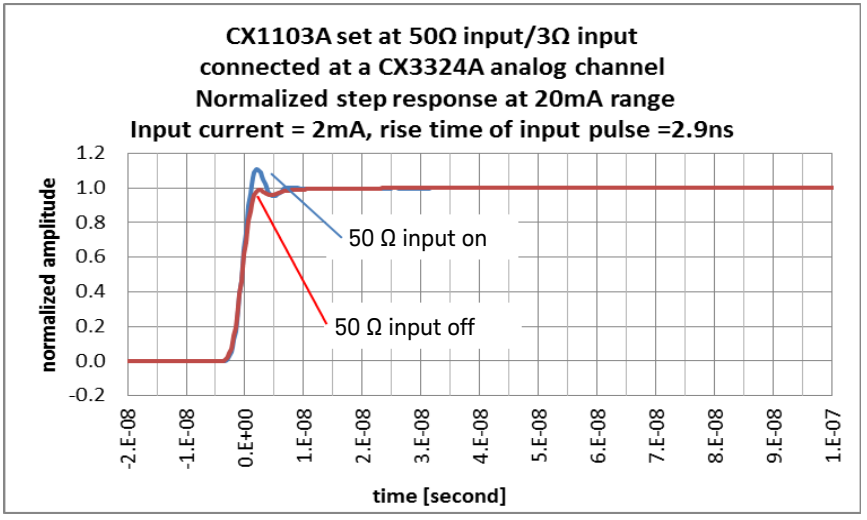
- -3 dB bandwidth: 260 kHz

Figure 3-31 **Frequency Response, 200 nA Range**



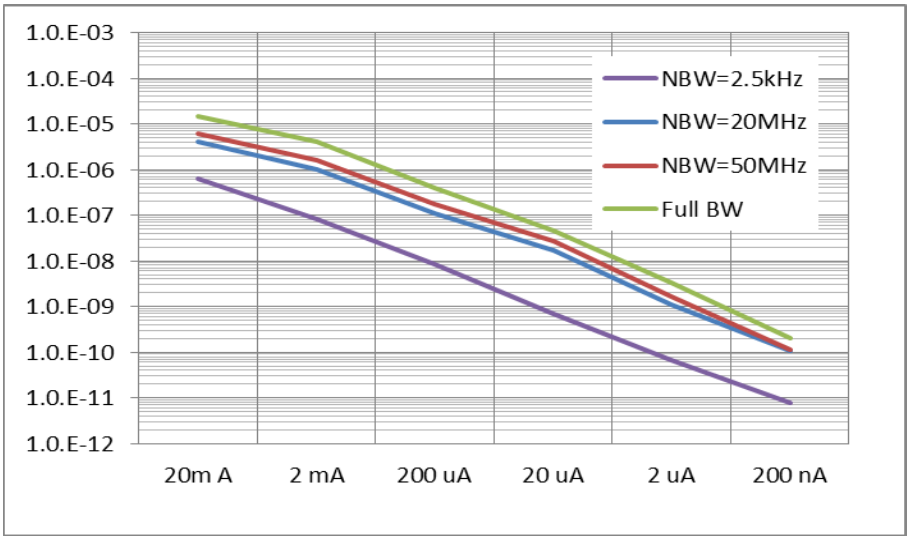
- -3 dB bandwidth: 110 kHz

Figure 3-32 **Step Response, 20 mA Range**



- 10-90% rise time: 3.5 ns
- 10-90% rise time of CX1103A: 1.96 ns = sqrt (3.5^2-2.9^2)

Figure 3-33 **RMS Noise [A] vs Current Range, with CX3300 and Sensor Input Open**



NBW: Bandwidth limit

Full BW: Bandwidth limit off

Figure 3-34 **Input Impedance**

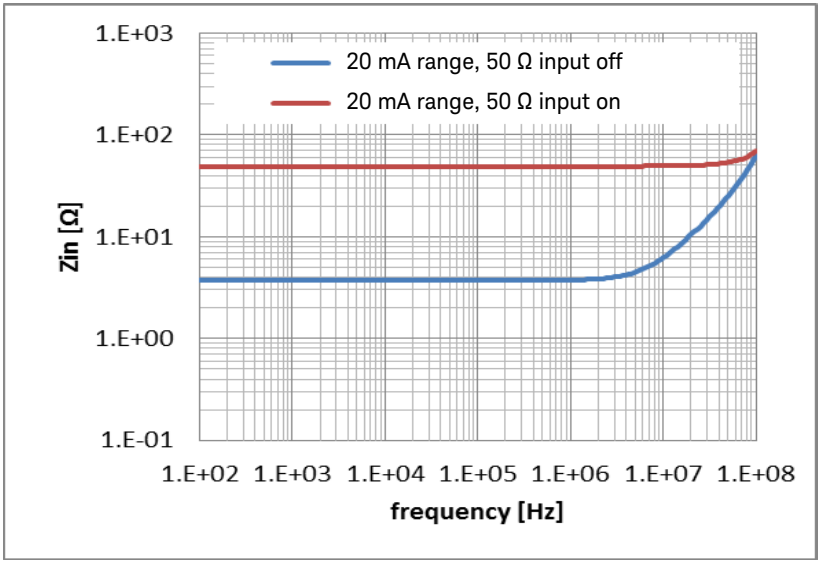


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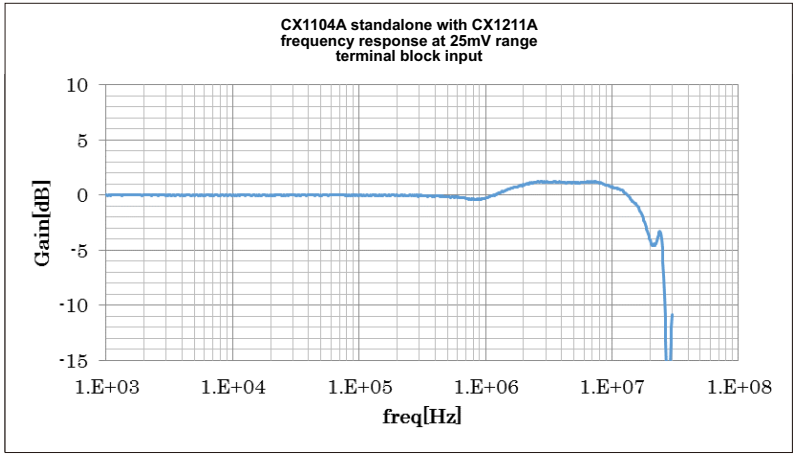
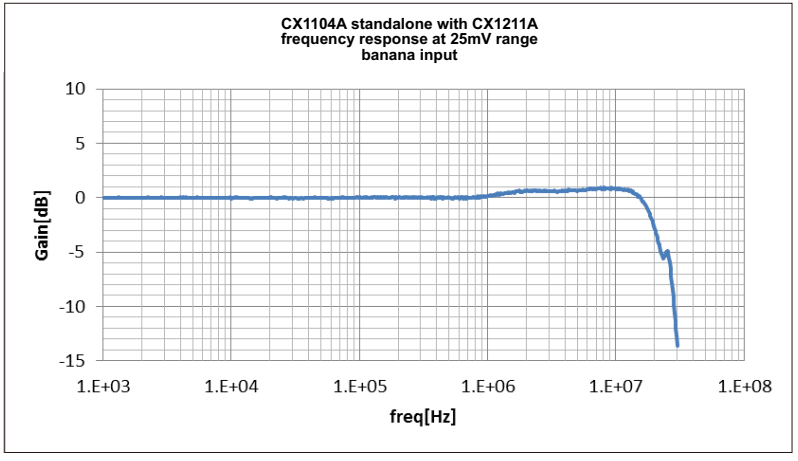
Figure 3-35 **Frequency Response, with CX1211A, Terminal Block Input**



