Accelerating Power Supply Design and Validation

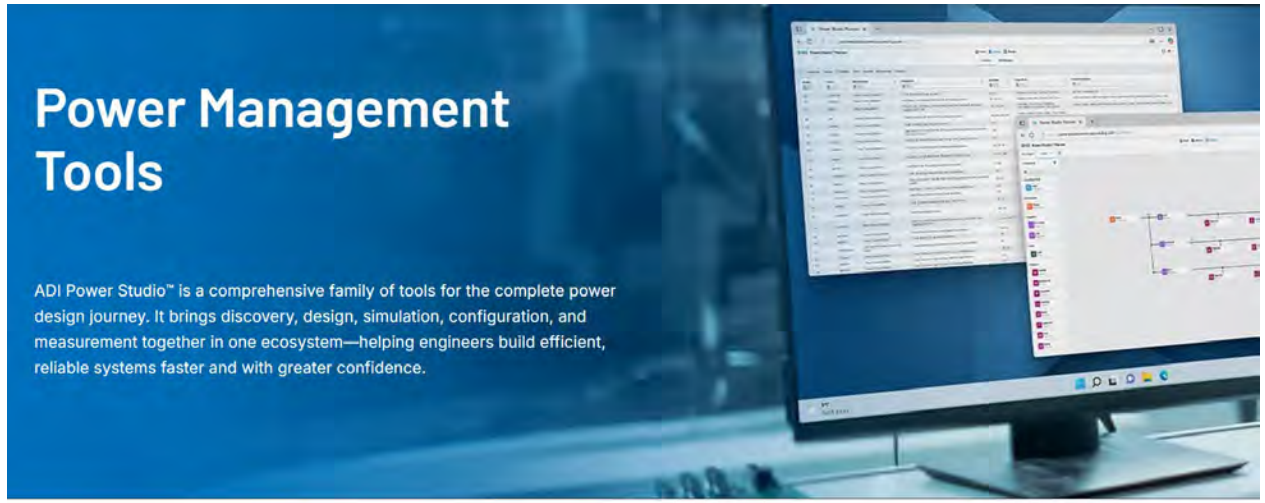
Bill Geosits
Principal Engineer, Field Applications

November 5, 2026

Introducing ADI Power Studio



ADI Power Management Tools



Your Companion Across the Entire Power Design Journey

ADI Power Studio helps power engineers at every stage of their design process simplify complexity, validate designs early, and optimize architectures efficiently, enabling faster development cycles, reduced rework, and greater confidence in delivering power-dense systems to market.

Plan »	Design »	Simulate »	Configure »	Measure
System-Level Power Tree Creation	IC-Level Power Supply Design	Industry-Standard Simulation	Digital Power System Management	Evaluation and Power Supply Characterization
WEB-BASED ADI Power Studio™ Planner WINDOWS LTpowerPlanner®	WEB-BASED ADI Power Studio™ Designer WINDOWS LTpowerCAD®	WINDOWS + macOS LTspice® WINDOWS OASIS™/SIMPLIS®	WINDOWS LTpowerPlay® ADI Power Studio™ Systemizer Signal Chain Power	WINDOWS LTpowerAnalyzer™

Plan Design Simulate Configure Measure

©2024 Analog Devices, Inc. All Rights Reserved.

Power Studio Goal & Introduction

Goal

A Unified Strategy for
Power Supply Design Tools.

Consolidation. Standardize Approach
Simplification. Unified Workflow
Cohesion. Seamless Connection Between Tools

Power Studio

Power Studio seamlessly connects **Power Studio Planner** and **Power Studio Designer** into a **cohesive** solution, streamlining power supply design.

- A **unified** workflow leading to **simplification** of the **customer** experience.
- Development has been **standardized** around a **reusable** common architecture & process, **consolidating** complexity for a consistent **software delivery** approach.

Power Studio Planner



Power Studio Planner enables
system-level power tree planning.

Power Studio Designer

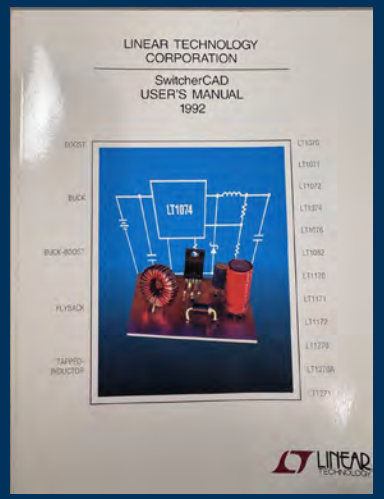


Power Studio Designer enables
IC-level power supply design.

Analog Devices Confidential Information. ©2026 Analog Devices, Inc. All Rights Reserved.

Previous Power Tool Landscape

1. Plan System
2. Find Solution
3. Design Circuit
4. Simulate
5. Debug & Test



EE-Sim Maxim Integrated EE-Sim S. Finder

LTpowerPlanner

Power Studio Planner

LTpowerCAD

Power Studio Designer

EE-Sim Maxim Integrated EE-Sim DC-DC

LTspice

EE-Sim OASIS

LTpowerPlay

LTpowerCAD App Suite

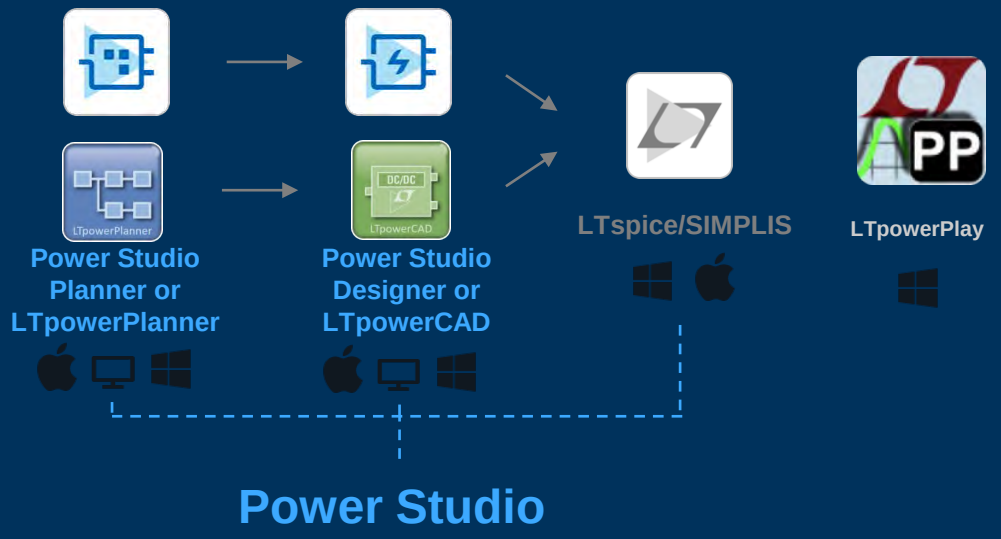
Part Support

- ADI
- Legacy LT
- Legacy Maxim

Analog Devices Confidential Information. ©2026 Analog Devices, Inc. All Rights Reserved.

Power Studio Landscape

1. Plan System
2. Find Solution
3. Design Circuit
4. Simulate
5. Debug & Test



Part Support

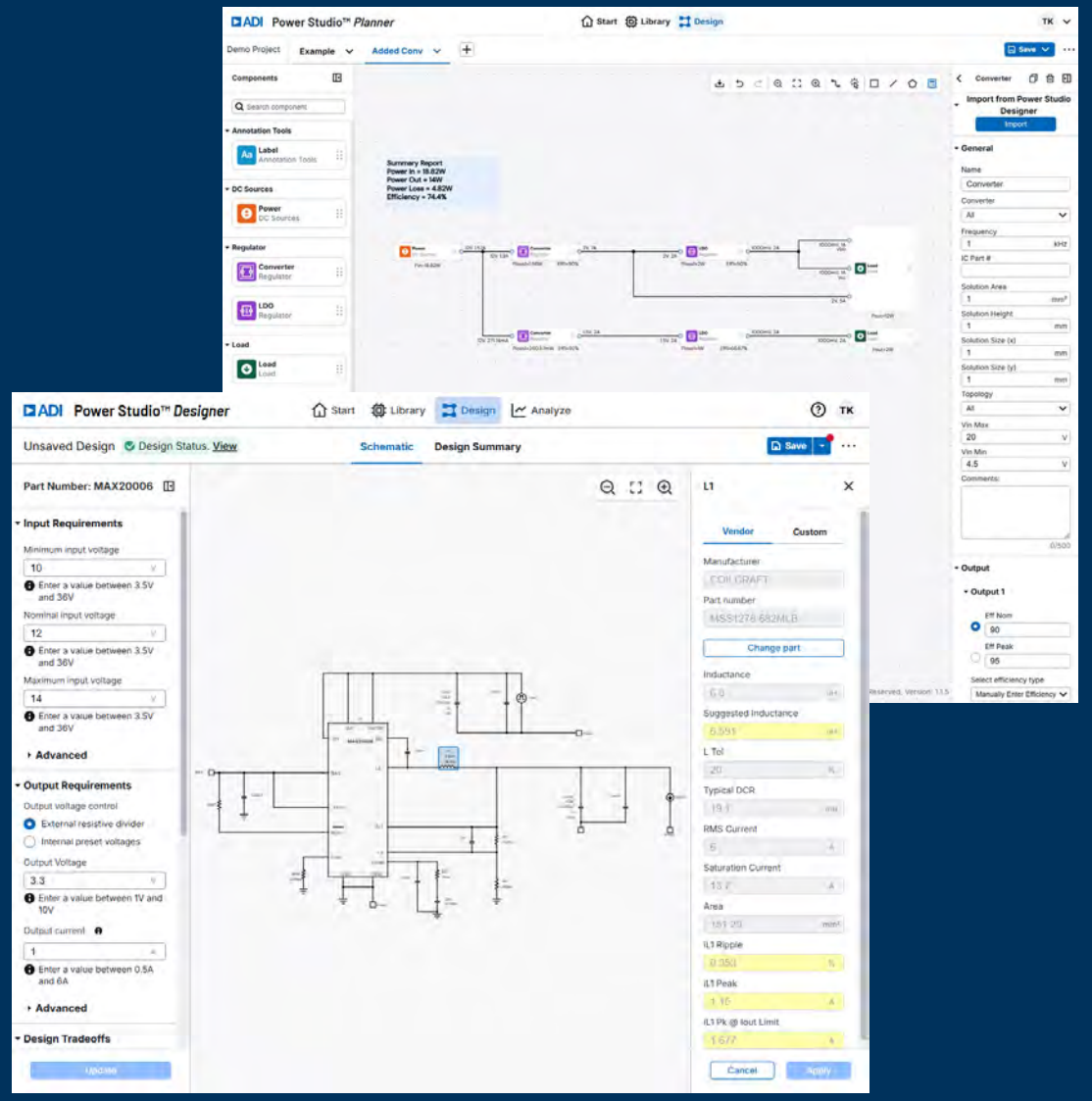
- ADI
- Legacy LT
- Legacy Maxim

Analog Devices Confidential Information. ©2026 Analog Devices, Inc. All Rights Reserved.