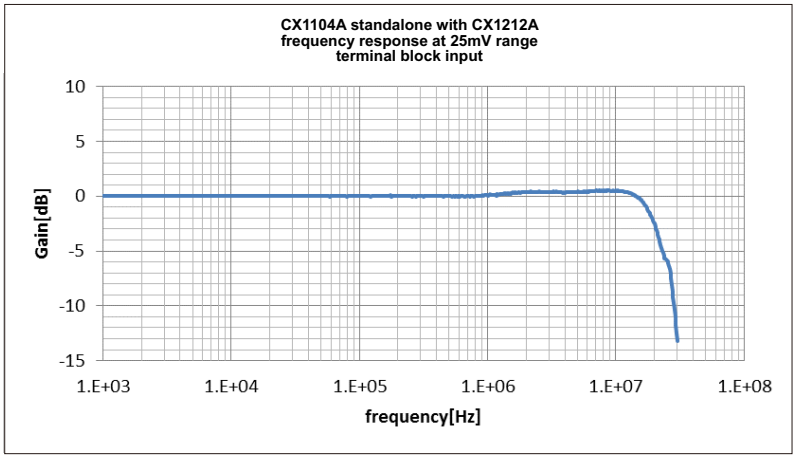
- -3 dB bandwidth: 20.05 MHz

Figure 3-36 **Frequency Response, with CX1211A, Banana Adapter Input**



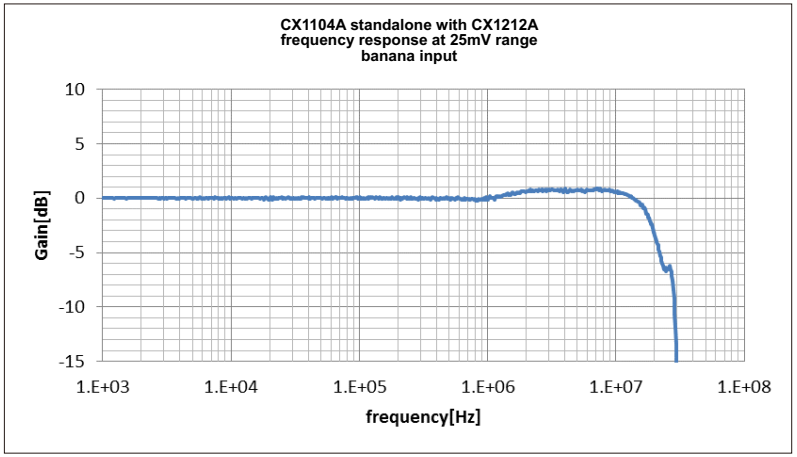
- -3 dB bandwidth: 18.6 MHz

Figure 3-37 **Frequency Response, with CX1212A, Terminal Block Input**



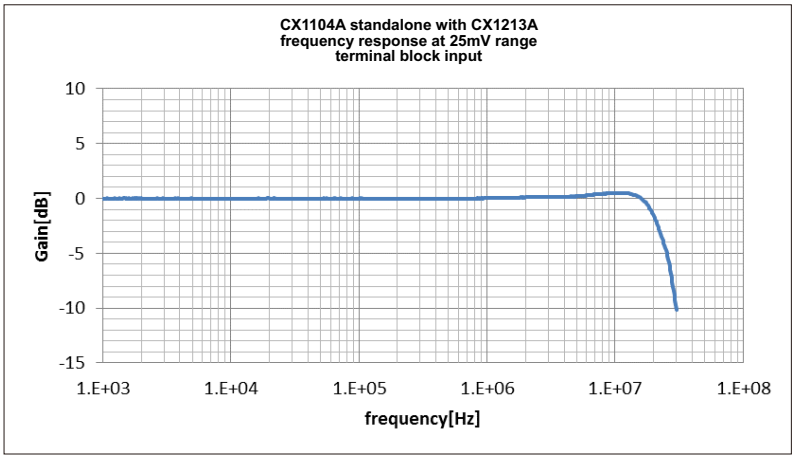
- -3 dB bandwidth: 20.53 MHz

Figure 3-38 **Frequency Response, with CX1212A, Banana Adapter Input**



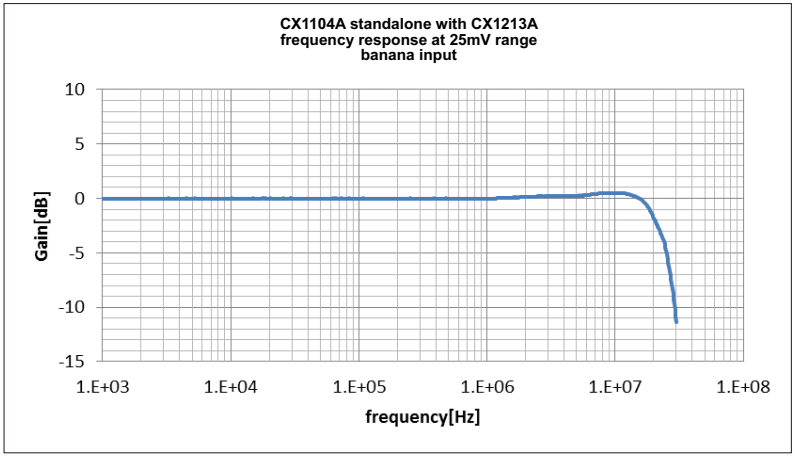
- -3 dB bandwidth: 19.33 MHz

Figure 3-39 **Frequency Response, with CX1213A, Terminal Block Input**



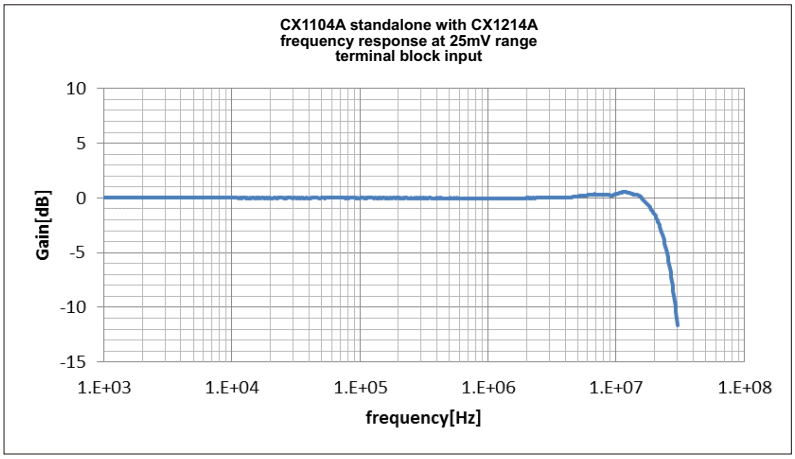
- -3 dB bandwidth: 22.02 MHz

Figure 3-40 **Frequency Response, with CX1213A, Banana Adapter Input**



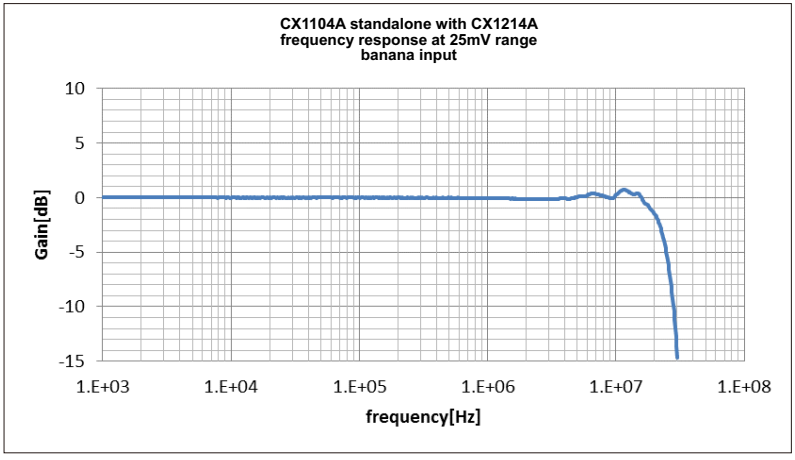
- -3 dB bandwidth: 22.02 MHz

Figure 3-41 **Frequency Response, with CX1214A, Terminal Block Input**



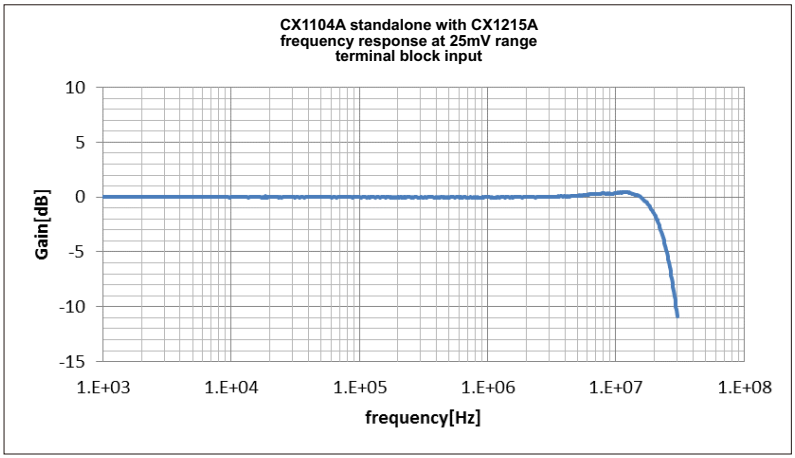
- -3 dB bandwidth: 22.35 MHz

Figure 3-42 **Frequency Response, with CX1214A, Banana Adapter Input**



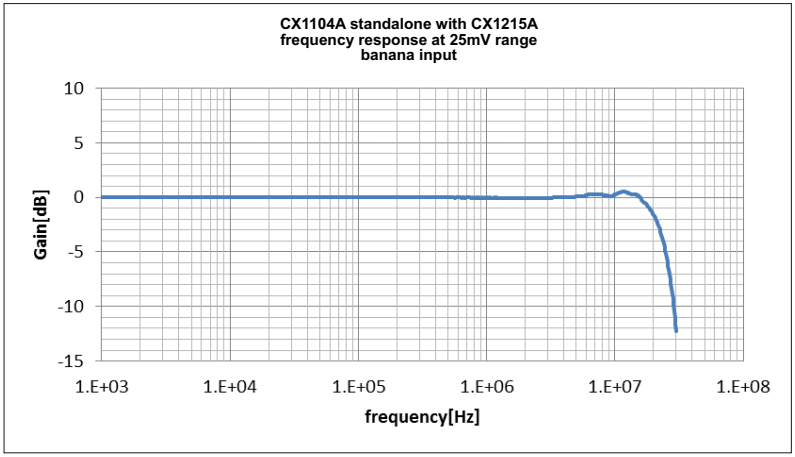
- -3 dB bandwidth: 22.35 MHz

Figure 3-43 **Frequency Response, with CX1215A, Terminal Block Input**



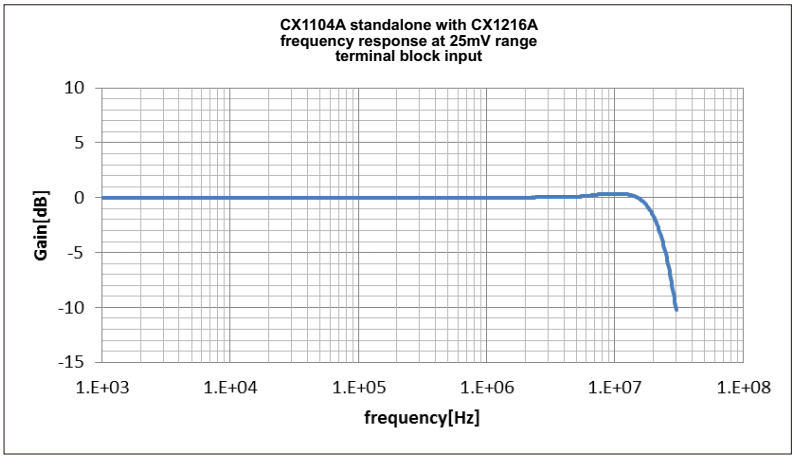
- -3 dB bandwidth: 22.35 MHz

Figure 3-44 **Frequency Response, with CX1215A, Banana Adapter Input**



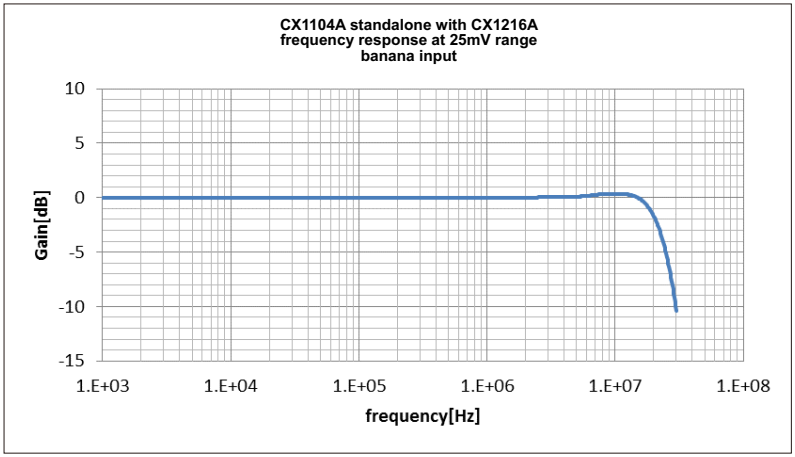
- -3 dB bandwidth: 22.35 MHz

Figure 3-45 **Frequency Response, with CX1216A, Terminal Block Input**



- -3 dB bandwidth: 22.02 MHz

Figure 3-46 **Frequency Response, with CX1216A, Banana Adapter Input**



- -3 dB bandwidth: 22.02 MHz

Figure 3-47 **Step Response, 25 mA Range**

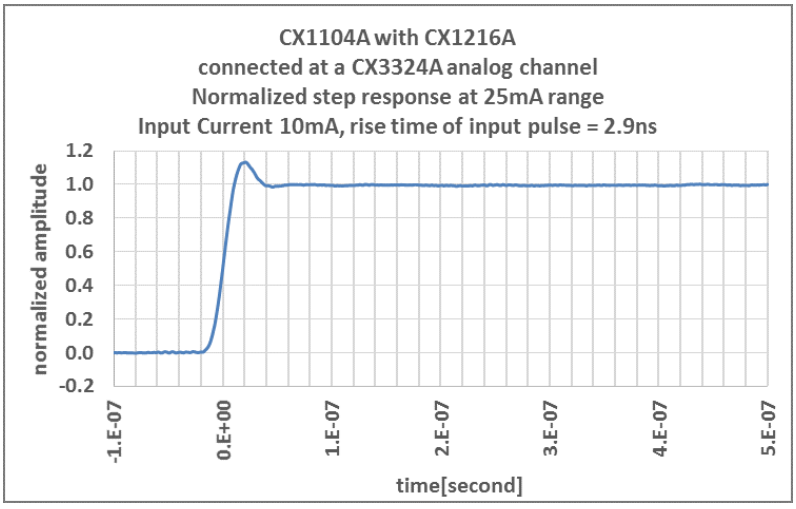


Figure 3-48 **Step Response, 250 mA Range**

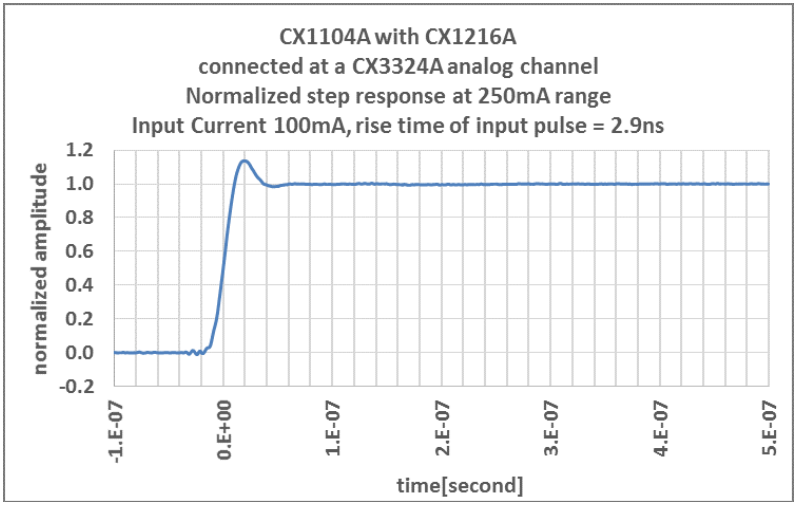
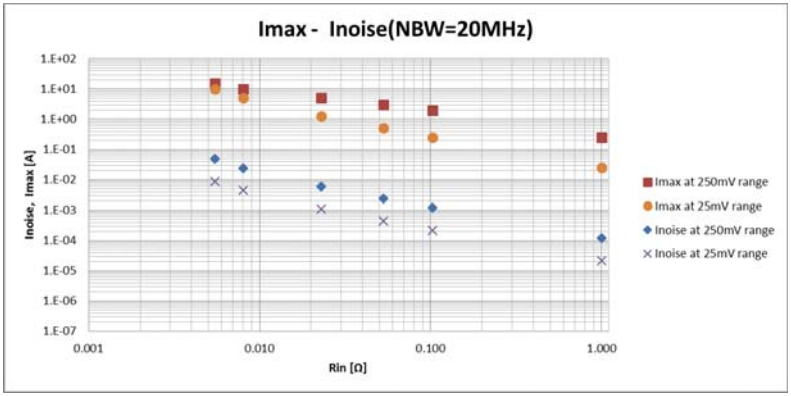
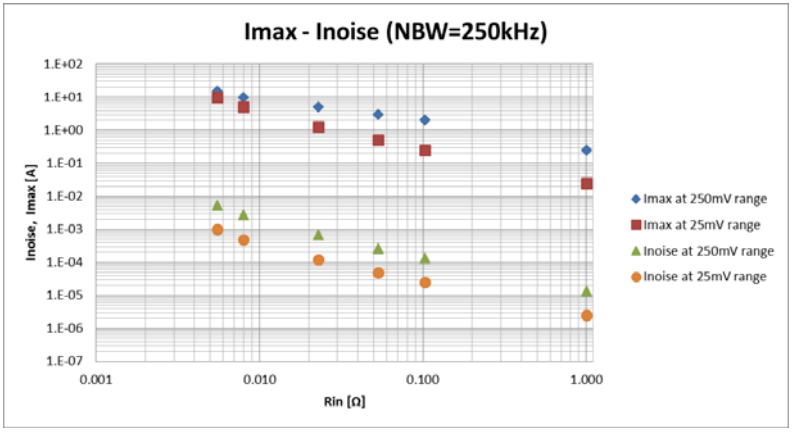


Figure 3-49 **RMS Noise [A] vs Resister Values by Range, with CX3300 and 50 Ω Input**



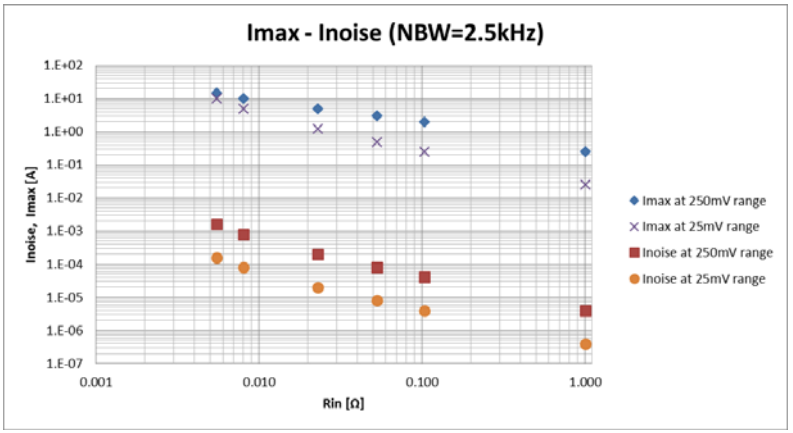
NBW: Bandwidth limit, 20 MHz

Figure 3-50 **RMS Noise [A] vs Resister Values by Range, with CX3300 and 50 Ω Input**



NBW: Bandwidth limit, 250 kHz

Figure 3-51 **RMS Noise [A] vs Resister Values by Range, with CX3300 and 50 Ω Input**



NBW: Bandwidth limit, 2.5 kHz

Figure 3-52 **Input Impedance (Differential Mode), with CX1211A, Terminal Block Input**

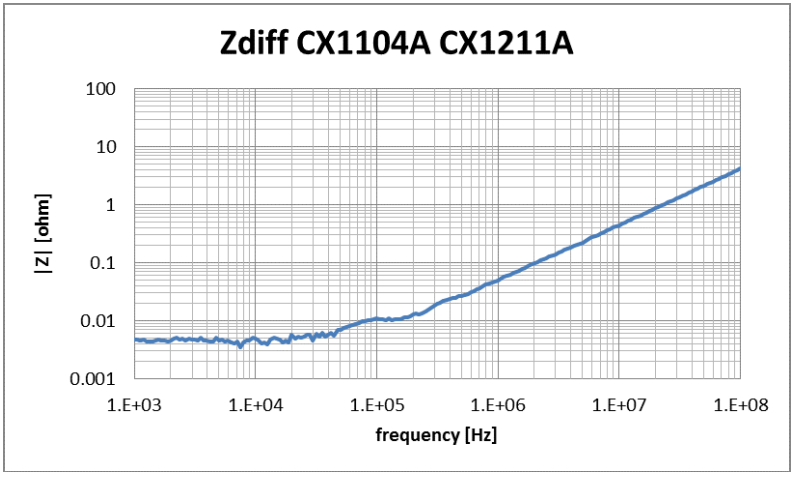


Figure 3-53 **Input Impedance (Differential Mode), with CX1211A, Banana Adapter Input**

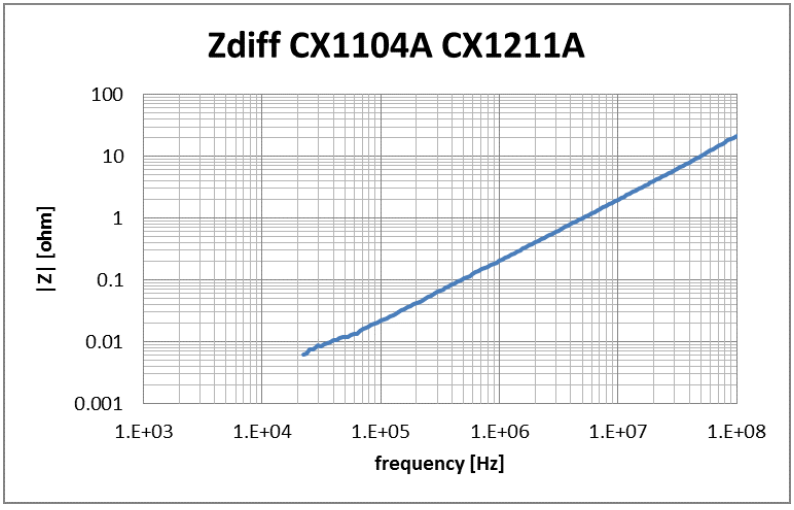


Figure 3-54 **Input Impedance (Common Mode), with CX1211A**

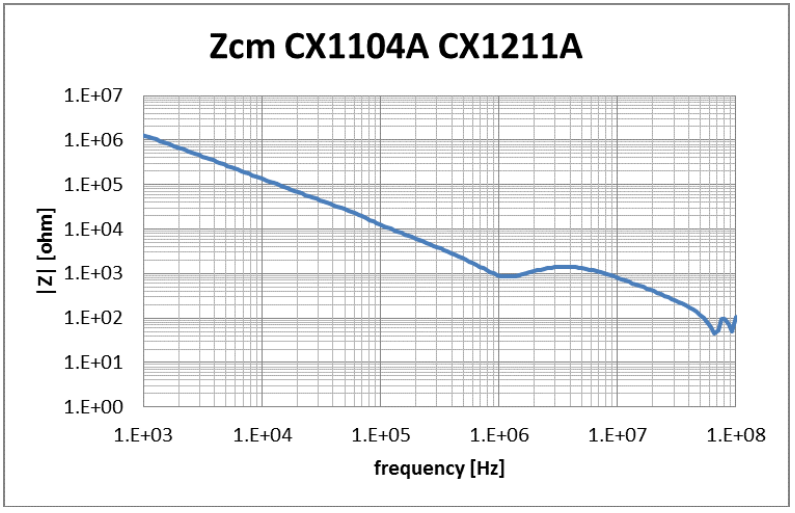


Figure 3-55 **Input Equivalent Circuit, with CX1211A**

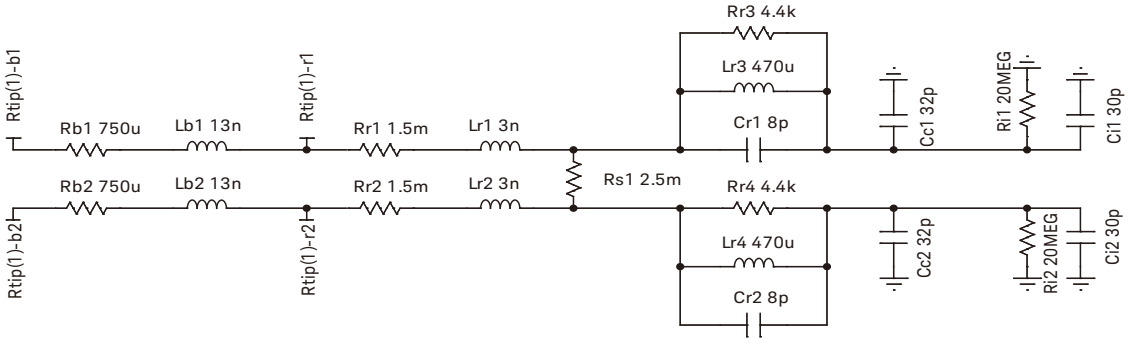


Figure 3-56 **Input Impedance (Differential Mode), with CX1212A, Terminal Block Input**

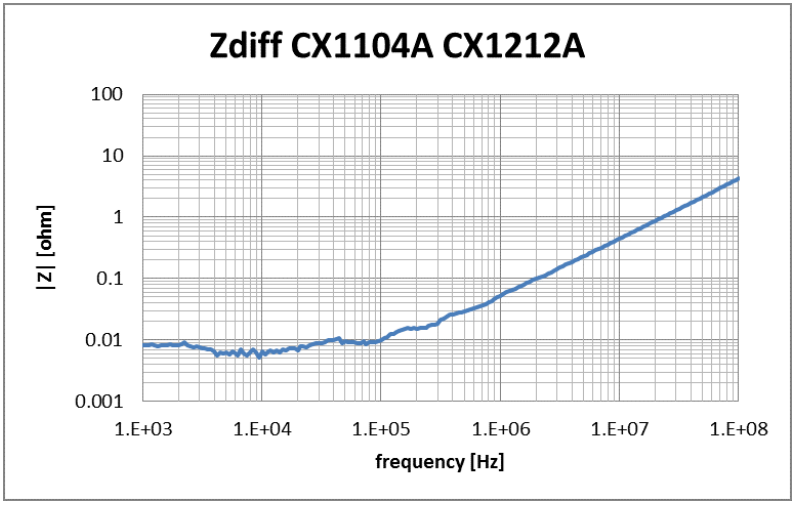


Figure 3-57 **Input Impedance (Differential Mode), with CX1212A, Banana Adapter Input**

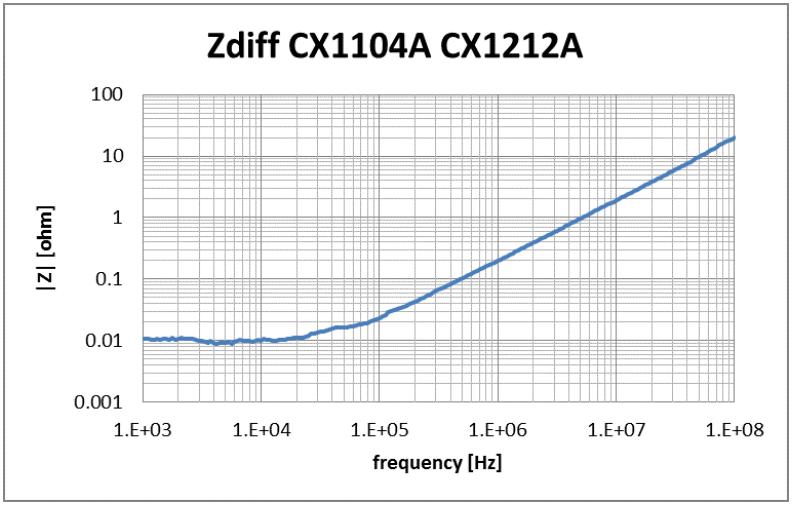


Figure 3-58 **Input Impedance (Common Mode), with CX1212A**

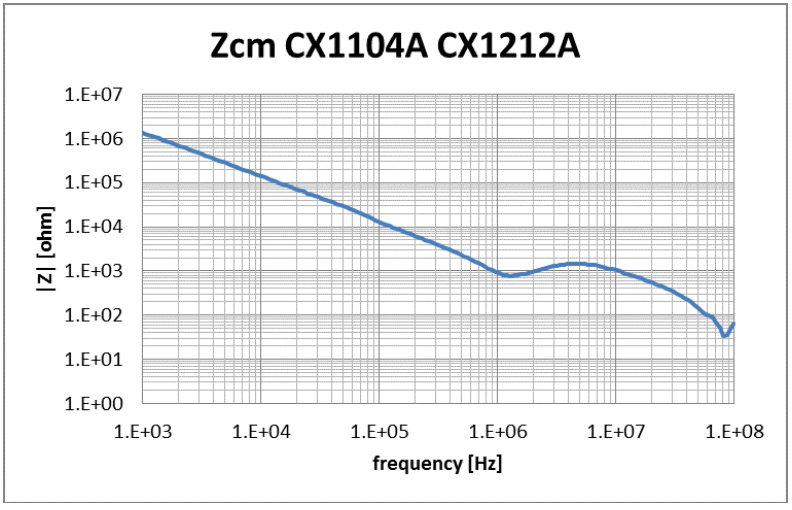


Figure 3-59 **Input Equivalent Circuit, with CX1212A**

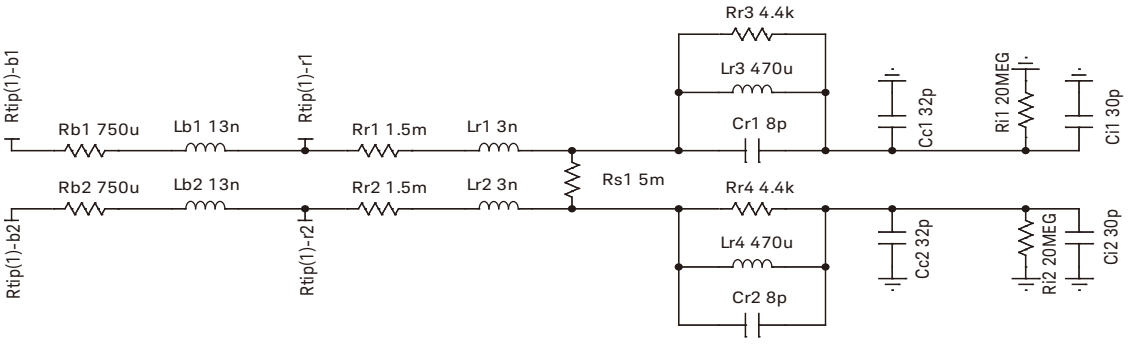


Figure 3-60 **Input Impedance (Differential Mode), with CX1213A, Terminal Block Input**