Power Studio Value

Features

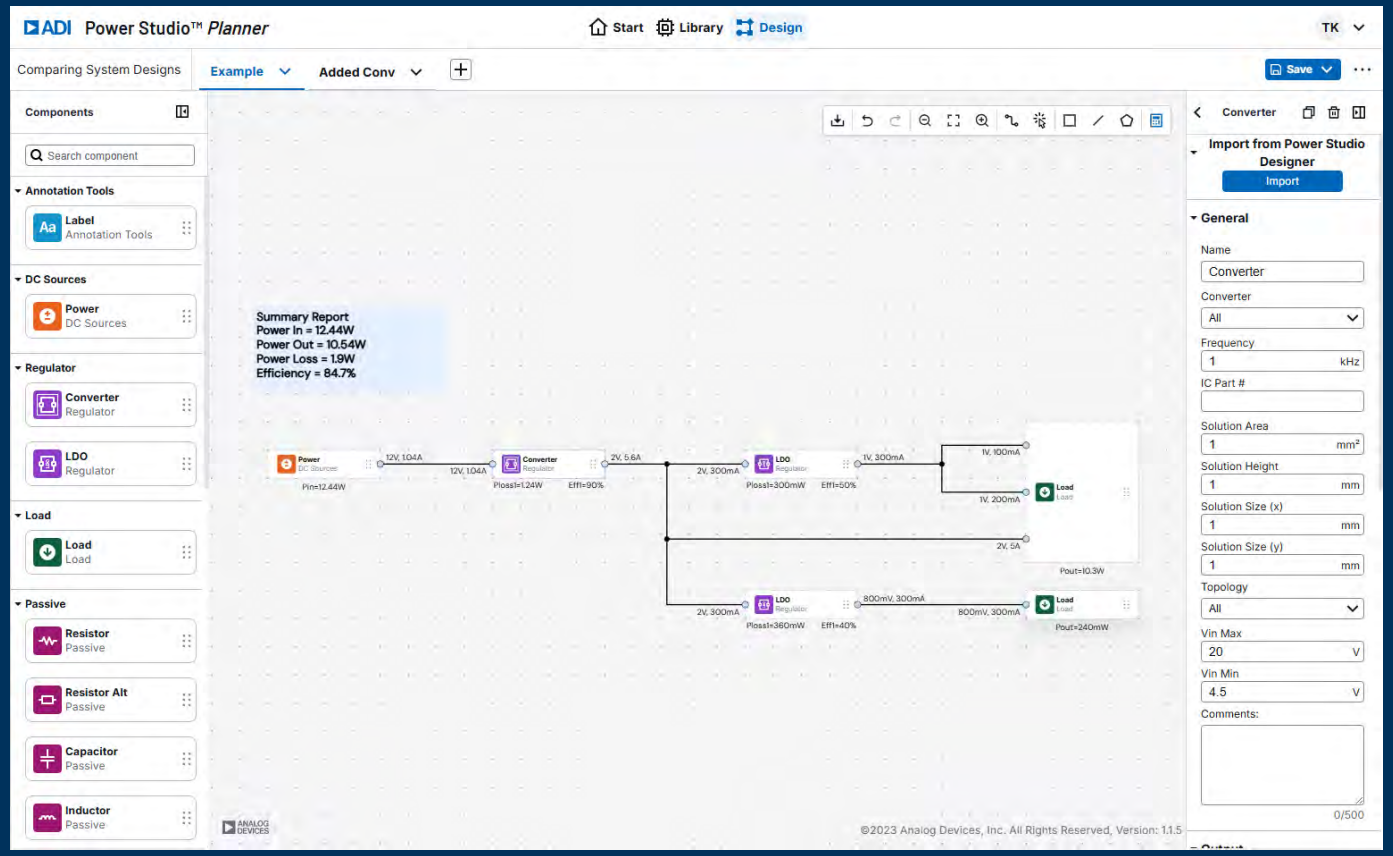
- Low Barrier to Adoption
- Unified Product Portfolio
- Secure IP Protection



Analog Devices Confidential Information. ©2026 Analog Devices, Inc. All Rights Reserved.

Power Studio Planner

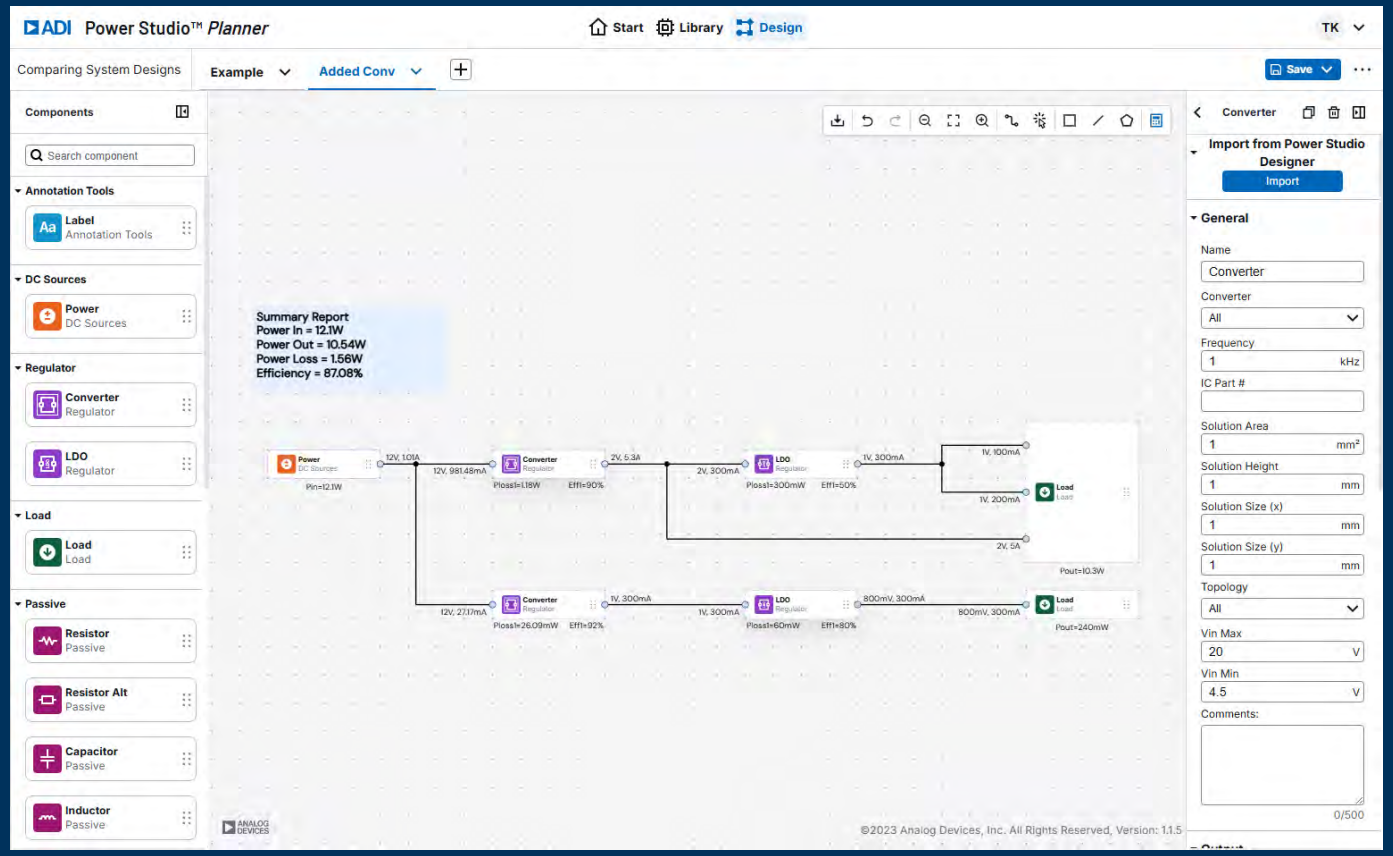
- Design and layout different system-level solutions
- Select parts from the unified parts library
- Import part parameters and efficiencies from Power Studio Designer
- Compare options with Calculate Power to calculate system-level power and efficiency



Analog Devices Confidential Information. ©2026 Analog Devices, Inc. All Rights Reserved.

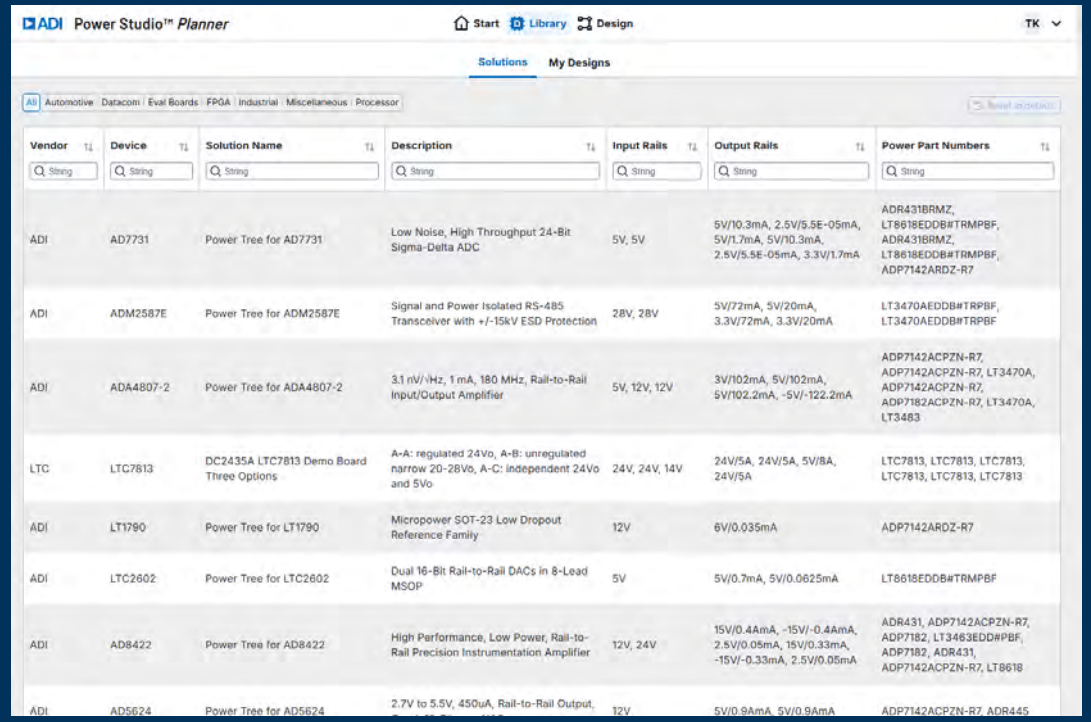
Power Studio Planner

- New UI/UX
- New Calculation Engine
  - Powered by LTspice
  - Complex resistor networks
  - Non-linear parts
  - Highly extensible
- New Components Mux & Switch
- Convenience and Accessibility of Web
- Desktop version in active development



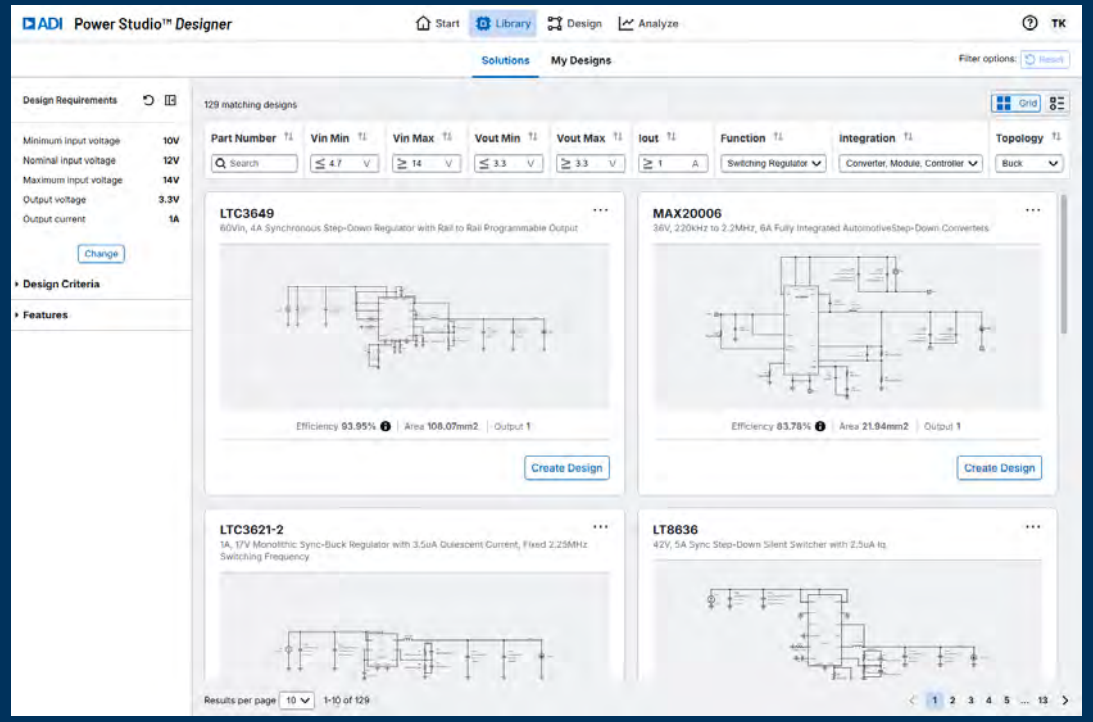
Analog Devices Confidential Information. ©2026 Analog Devices, Inc. All Rights Reserved.