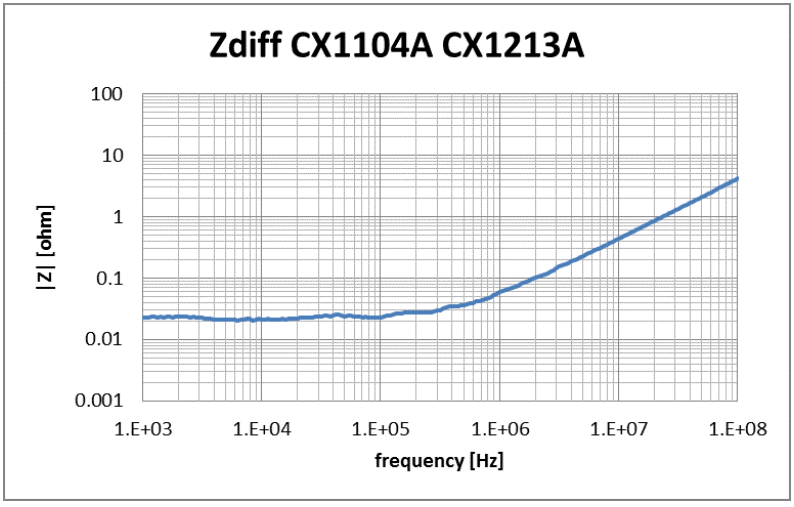


Figure 3-61 **Input Impedance (Differential Mode), with CX1213A, Banana Adapter Input**

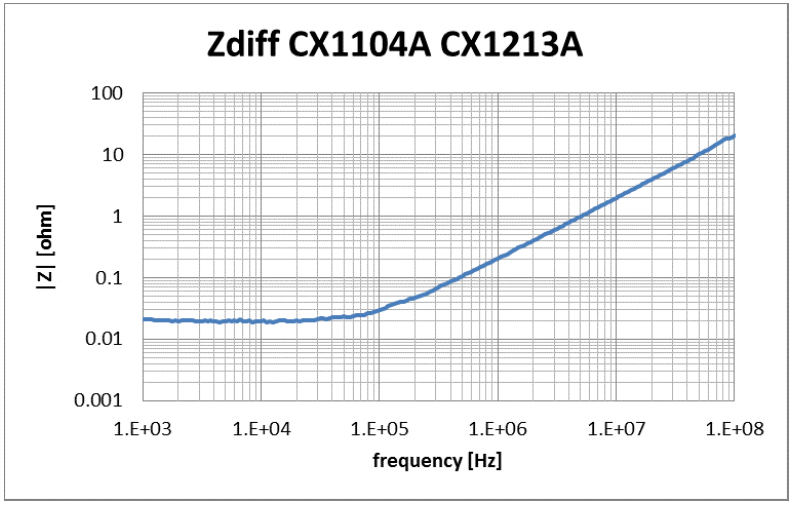


Figure 3-62 **Input Impedance (Common Mode), with CX1213A**

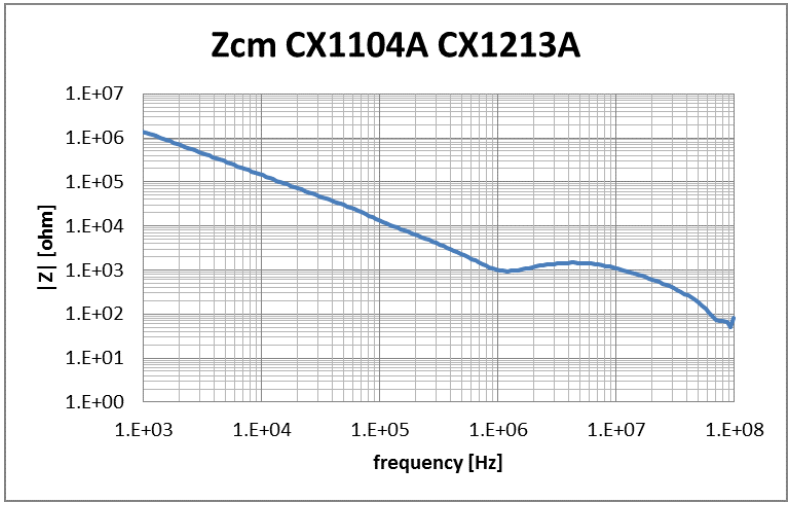


Figure 3-63 **Input Equivalent Circuit, with CX1213A**

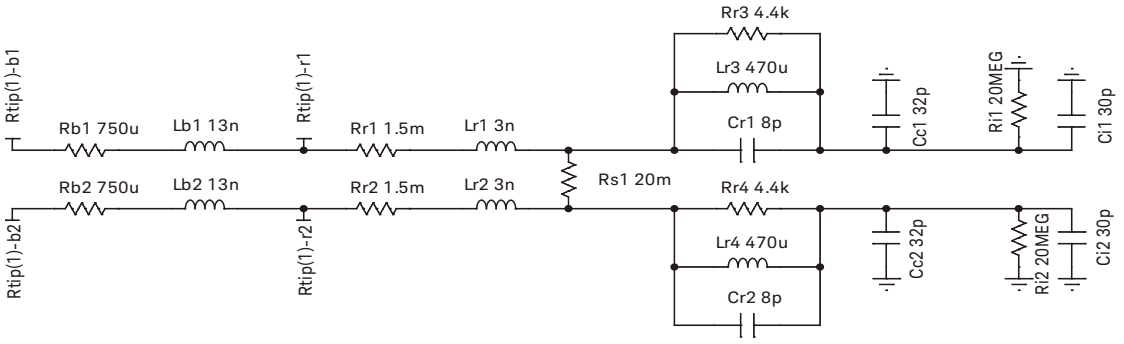


Figure 3-64 **Input Impedance (Differential Mode), with CX1214A, Terminal Block Input**

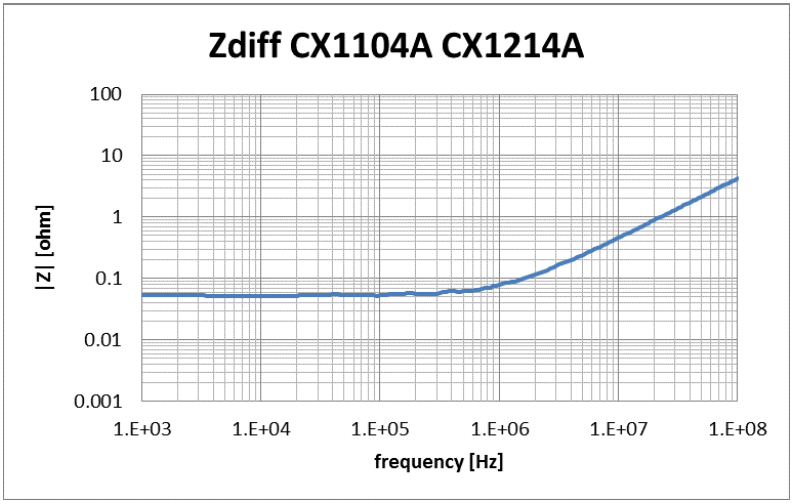


Figure 3-65 **Input Impedance (Differential Mode), with CX1214A, Banana Adapter Input**

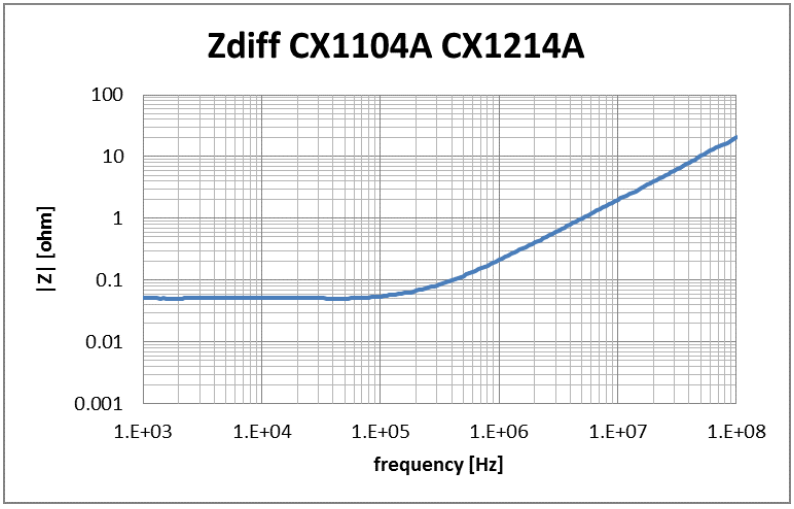


Figure 3-66 **Input Impedance (Common Mode), with CX1214A**

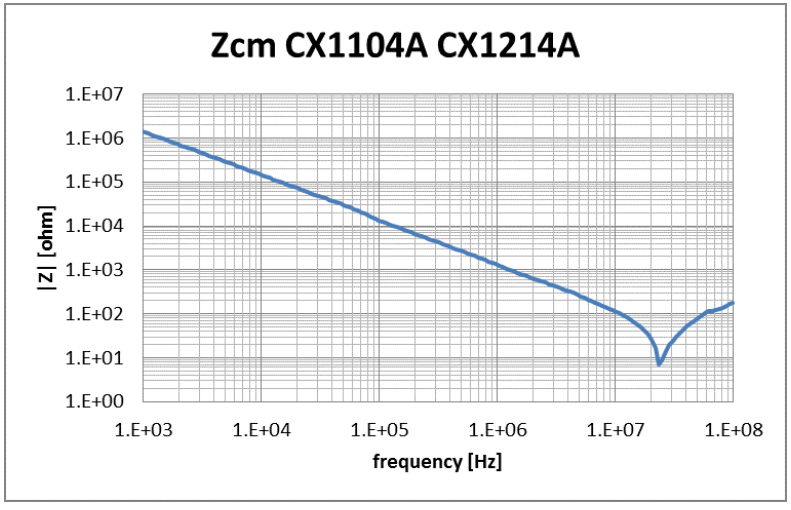


Figure 3-67 **Input Equivalent Circuit, with CX1214A**

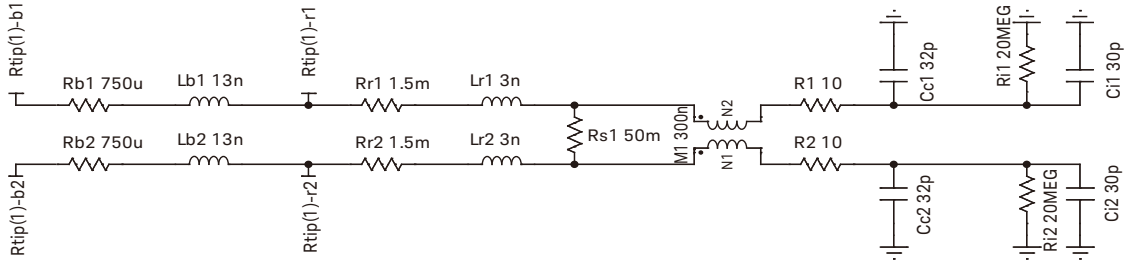


Figure 3-68 **Input Impedance (Differential Mode), with CX1215A, Terminal Block Input**

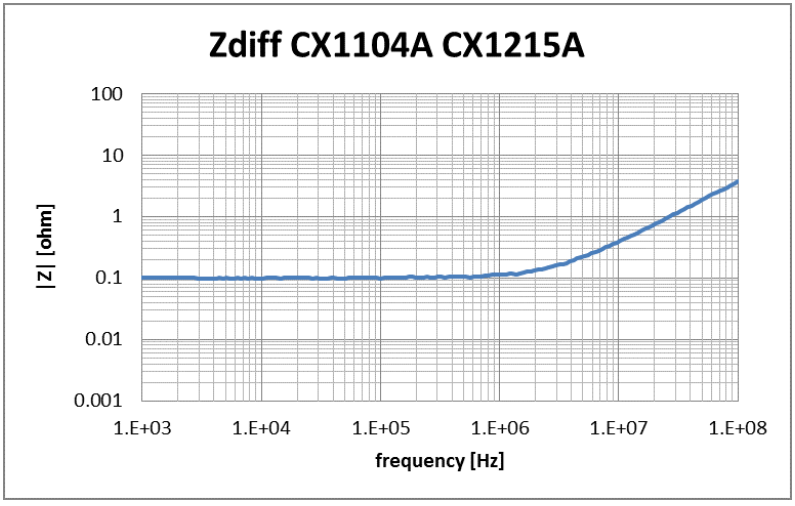


Figure 3-69 **Input Impedance (Differential Mode), with CX1215A, Banana Adapter Input**

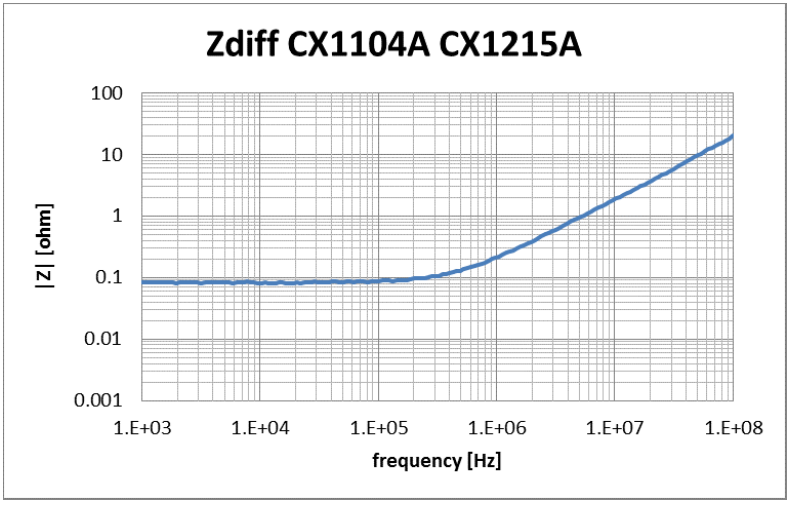


Figure 3-70 **Input Impedance (Common Mode), with CX1215A**

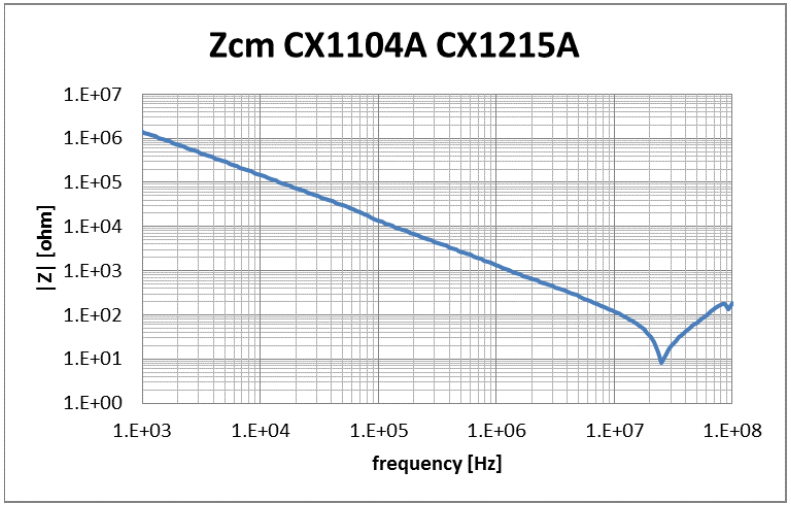


Figure 3-71 **Input Equivalent Circuit, with CX1215A**

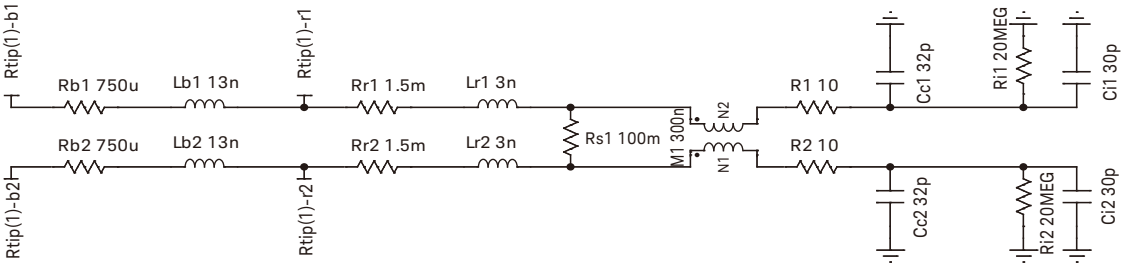


Figure 3-72 **Input Impedance (Differential Mode), with CX1216A, Terminal Block Input**

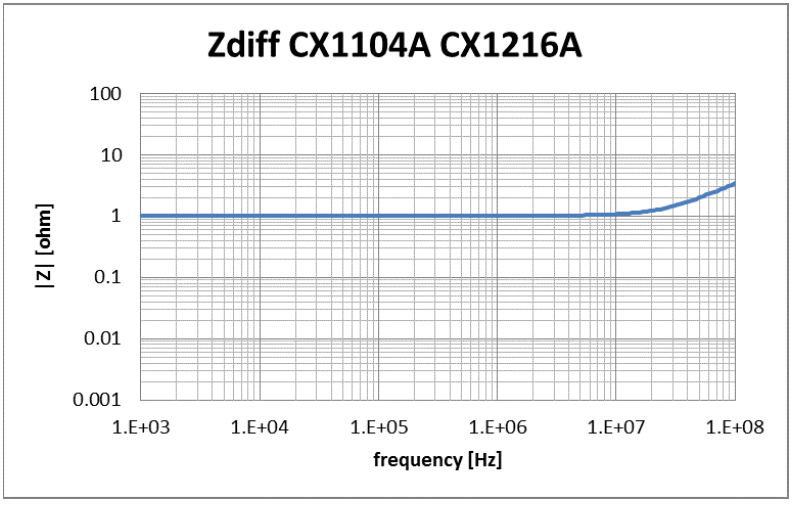


Figure 3-73 **Input Impedance (Differential Mode), with CX1216A, Banana Adapter Input**

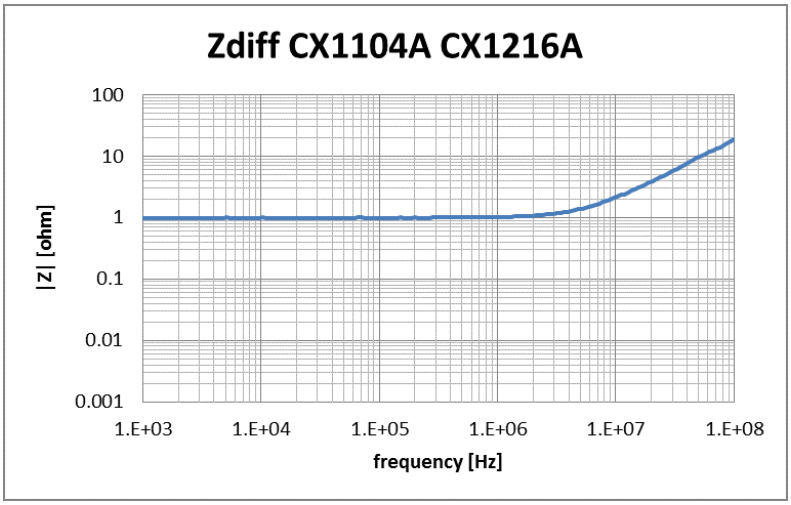


Figure 3-74 **Input Impedance (Common Mode), with CX1216A**

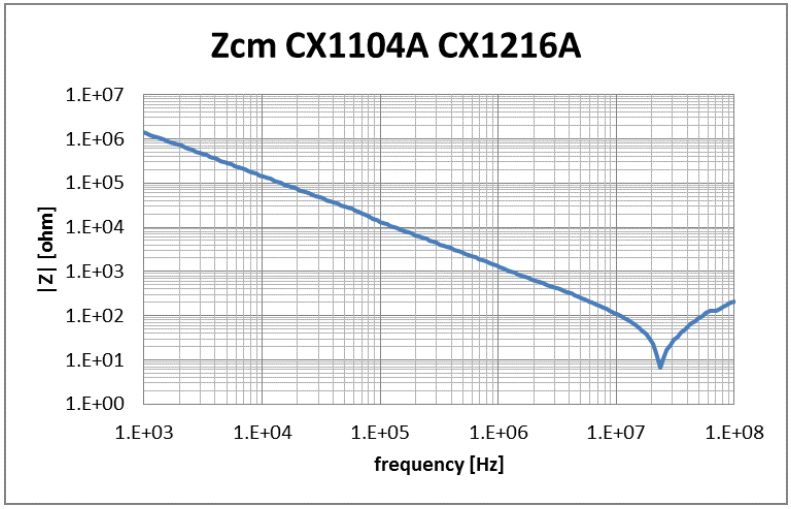


Figure 3-75 Input Equivalent Circuit, with CX1216A

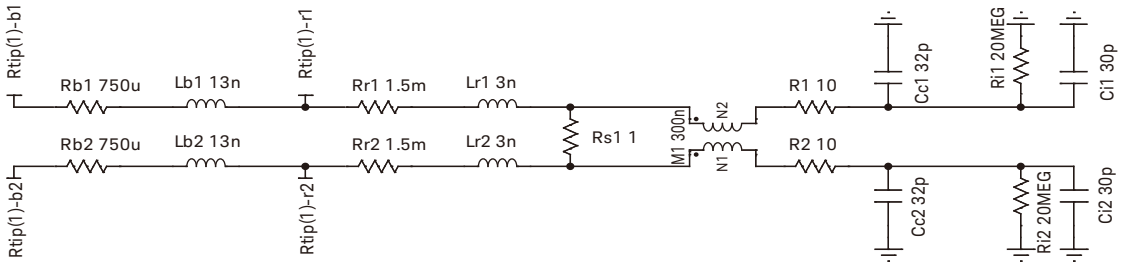
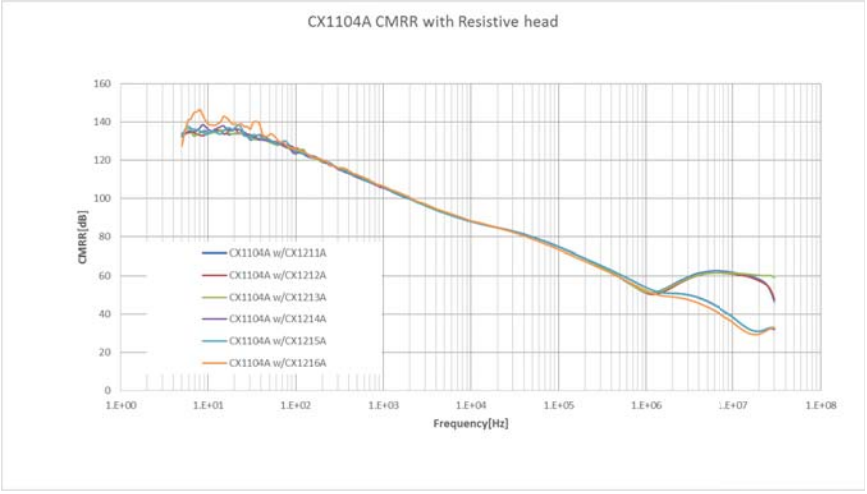
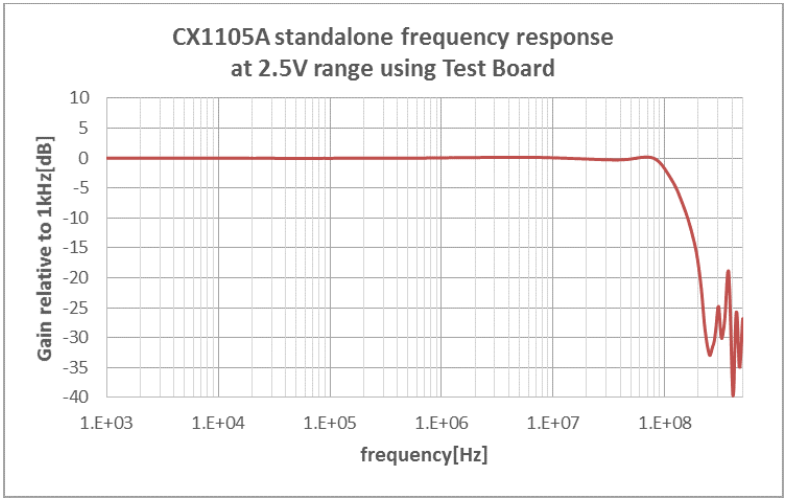