Power Studio Solutions and Advanced Part Search



Power Studio Planner

Solutions Library (~300 Designs)



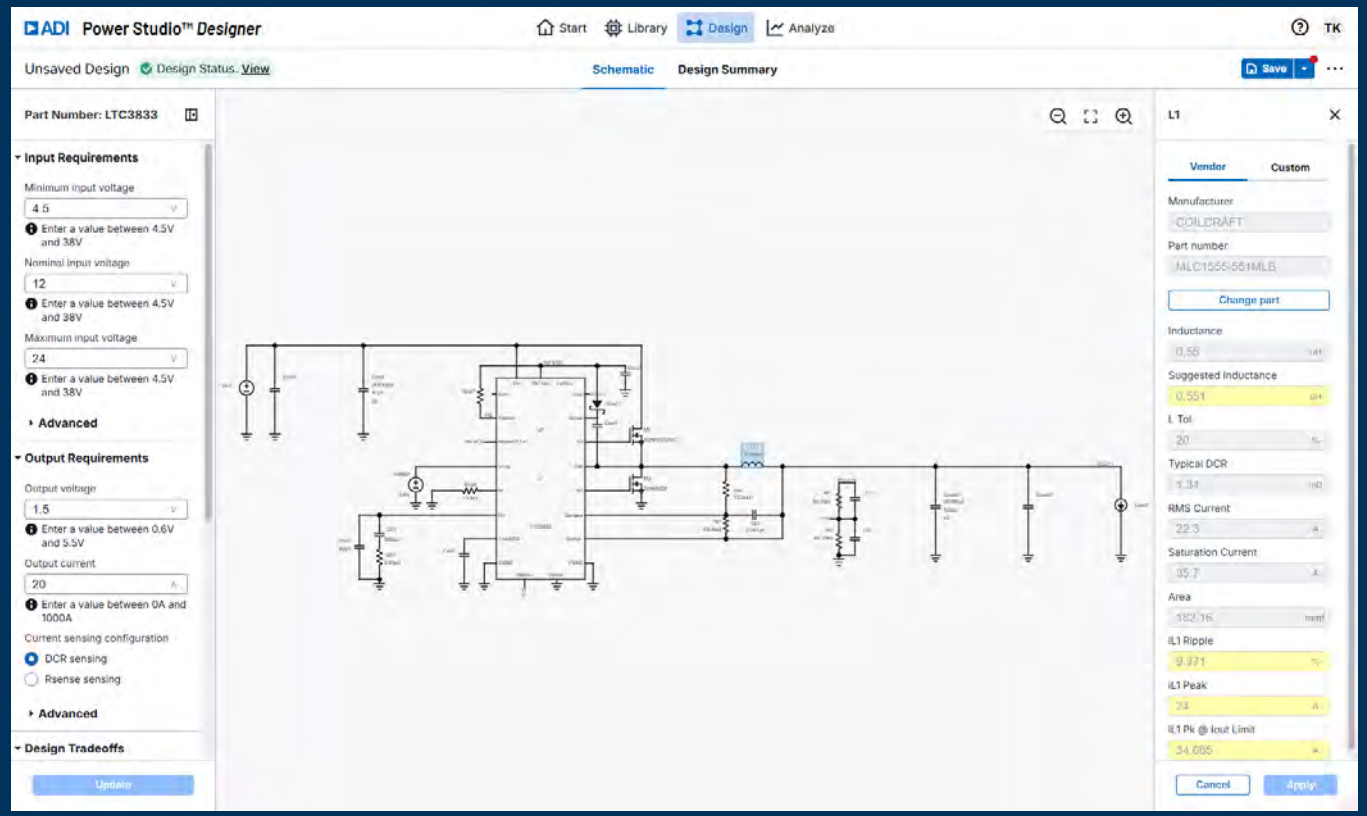
Power Studio Designer

Solution Library (~400 Designs)

Custom Solutions with Advanced Part Search

Analog Devices Confidential Information. ©2026 Analog Devices, Inc. All Rights Reserved.

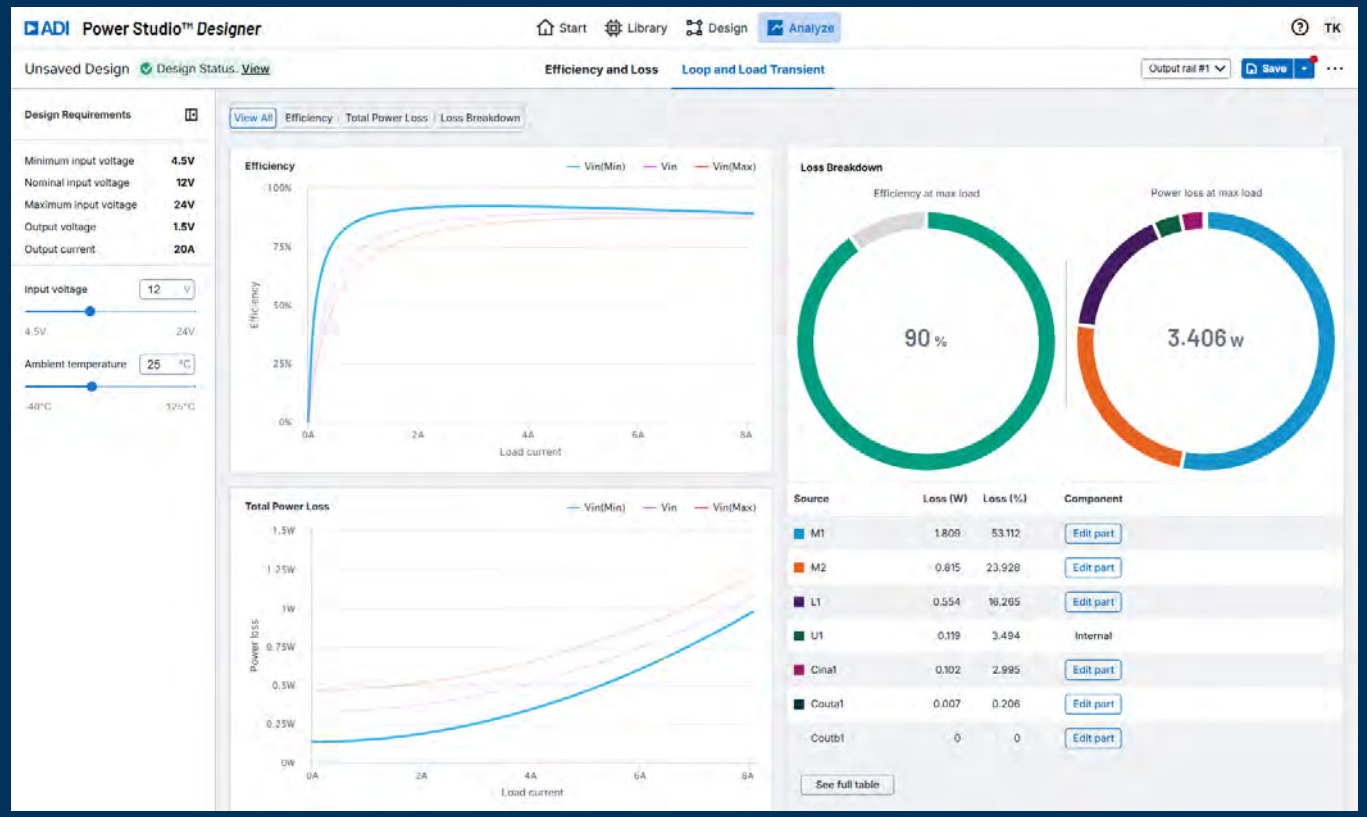
Power Studio Designer



- Interactive schematic with a unified symbols set (LT/Maxim)
- Advanced part selection
- Advanced vendor component selection
- Guides users to create optimized designs
- Bill of Materials & Key Information

Analog Devices Confidential Information. ©2026 Analog Devices, Inc. All Rights Reserved.

Power Studio Designer



- New UI/UX
- Customized Advanced Part Search
  - Comparable metrics
  - Unified part catalog (LT/Maxim/ADI)
- Convenience and Accessibility of Web
- Desktop version in active development

- Efficiency analysis
- Loop & Load Transient analysis
- Real-time data visualization

Analog Devices Confidential Information. ©2026 Analog Devices, Inc. All Rights Reserved.



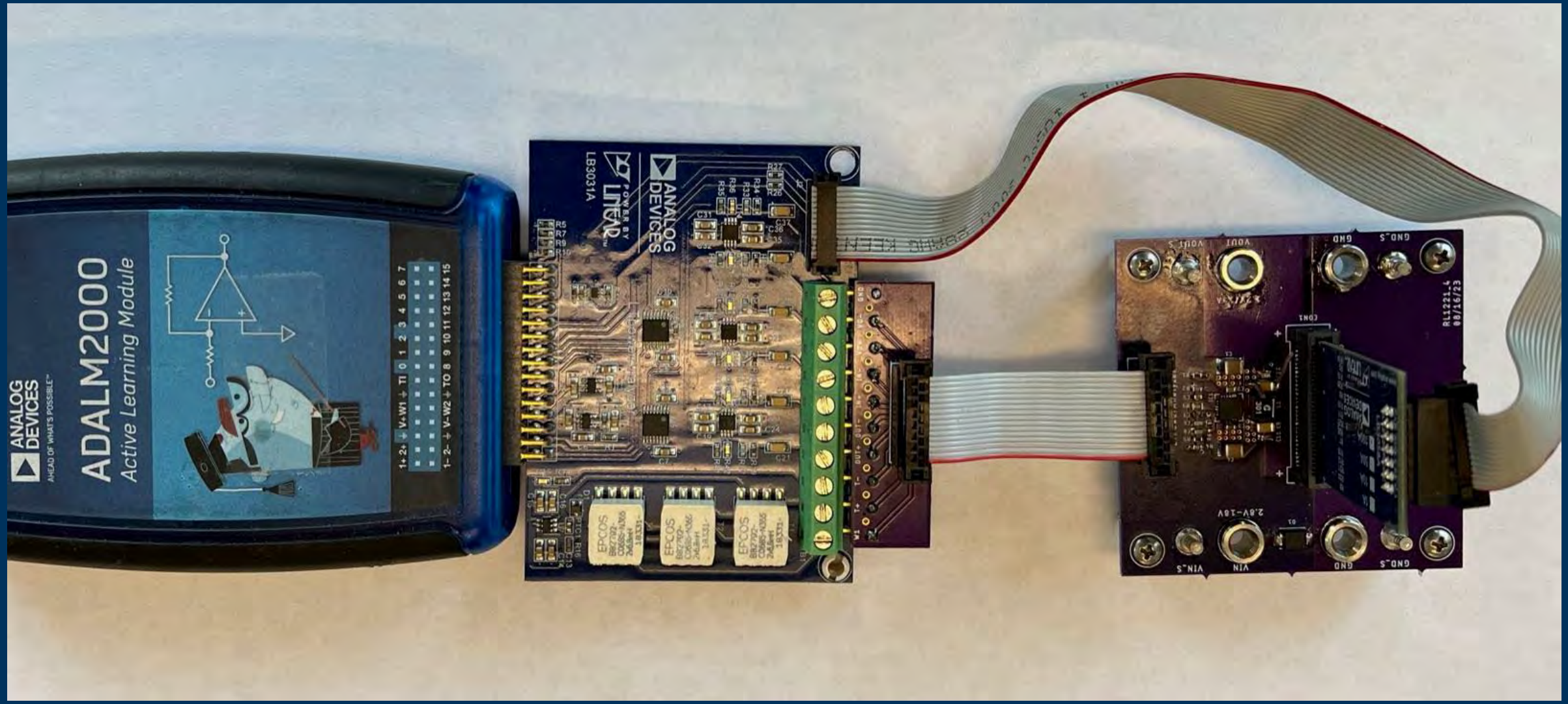
ANALOG DEVICES | ADI Power

LTpowerAnalyzer, Live Demonstration

Bill Geosits
Principal Engineer, Field Applications

November 5, 2026

The LTPowerAnalyzer - Overview



Analog Devices Confidential Information—Not for External Distribution. ©2024 Analog Devices, Inc. All Rights Reserved.

LTpowerAnalyzer: Bode Plots On the Go!

Todays Agenda

Overview

- What is it?
- Features
- Specifications

Hardware

- ADALM2000 overview
- What's in the box
  - Contents of Kit
- Connectors
- Hooking it up

Software [1.8.9.0 install]

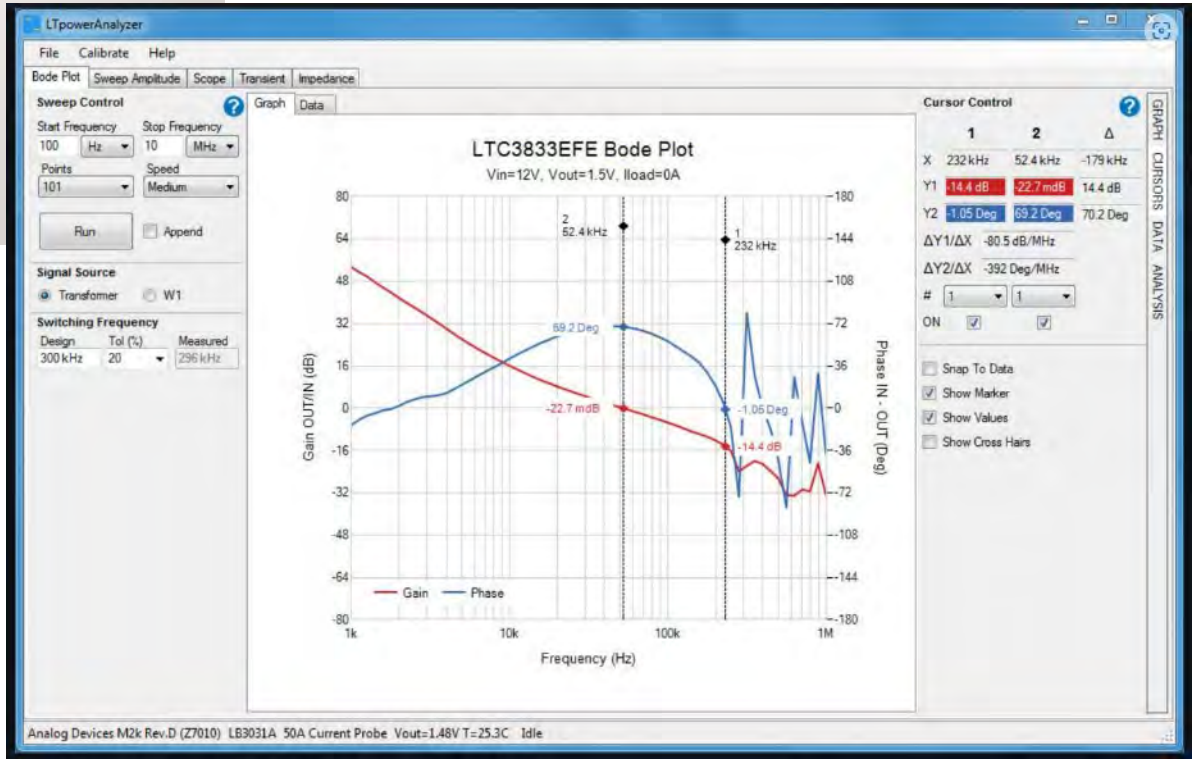
- GUI /Basic Operation
  - Operating tabs
  - Basic Controls
  - Calibrate often

Analyze some hardware

- **Perform Power Analysis using Analyzer and demo hardware**
  - **Bode**
  - **Transient**
  - **Output Impedance**

Conclusion





©2025 Analog Devices, Inc. All Rights Reserved.

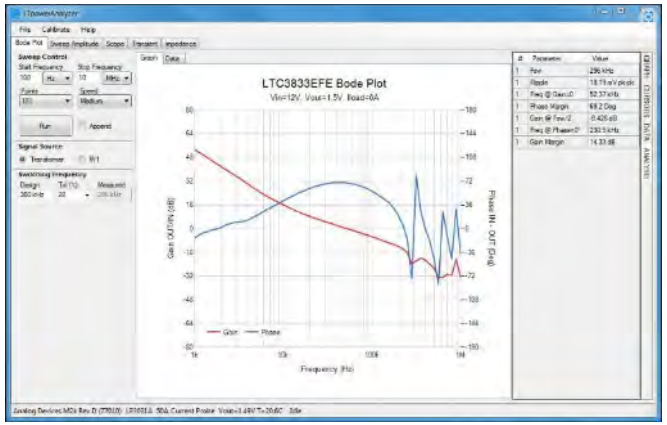
Overview

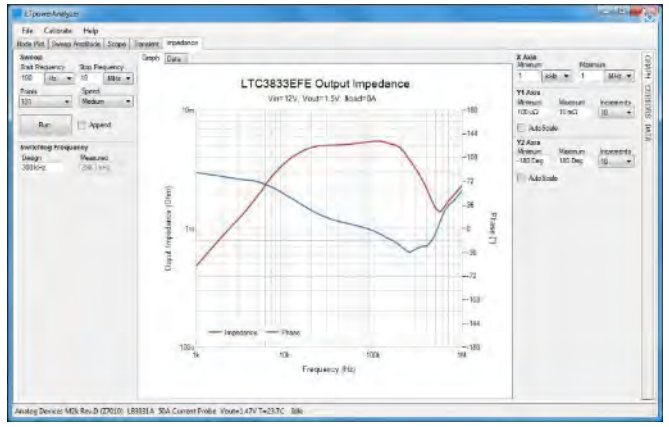
LTPOWERANALYZER – WHAT IS IT

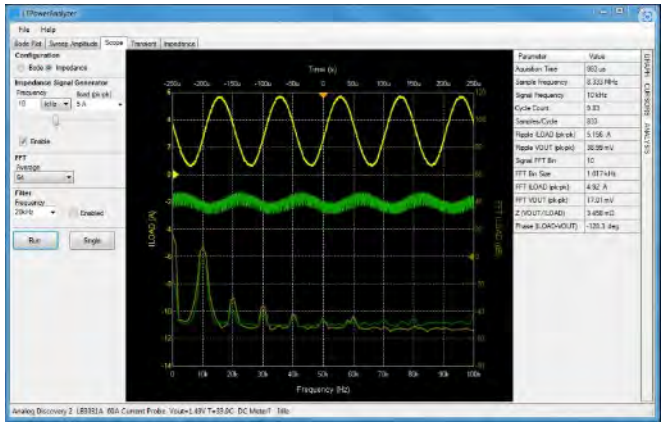
A very low overhead, portable, power converter test and measurement system!

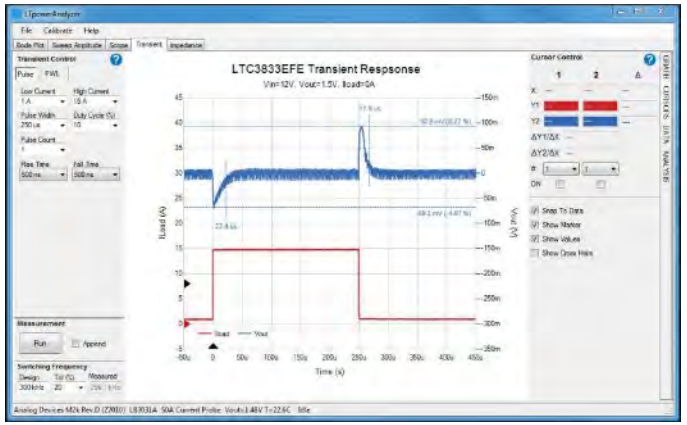
- What is it:
  - The LTpowerAnalyzer is a tool that analyzes the AC and DC performance of power converter hardware. It can be used to generate:
    - Bode Plots – Frequency Response
    - Transient Plots
    - Output Impedance Measurements
- Why?
  - This tool-set is the logical extension of our power product portfolio. As we further partner with our customers, test and measurement communication is the final step in closing the loop.
    - Analog Devices FAEs will be using the same tool to validate power and to communicate with our design partners. – This audience.











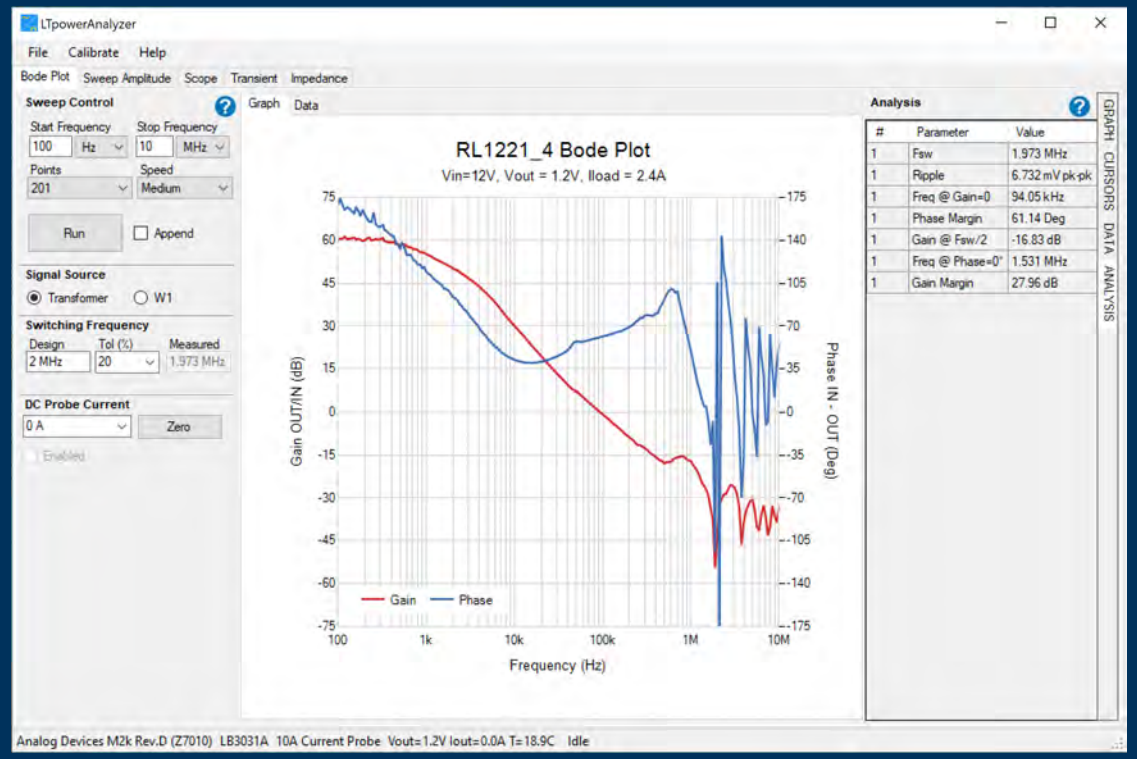
©2025 Analog Devices, Inc. All Rights Reserved.

LTpowerAnalyzer Vs Bode100

LTpowerAnalyzer

Phase Margin : 61.14 Deg @ 94.0kHz

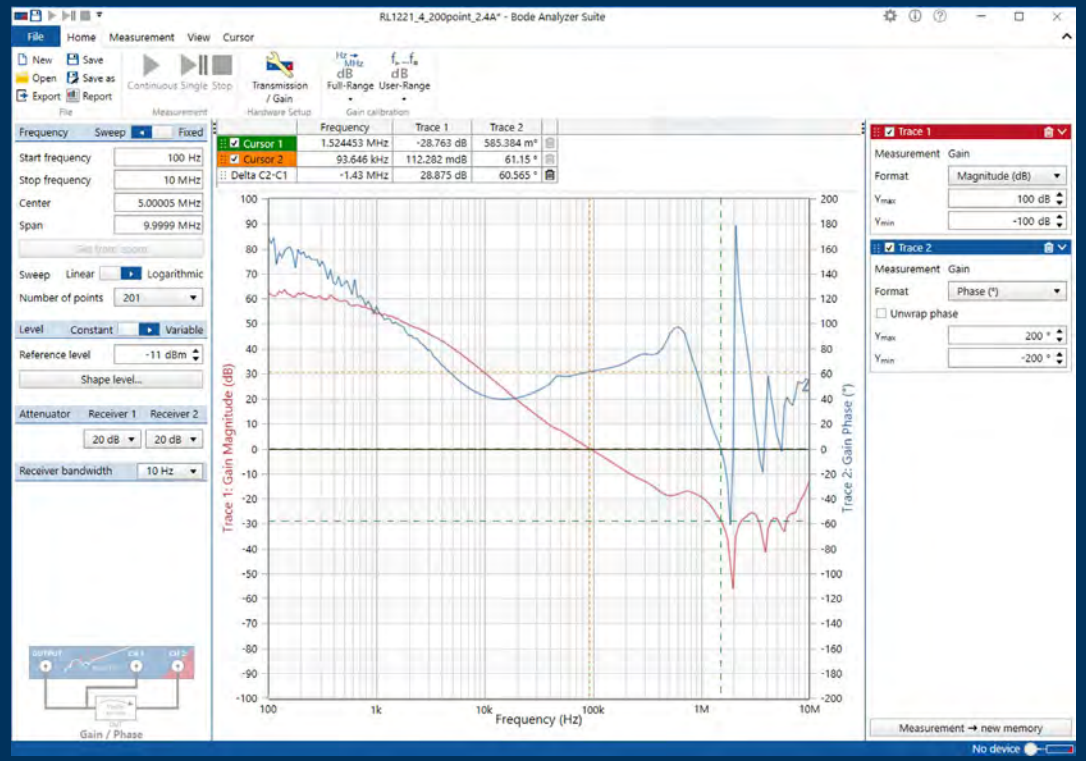
Gain Margin: 28.0 dB @1.53Mhz



Bode100

Phase Margin : 61.15 Deg @ 93.6kHz

Gain Margin: 28.7 dB @1.52Mhz



©2024 Analog Devices, Inc. All Rights Reserved.