Figure 3-76 CMRR by Resistive Sensor Head



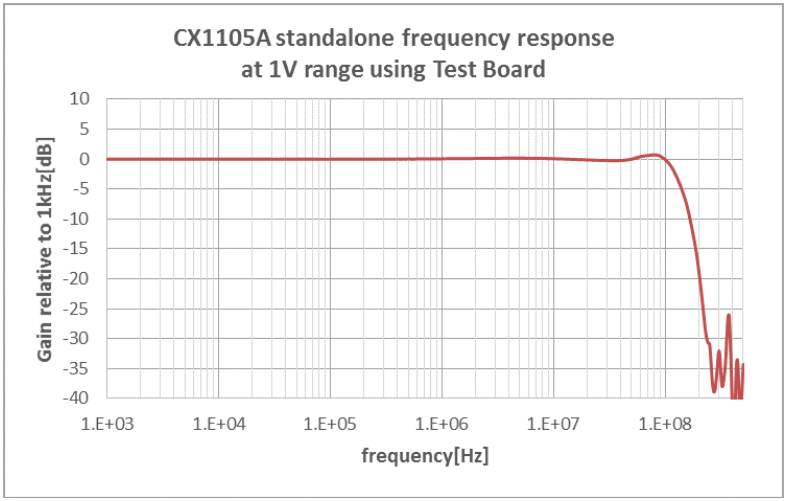
CX1105A

Figure 3-77 Frequency Response, 2.5 V Range



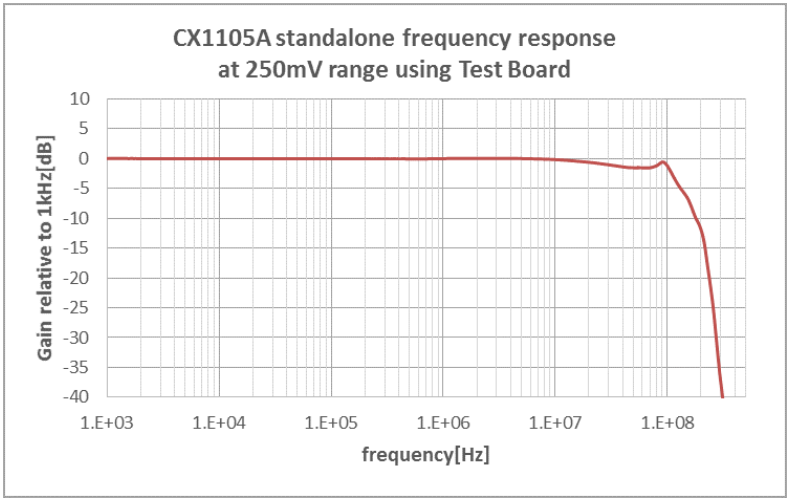
- Input voltage: 887 mVpk (35% full scale)
- -3 dB bandwidth: 102 MHz

Figure 3-78 **Frequency Response, 1 V Range**



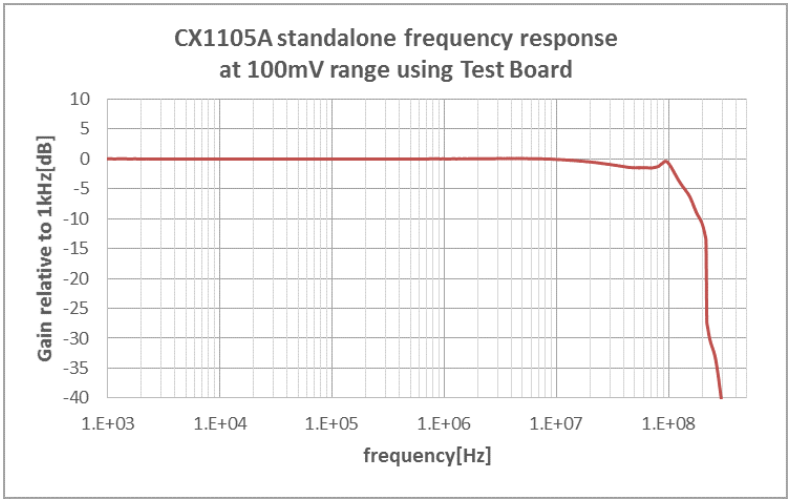
- Input voltage: 887 mVpk (89% full scale)
- -3 dB bandwidth: 125 MHz

Figure 3-79 **Frequency Response, 250 mV Range**



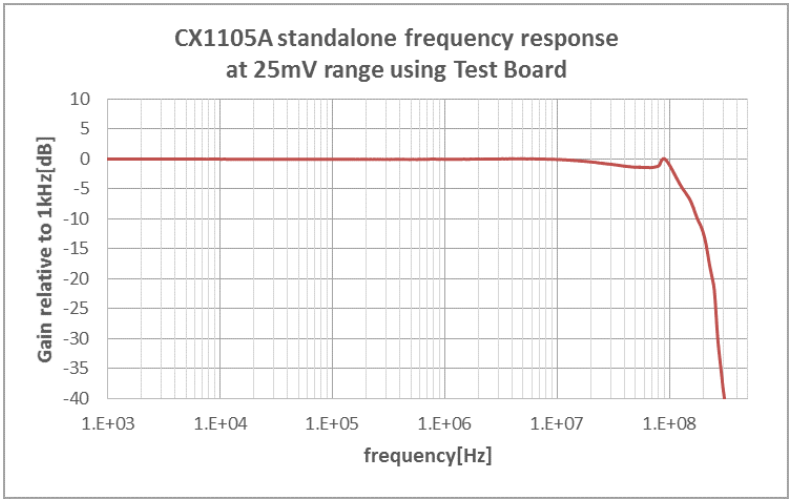
- Input voltage: 250 mVpk (100% full scale)
- -3 dB bandwidth: 111 MHz

Figure 3-80 **Frequency Response, 100 mV Range**



- Input voltage: 100 mVpk (100% full scale)
- -3 dB bandwidth: 117 MHz

Figure 3-81 **Frequency Response, 25 mV Range**



- Input voltage: 25 mVpk (100% full scale)
- -3 dB bandwidth: 113 MHz

Figure 3-82 **Step Response, 25 mV Range**

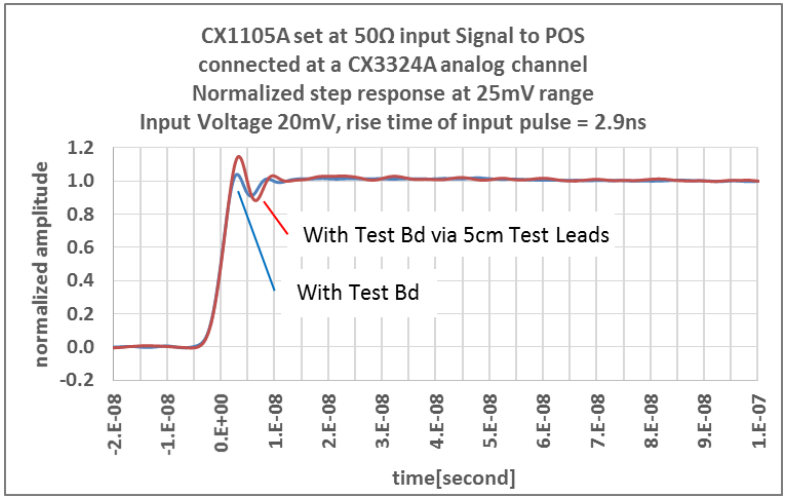
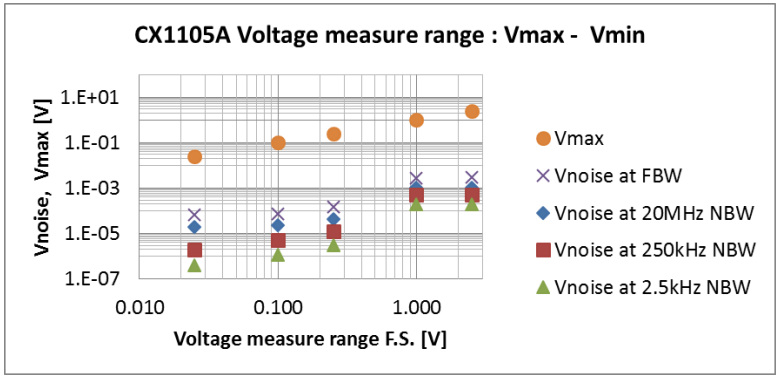


Figure 3-83 **RMS Noise [V] vs Voltage Range, with CX3300**



NBW: Bandwidth limit

Figure 3-84 **Input Impedance (Differential Mode), 2.5 V and 1 V Range**

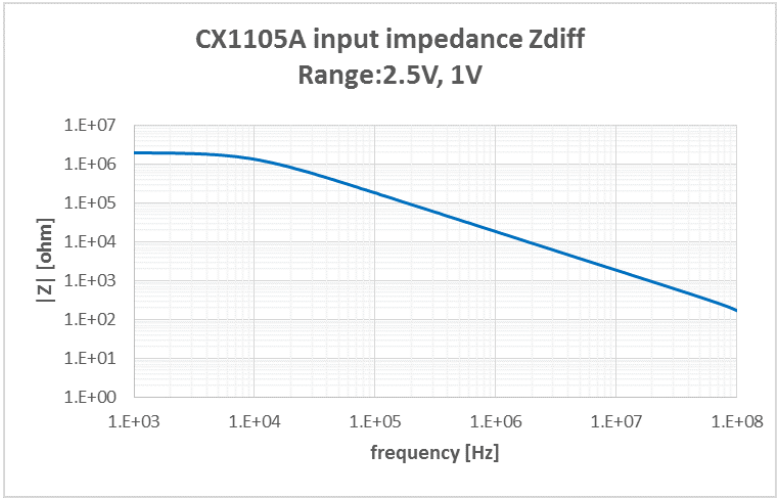


Figure 3-85 **Input Impedance (Common Mode), 2.5 V and 1 V Range**

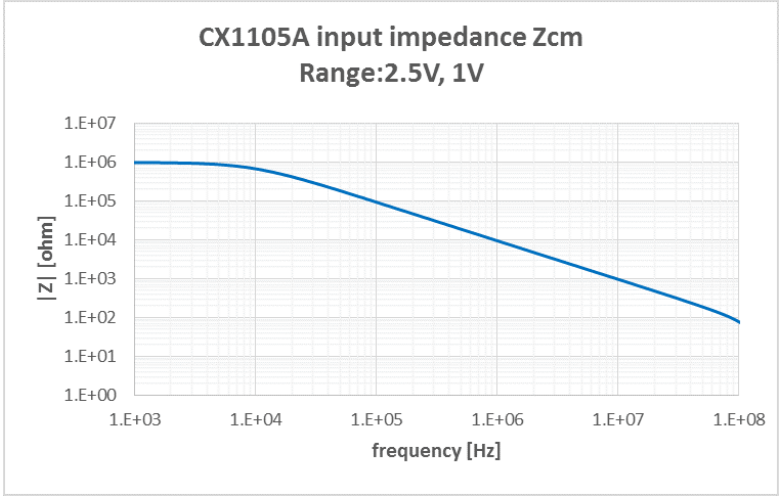


Figure 3-86 **Input Equivalent Circuit, 2.5 V and 1 V Range**

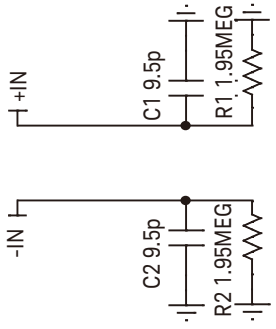


Figure 3-87 **Input Impedance (Differential Mode), 250 mV, 100 mV, and 25 mV Range**