Parameter	Conditions	Min	Max	Units
LB30301				
DC Input Voltage	T+, T-, OUT+, OUT-, IN+, IN-, VOUT+, VOUT- to GND to prevent damage.		+/-100	V
Full Scale Signal Voltage	OUT+ to OUT- IN+ to IN- AC differential voltage to prevent signal clipping		+/-230	mV
	VOUT+ to VOUT- AC differential voltage to prevent signal clipping		+/-600	mV
Bandwidth		100	10M	Hz
LB3058A				
Max Voltage Rating		-0.3	30	V
Max Peak Current	-A		1.2	A
	-B		12	A
	-C		60	A
	-D		120	A
Max DC Power Dissipation			10	W
Min Current Rise Time		200		nsec
Max Temperature	Automatic Thermal Shutdown		80	C

©2025 Analog Devices, Inc. All Rights Reserved.

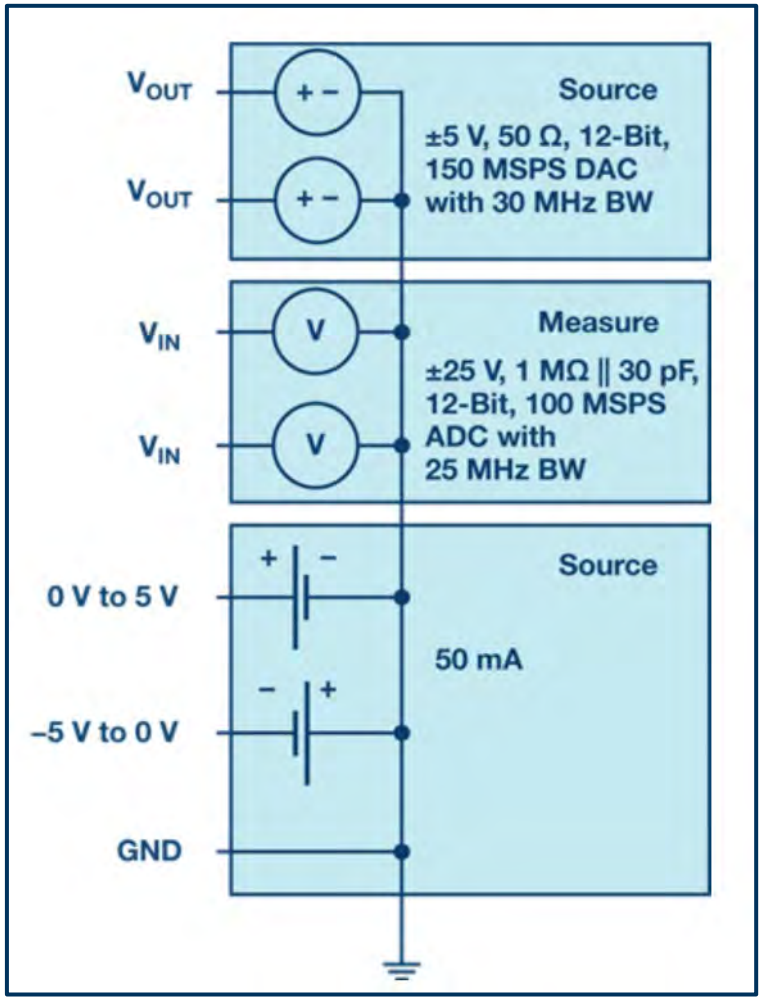
LTpowerAnalyzer Hardware



Hardware

The main interface for the LTPA is the Analog Devices Advanced Learning Module – ADALM2000





ADALM2000 - Overview

- Two-channel USB digital oscilloscope
- Two-channel arbitrary function generator
- 16-channel digital logic analyzer (3.3V CMOS and 1.8V or 5V tolerant, 100MS/s)
- 16-channel pattern generator (3.3V CMOS, 100MS/s)
- 16-channel virtual digital I/O
- Two input/output digital trigger signals for linking multiple instruments (3.3V CMOS)
- Single channel voltmeter (AC, DC, ±25V)
- Network analyzer – Bode, Nyquist, Nichols transfer diagrams of a circuit. Range: 1Hz to 10MHz
- Spectrum Analyzer – power spectrum and spectral measurements (noise floor, SFDR, SNR, THD, etc.)
- Digital Bus Analyzers (SPI, I²C, UART, Parallel)
- Two programmable power supplies (0…+5V , 0…-5V)

©2025 Analog Devices, Inc. All Rights Reserved.

Hardware

WHAT'S IN THE LTPA BOX





MAIN KIT BOX

The LTpowerAnalyzer kit, along with the ADALM2000 provide many options for connecting to, and assessing the performance of your power converter

©2025 Analog Devices, Inc. All Rights Reserved.

Hardware

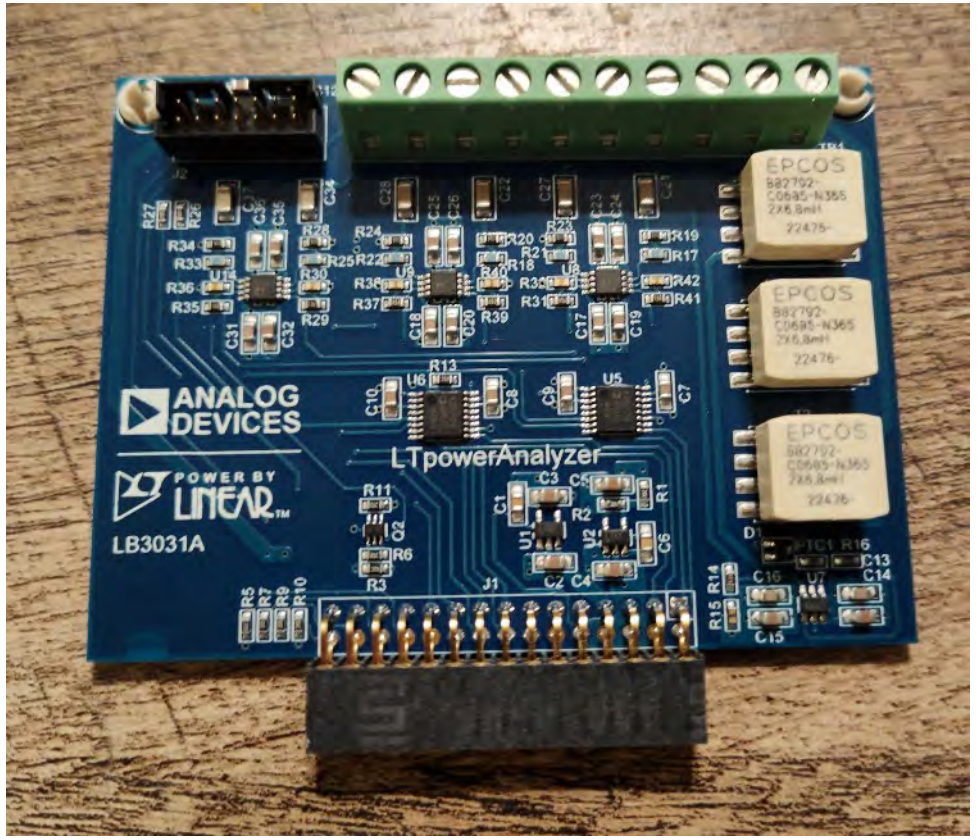
WHAT'S IN THE BOX (CONT.)

The LB3031A, pictured to the right [top] is the primary interface between the power converter under test, the current injection probe and the ADALM2000 module.

- This will be referred to as the "Main Board" in the LTPA system

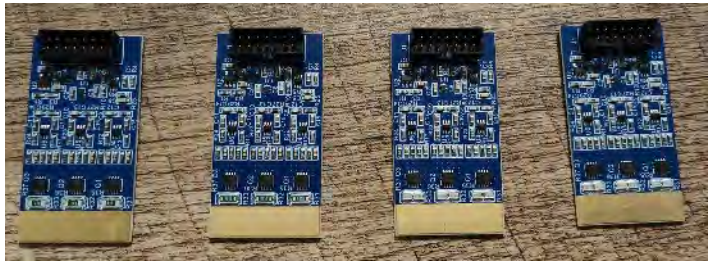
The connections available are:

- Main ADALM dual row connector
- Current Probe Ribbon Header
- Analog Kelvin connection terminal Block



The included Current Probe modules are pictured to the right.

- These come in 1A, 10A, 50A, and 100A flavors. Choose the next size up for your application typically.
- Note the polarized connections at the tabs. **[Do not reverse. Damage will occur.]**





©2025 Analog Devices, Inc. All Rights Reserved.

Hardware

WHAT'S IN THE BOX (CONT.)

The Boards on this page interface the Main Board to the DUT through a ribbon cable.

DUT Connector Blocks

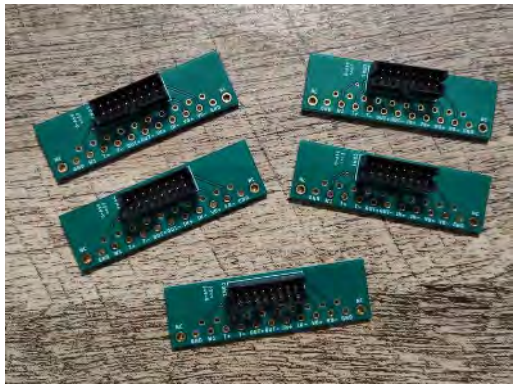
- Shown on the right are connector blocks used to convert the kelvin connections from the DUT, to a ribbon connector for attachment to the Main Board.
- This board gives access to all individual signals from the ribbon.

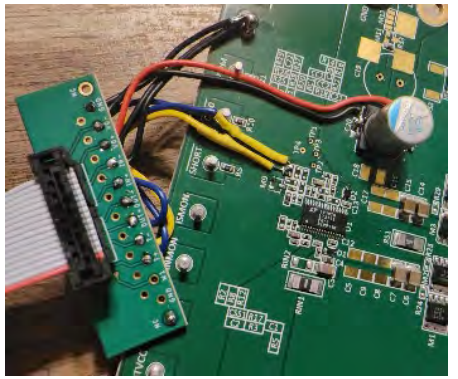
Interposer Board

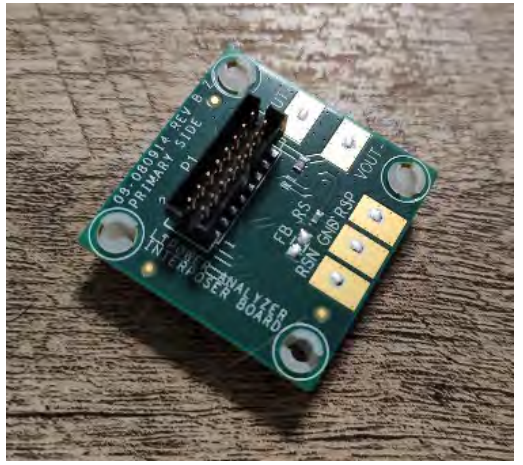
- Shown on the right, center row is an interposer board.
- This board is useful when no provision for an injection resistor was included in a DUT design.
  - It moves the top resistor (R1) from the divider of the DUT to the interposer and provides pads for the signal injection resistor and sense connections.
- This allows for a simple 4 wire attachment to a standard converter configuration and ribbon cable.

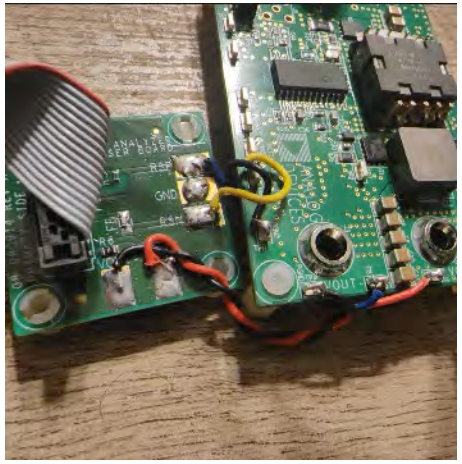
Main Board [LB3031A] Connector Block

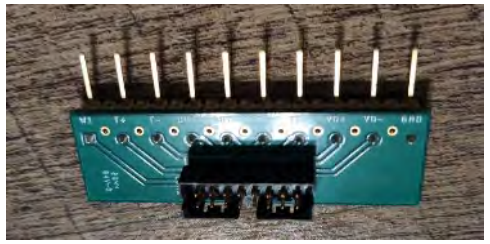
- Shown on the right is the corresponding connector board that mates with the terminal block on the Main Board and allows ribbon connection to the DUT via a DUT Connector Block/Interposer Board.

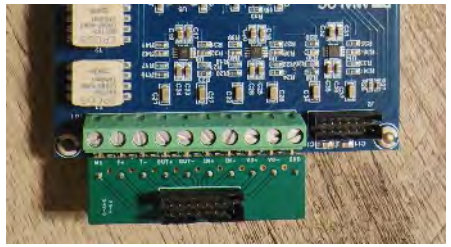












©2025 Analog Devices, Inc. All Rights Reserved.

Hardware

WHAT'S IN THE BOX (CONT.)

Ribbon Cables

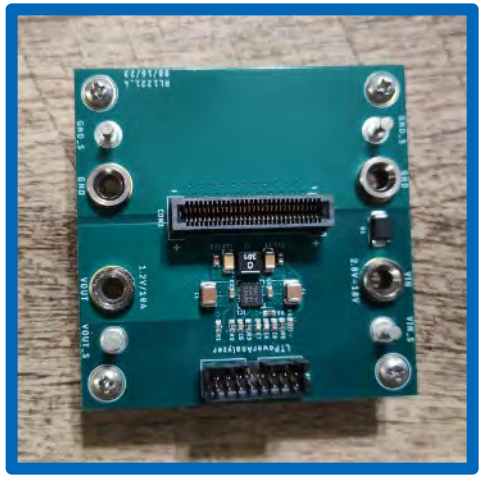
- Shown on the right and above, are the included ribbon cables. The intended uses are:
  - The longer cable to the right connects between the LB3031A and a Current Injection Probe
  - The shorter above is used to connect the DUT and Main Board Connector Block boards.





Included DUT

- Shown on the right is the trial DUT included with the PowerAnalyzer
  - Based on LT8642S Silent Switcher
  - Remember to load during test as the board will move into a DCM/Burst mode.
  - Connectors are included for the current injection probe and the kelvin sense ribbon.
  - Goals are to have this be standard on ADI EVAL hardware



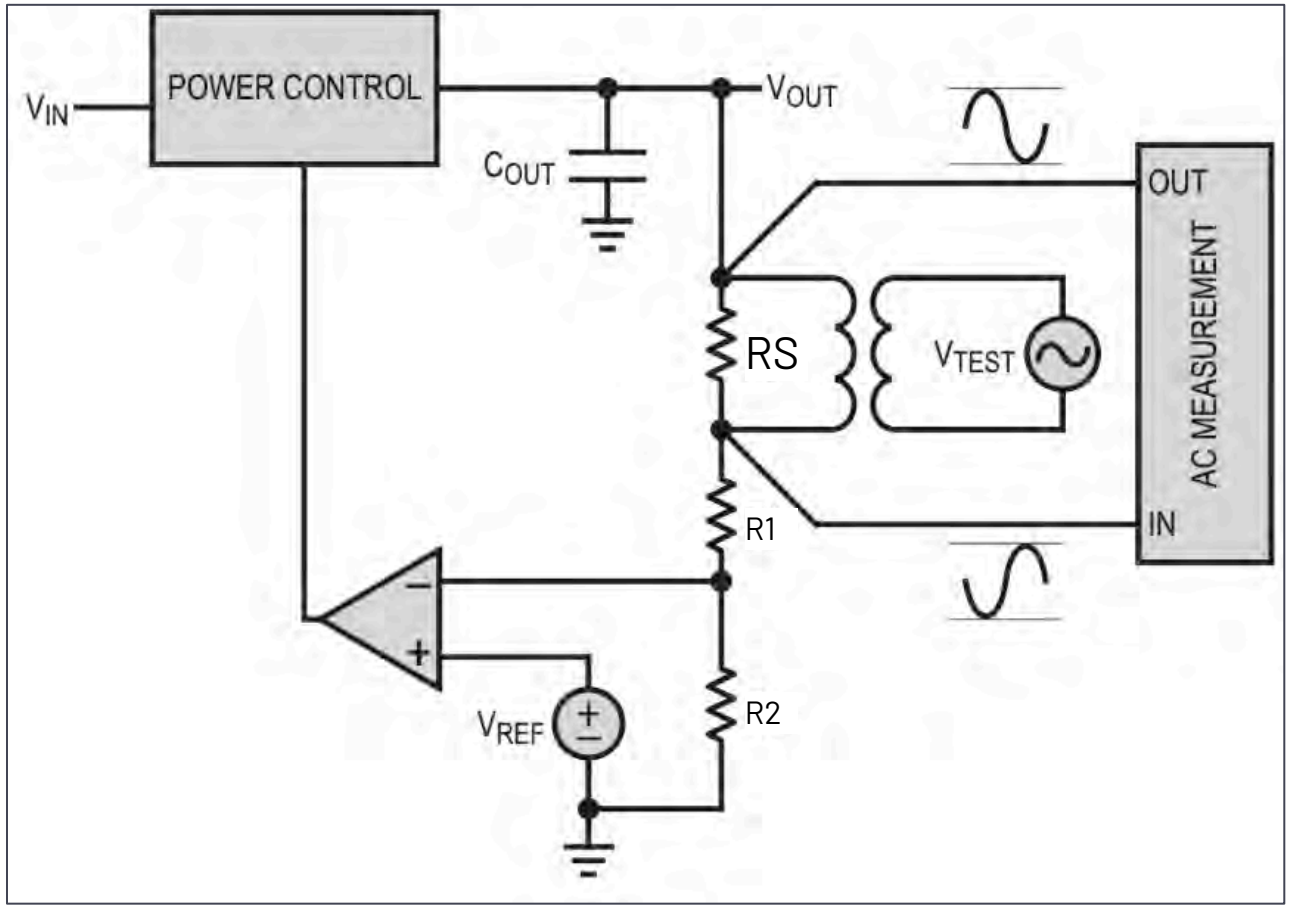


©2025 Analog Devices, Inc. All Rights Reserved.

Hardware

BASIC THEORY

- The diagram to the right shows the signaling and connections required in general, to perform a frequency response measurement on a DUT
- Vtest is transformer coupled into the control loop of the DUT/Power Control block via R1.
    - This imposes an AC, small signal tone in the control loop.
- The output perturbation based on the small signal tone is measured and the transfer function of the control loop can be calculated and plotted.



Basic Frequency Response Measurement

©2025 Analog Devices, Inc. All Rights Reserved.

Hardware

LTPA CONNECTION AND MEASUREMENT DESCRIPTION

The diagram to the right shows the connections necessary for performing measurements with the LTPA on a DC/DC power converter.

T+/- is the transformer coupled AC perturbation voltage

- Kelvin connected to **RS** resistor [Note +/- conventions in drawing]
  - **RS** is inserted into the FB divider in the basic converter schematic.
    - Typically, 10-50 Ohms
    - This is the point of signal injection

OUT+/- pair is connected across the entire FB divider, from the top of RS.

- This kelvin connection senses the perturbation across the FB circuit.

IN +/- pair is connected between the bottom of RS across the FB divider.

- This Kelvin connection senses the signal appearing at the top of the divider being injected into the DUT control loop.

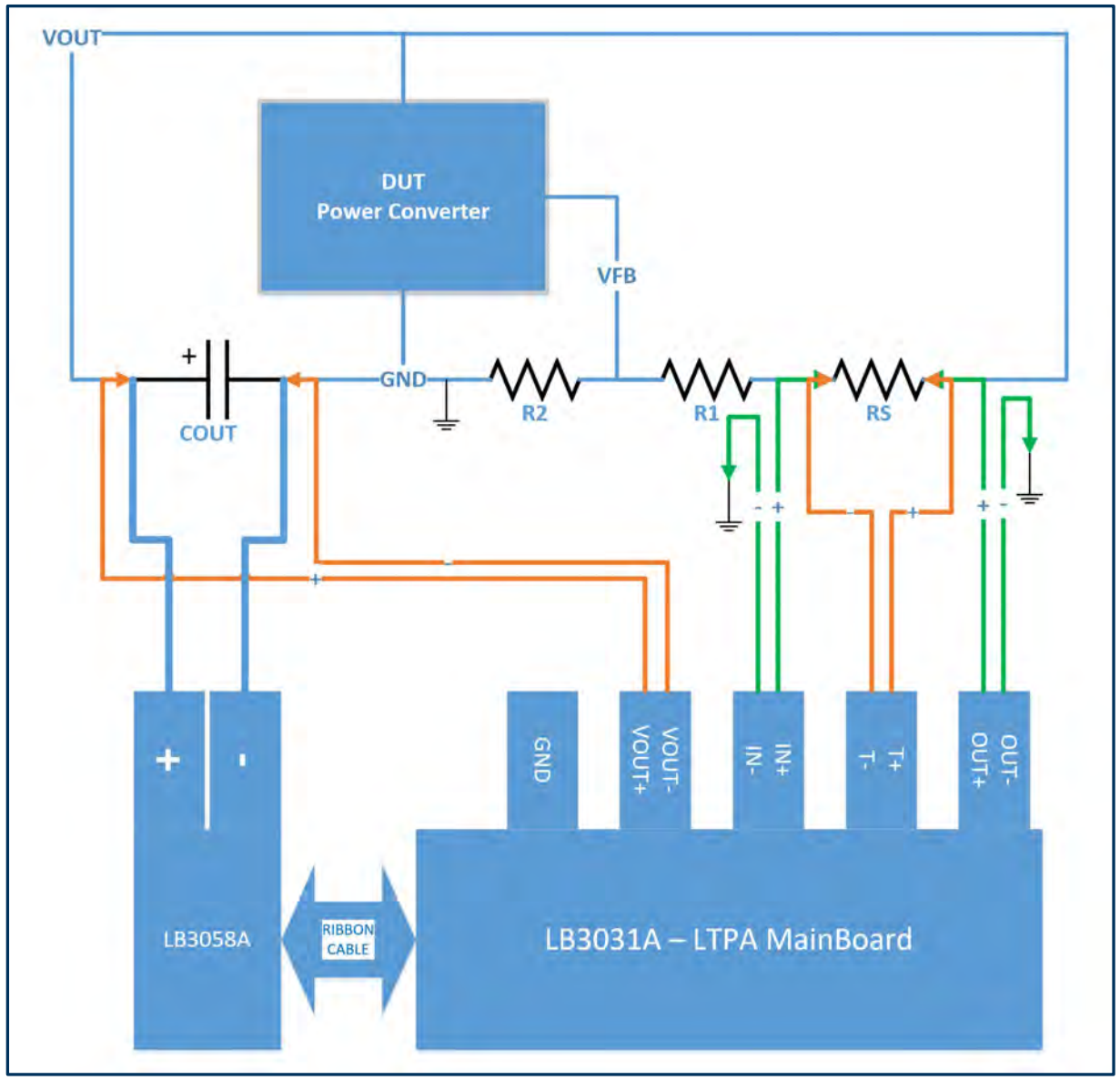
VOUT +/- pair is connected across the output capacitance.

- This Kelvin connection senses the output voltage + AC across the output capacitor.

LB3058A

- This is the main Current Probe connection. *Make note of the probe polarity when connecting.*
  - This is a high current path and requires low inductance, high conductivity implementation.

Using these connections, the LTPA signal and measurement system can perform: Frequency and Transient response, as well as Output Impedance Measurements and return analytic information useful in the verification and validation of power system implementations.