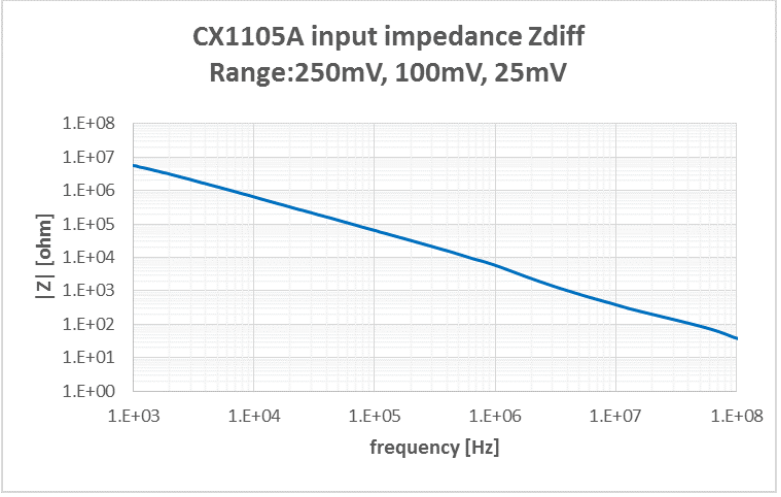


Figure 3-88 **Input Impedance (Common Mode), 250 mV, 100 mV, and 25 mV Range**

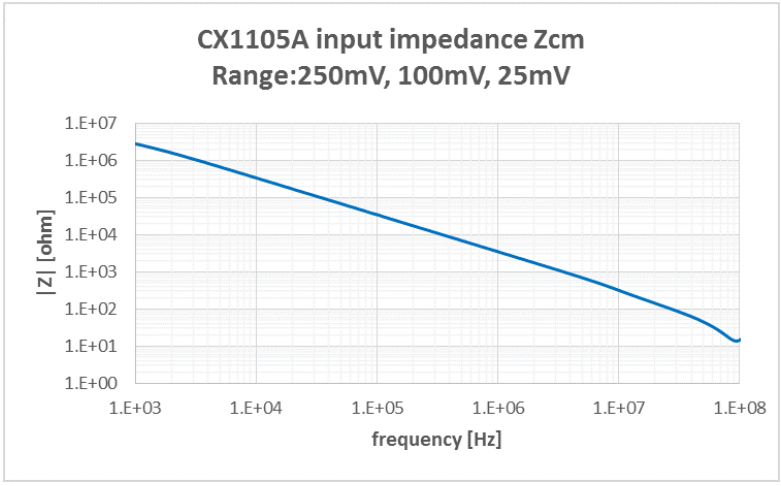


Figure 3-89 **Input Equivalent Circuit, 250 mV, 100 mV, and 25 mV Range**

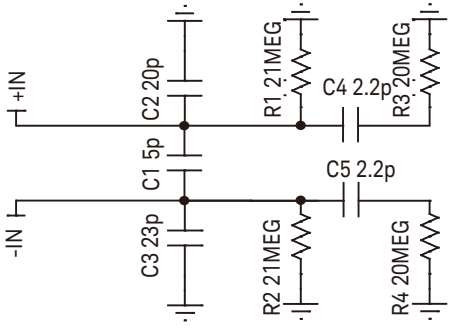
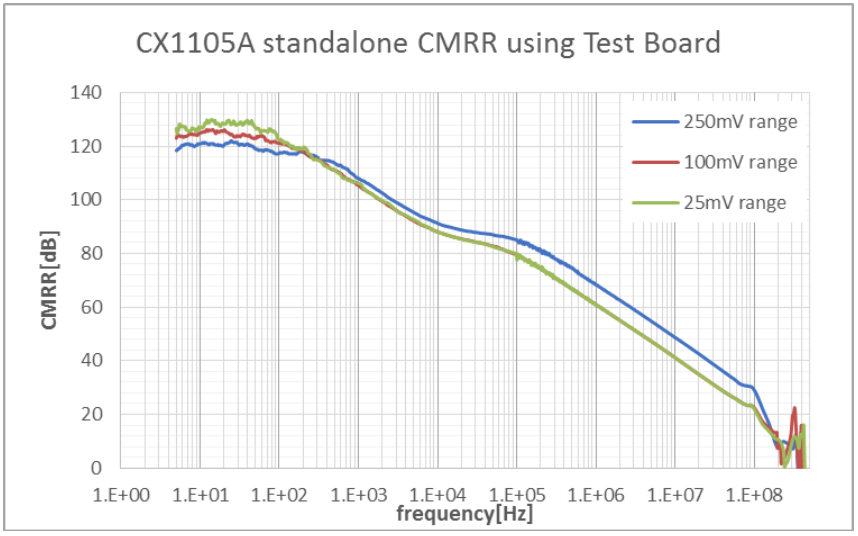
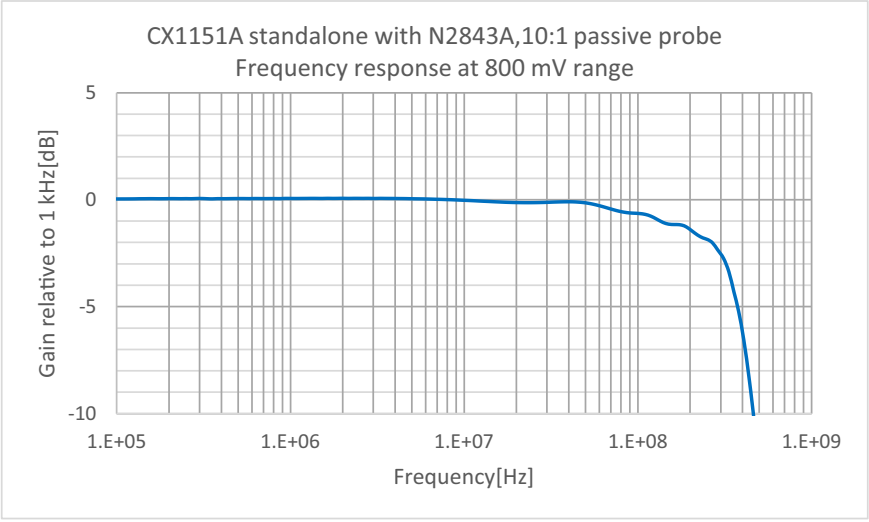


Figure 3-90 **CMRR**



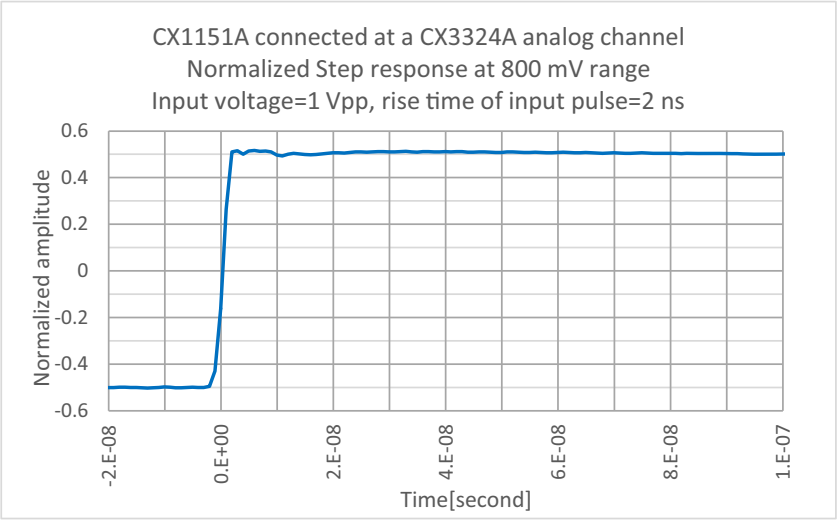
CX1151A

Figure 3-91 **Frequency Response**



- -3 dB bandwidth: 310 MHz

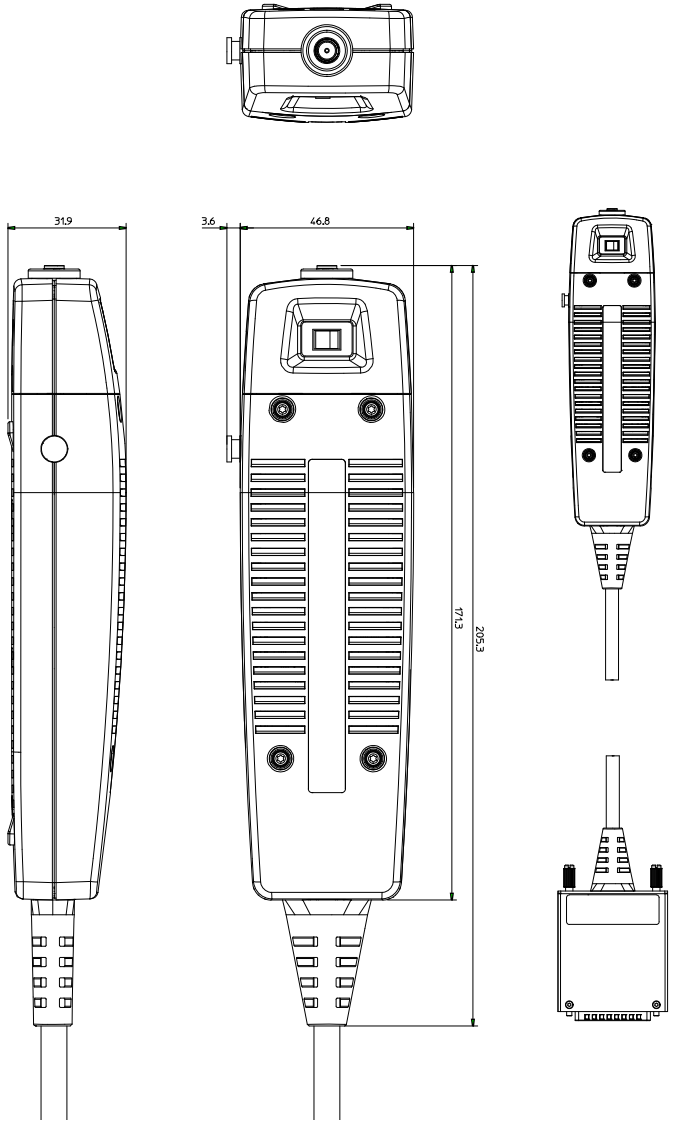
Figure 3-92 **Step Response**



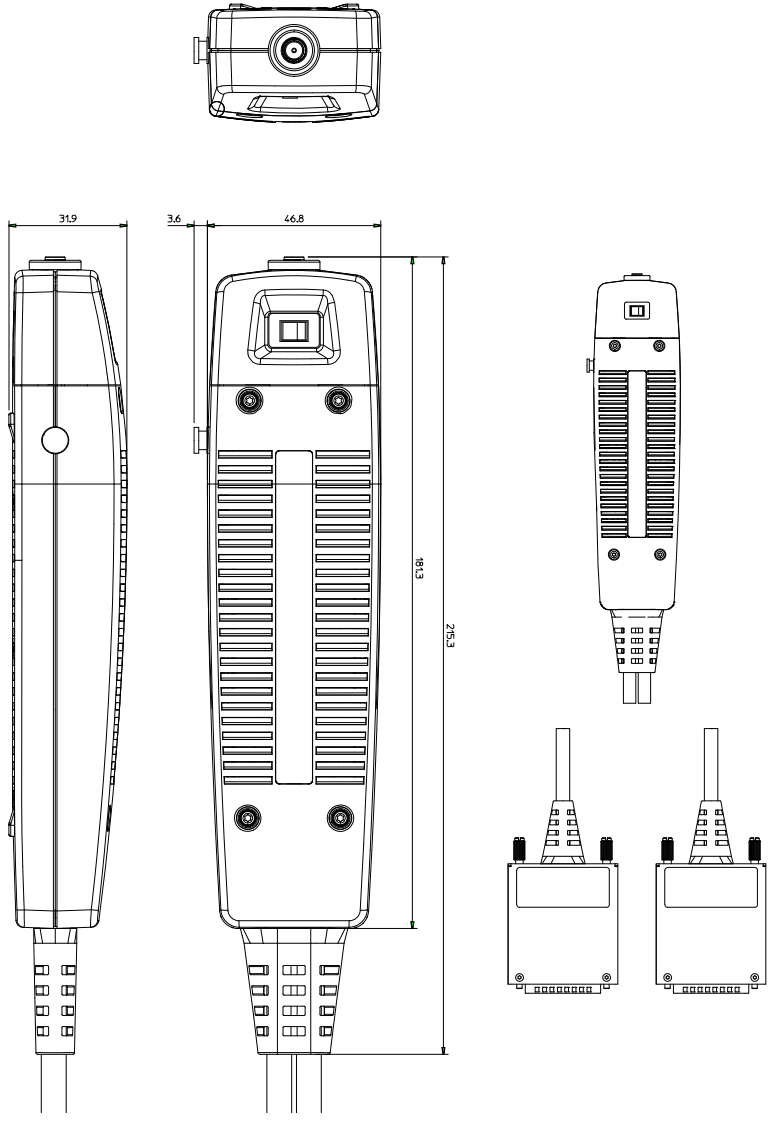
- 10-90% rise time: 2.5 ns
- 10-90% rise time of CX1151A: 1.5 ns = sqrt (2.5^2-2.0^2)