Basic LTpowerAnalyzer Connections With general Power Converter

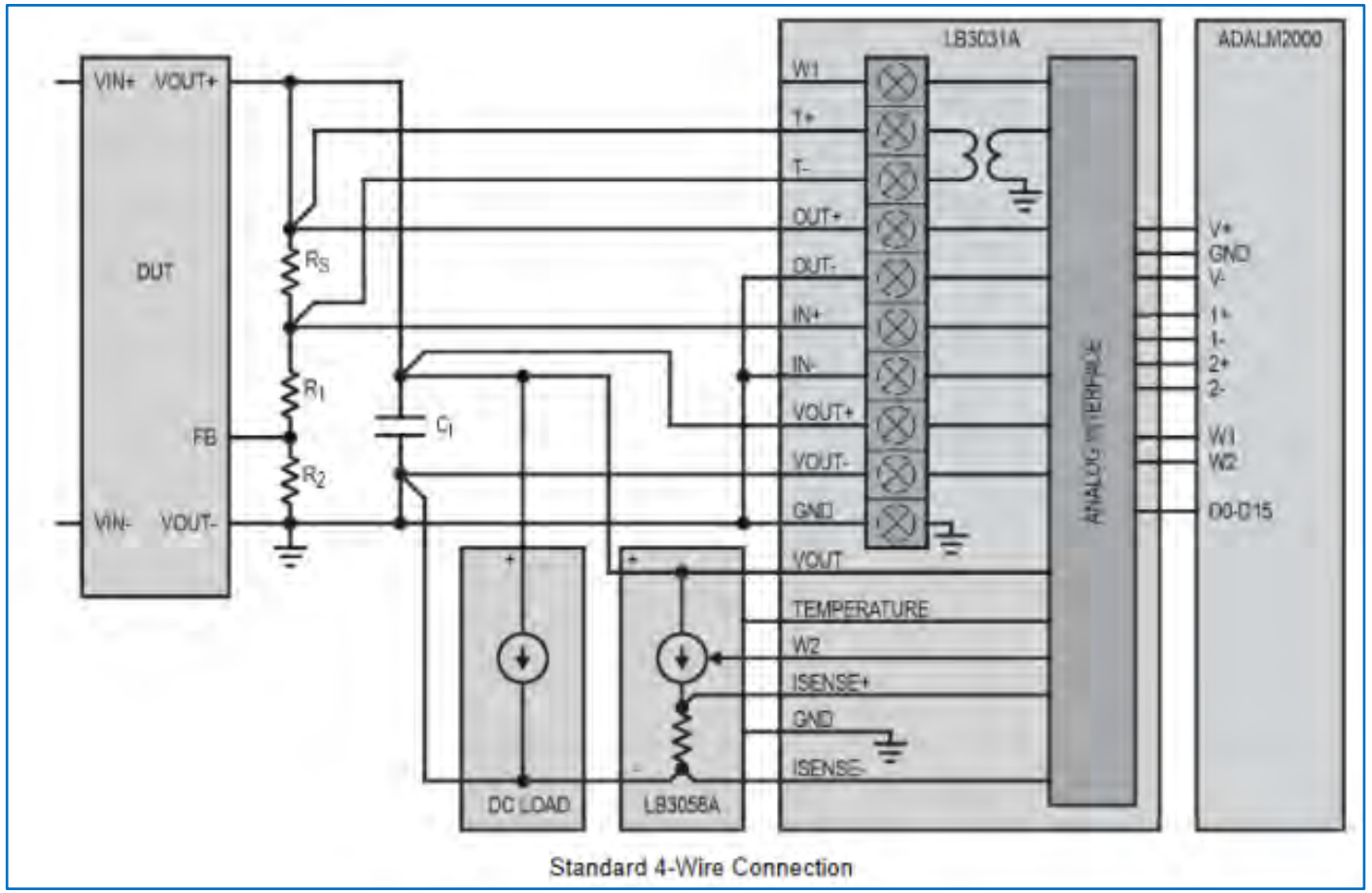
©2025 Analog Devices, Inc. All Rights Reserved.

Hardware

HOOKING IT UP – VARYING CONNECTION SCENARIOS

- Different Physical Measurement Scenarios require alternate physical attachment points
- Standard 4 wire Kelvin Connection.
  - This implements the previous discussed connections in a straightforward manner.

The convention for the Kelvin pair naming is: ***"Hook them up by the signal's name, as opposed to thinking in terms of input and output directions"*** for instance "out +/–" go on the output of the power converter, but they are an input pair in actuality.



Standard 4-Wire Connection

All of these setup example drawings are contained in the HELP section of the LTpowerAnalyzer tool.

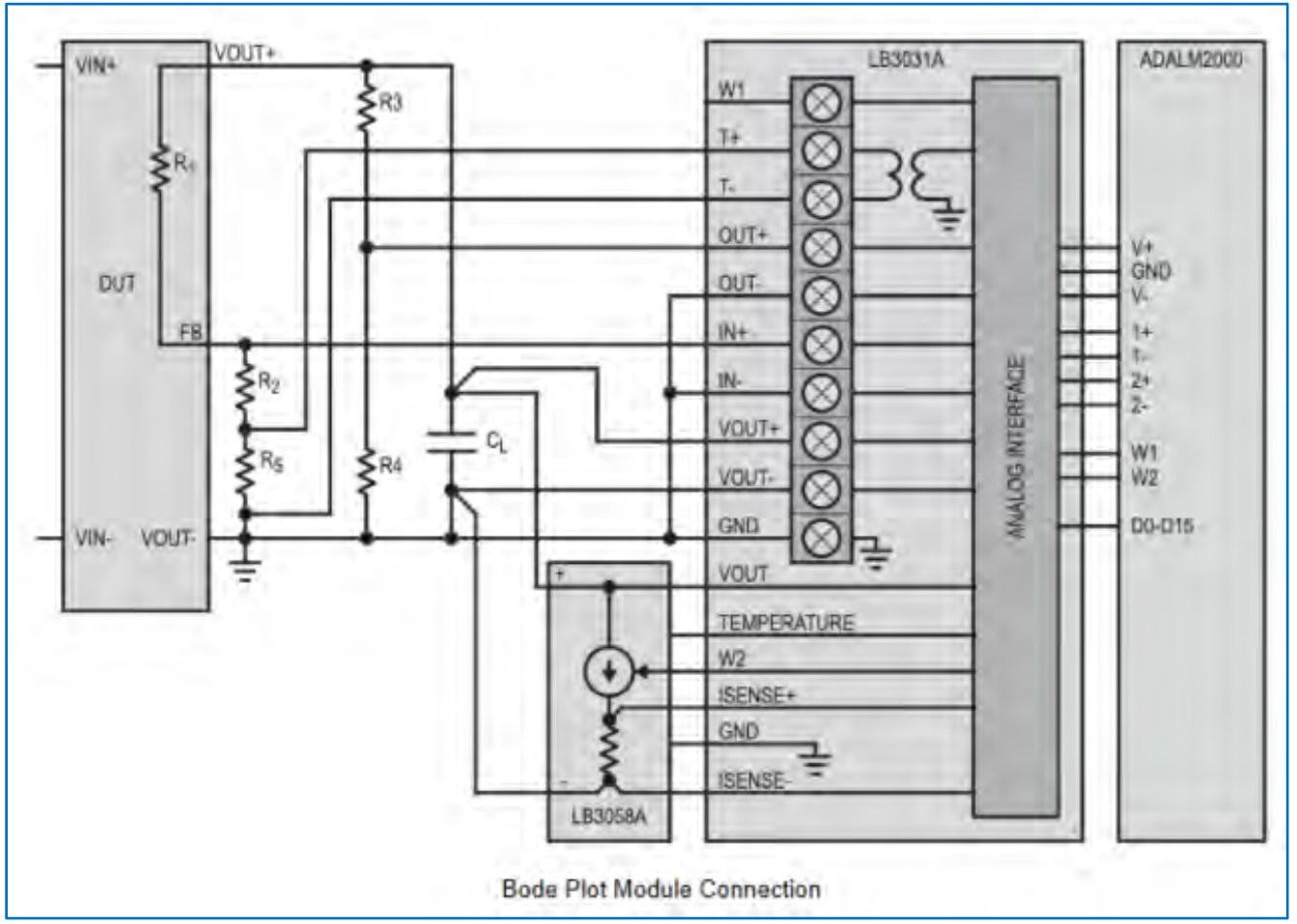
©2025 Analog Devices, Inc. All Rights Reserved.

Hardware

HOOKING IT UP – VARYING CONNECTION SCENARIOS

Bode Plot Module Connection

- This diagram shows how to connect the system for an accurate plot when confronted with a uModule utilizing an internal top FB resistor.
- Note RS is added to the bottom of the divider.
- [Ratio of R3/R4 equals R1/R2.]
- See discussion in help file for further guidance on R3/4 values.



Bode Plot Module Connection

The convention for the Kelvin pair naming is: ***"Hook them up by the signal's name, as opposed to thinking in terms of input and output directions"*** for instance "out +/–" go on the output of the power converter, but they are an input pair in actuality.

All of these setup example drawings are contained in the HELP section of the LTpowerAnalyzer tool.

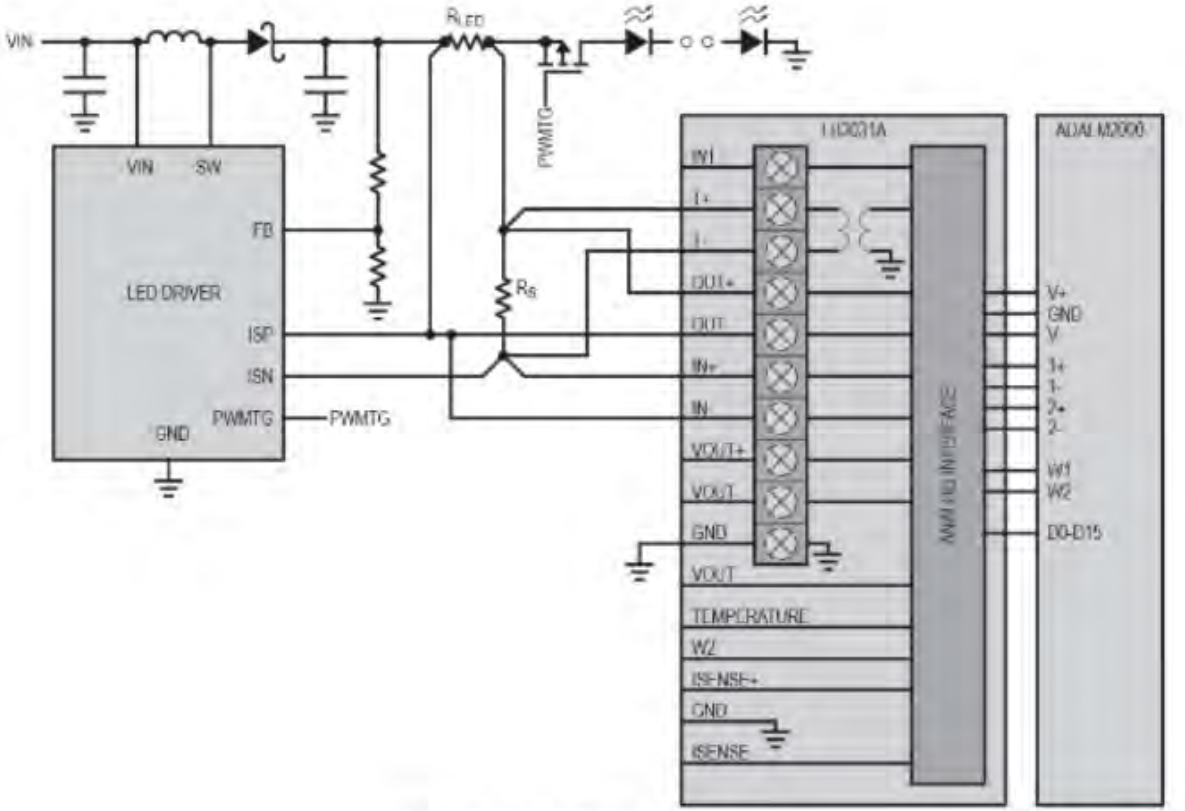
©2025 Analog Devices, Inc. All Rights Reserved.

Hardware

HOOKING IT UP – VARYING CONNECTION SCENARIOS

Bode Plot LED Driver Connection

- This diagram displays an implementation for measuring the response of a Boost mode LED current driver circuit.
- Note that the perturbation/AC signal is imposed on the current sense signal in the control loop.



Bode Plot LED Driver Connection

The convention for the Kelvin pair naming is: ***"Hook them up by the signal's name, as opposed to thinking in terms of input and output directions"*** for instance "out +/–" go on the output of the power converter, but they are an input pair in actuality.

All of these setup example drawings are contained in the HELP section of the LTpowerAnalyzer tool.

©2025 Analog Devices, Inc. All Rights Reserved.