4 Dimensions

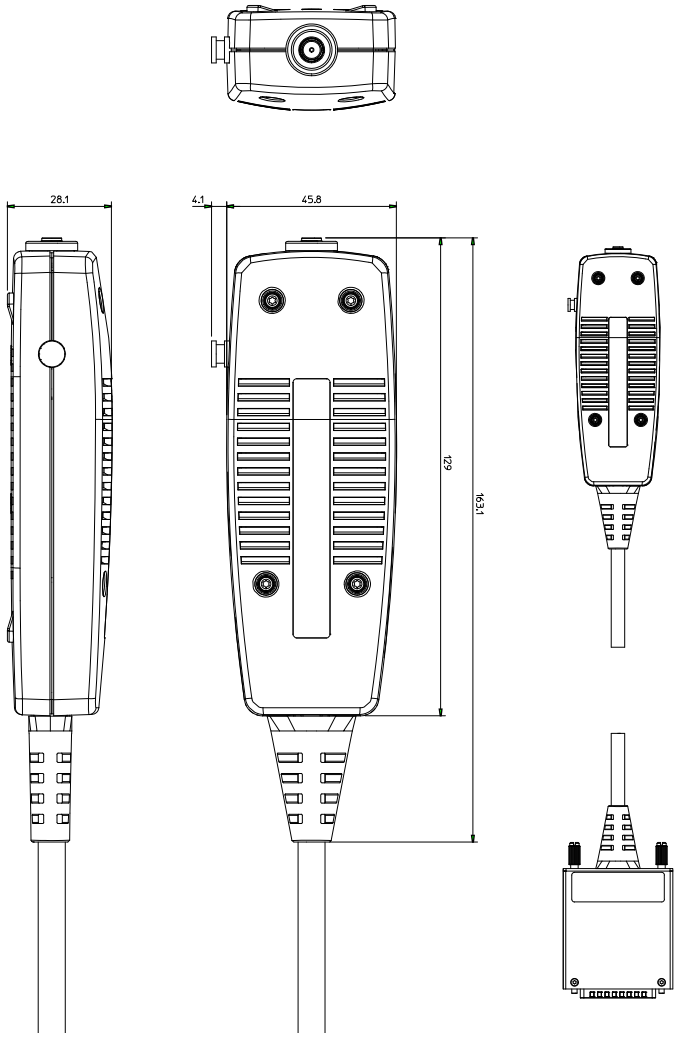
CX1101A



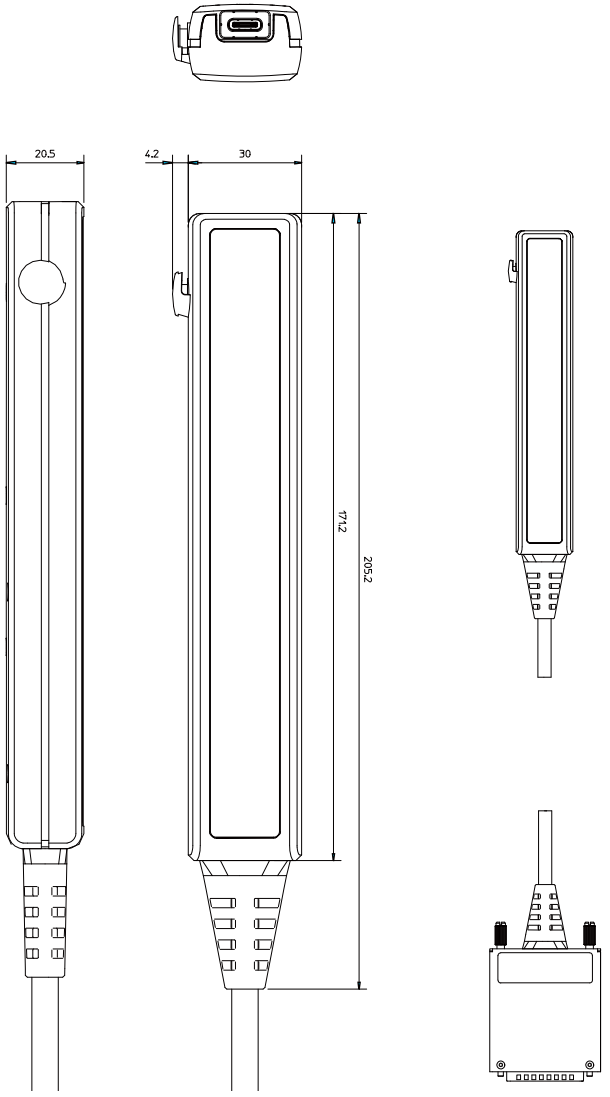
CX1102A



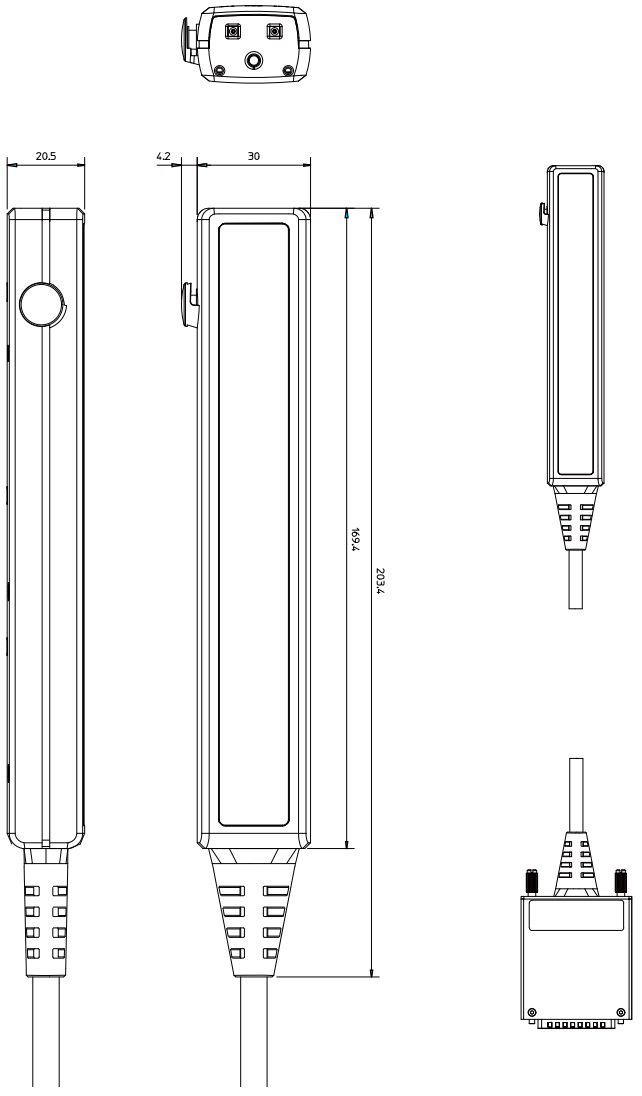
CX1103A



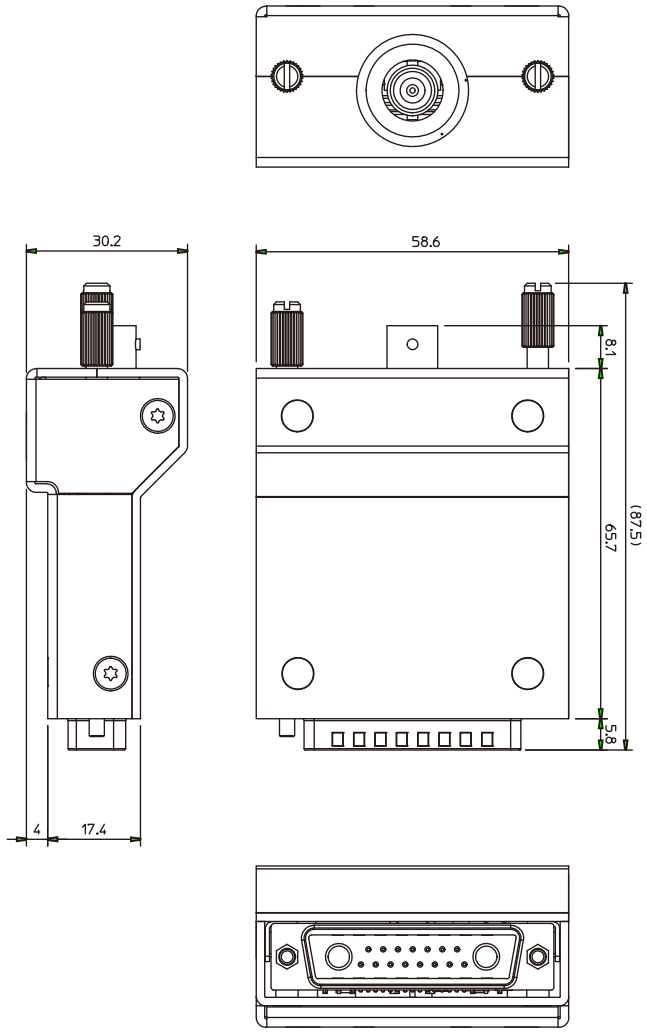
CX1104A



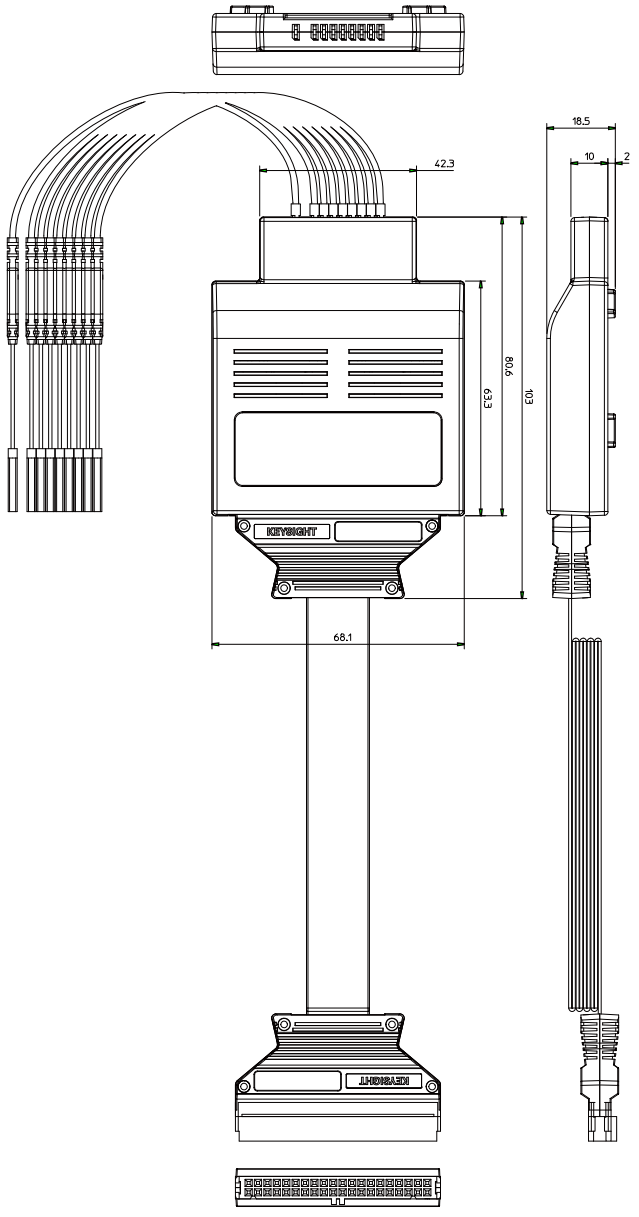
CX1105A



CX1151A



CX1152A



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