Hardware

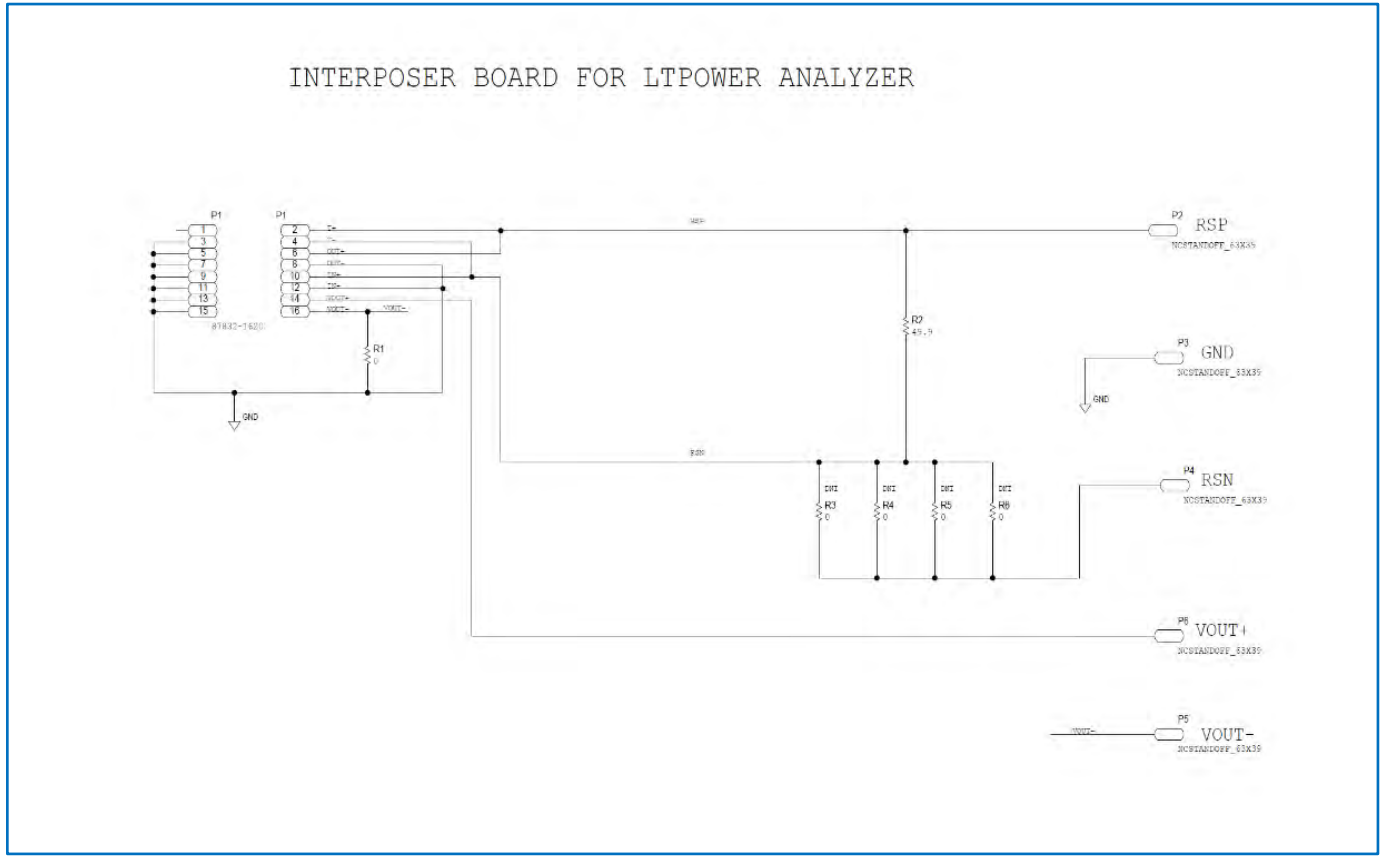
HOOKING IT UP – INTERPOSER BOARD

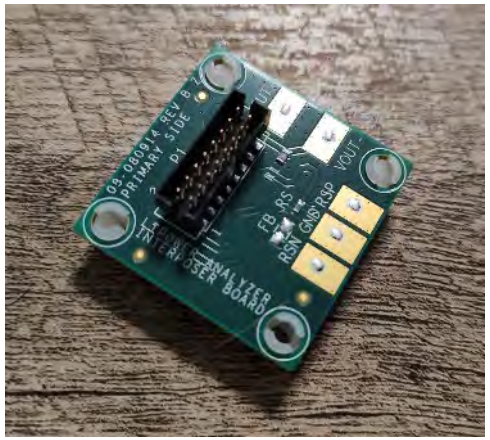
The Interposer board and its schematic are pictured to the right. This included assembly eases the inclusion of the LTPA injection port onto an assembly previously provisioned without a sense R or ribbon cable.

Comes with a 49.9 Ohm RS installed.

This board allows a direct connection between the LB3031A and the DUT via ribbon cable.

- Depop the **RTOP** on the DUT, in the power converter DUT feedback divider.
- Place the removed **RTOP** resistor in the **FB** position on the Interposer Board.
  - Or substitute with R of equivalence.
- Solder short wires [or twisted pair] from the **RSP/RSN** pads to the **RTOP** pads on the DUT
- Connect short wires [or twisted pair] from **VOUT+/-** pads to the output voltage, preferably across the DUT output capacitance.
- Connect the Main Board to the Interposer Board using the included short ribbon cable.









©2025 Analog Devices, Inc. All Rights Reserved.

Hardware

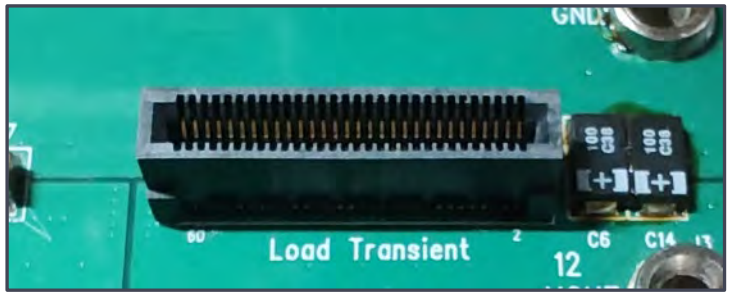
CURRENT PROBE ATTACH

The 60 pin edge connector used to attach the Current Probe Assembly to the DUT [**CON1**] is being placed on new demo hardware in many cases.

- The images to the right display two instances of the connector being included on hardware during their design.
- Hardware provisioned with this connector will likely also have the 16 pin Bode connector applied.

For hardware without a dedicated connector, the method for much of the ADI demo hardware is:

- locate the plane area separation near the output capacitance.
- Scrape solder mask back using a knife, exposing a copper area of comparable area to the pins of the connector.
- Solder the connector directly to the demo board plane area as done in the image to the right. [Two are included with the LTPA kit]
- In some cases, it may be more convenient to solder the current probe right to the DUT.
  - This is usually a superior electrical connection.



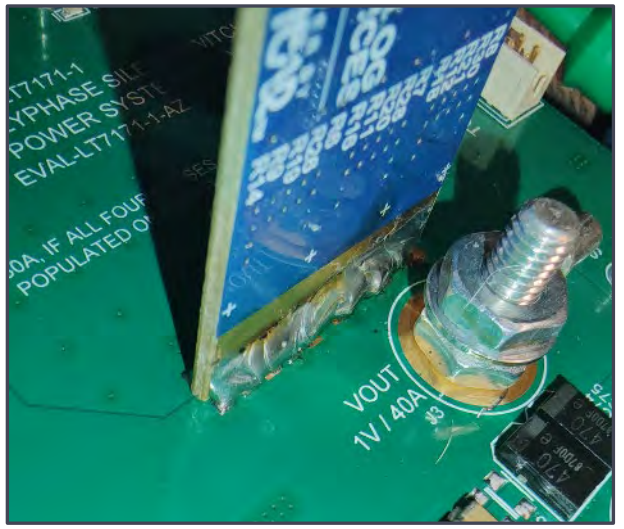
Current probe connectors included on hardware assembly



16 pin provisioned Bode Connector



Current probe soldered directly to assembly



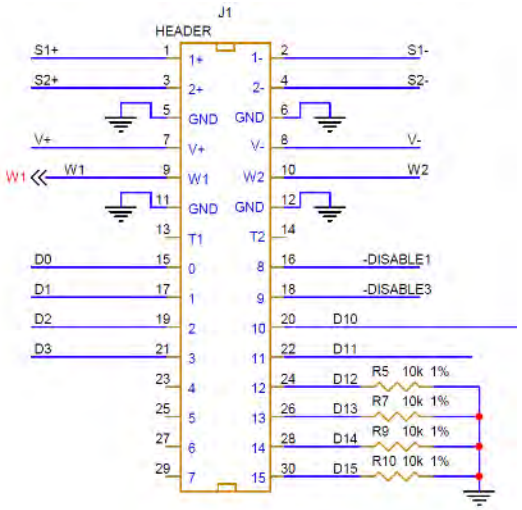
©2025 Analog Devices, Inc. All Rights Reserved.

Hardware

CONNECTOR REFERENCE

ADALM2000 signals

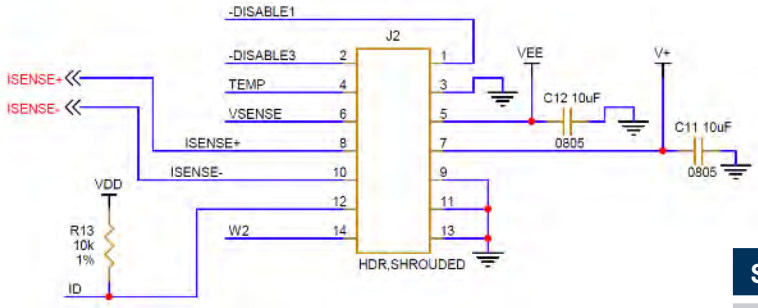
Signal	Description
S1+/-	Scope input channel one for ADALM2000
S2+/-	Scope input channel two for ADALM2000
V+/-	Positive and Negative DC voltages from ADALM2000 used to power the Analyzer
W1	Waveform Generator output 1 from ADALM2000
W2	Waveform Generator output 2 from the ADALM2000
D15:0	Digital I/O bits [15 downto 0] for ADALM2000
-Disable1	Digital I/O bit 8 of ADALM2000 [Active low]
-Disable3	Digtal I/O bit 9 of ADALM 2000 [Active low]
GND	Return signal for ADALM2000



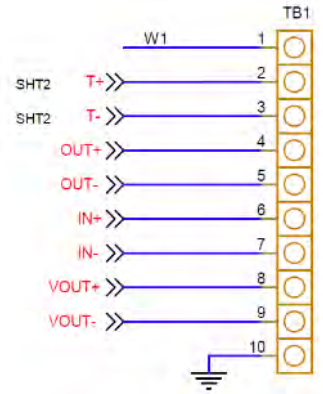
Main Connector

Bode signals

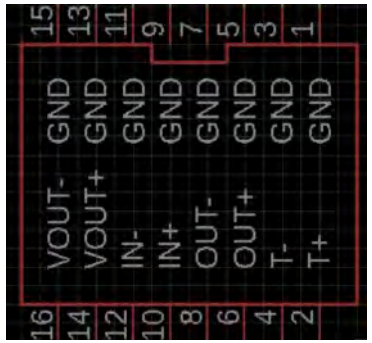
Signal	Description
T+/-	Signal injector output. From W1 generator. Buffered/Transformer isolated .
OUT+/-	Kelvin Sense Pair for DUT ourput Vout+/-
IN+/-	Kelvin Sense Pair for DUT input T+/-
VOUT+/-	Input analog signal measuring the output voltage of the DUT
GND	Return signal for the Bode connections



Current Probe Connector



Bode Connector



Current Probe signals

Signal	Description
DISABLE1	Control Signal for Current Probe Assembly
DISABLE3	Control Signal for Current Probe Assembly
VSENSE	Voltage sense for Current Probe
ISENSE +/-	Current sense for Current Probe
ID	Signal used to identify Current Probe Assembly output/operating range
W2	Output Analog drive signal to the Current Probe Assembly
TEMP	Temperature sense signal output from Current Probe Assembly
VEE	Negative Supply Rail to the Current Probe Assembly
V+	Positive Supply Rail to the Current Probe Assembly
GND	Return signal for the current probe interface

©2025 Analog Devices, Inc. All Rights Reserved.

LTpowerAnalyzer GUI – Software Interface



GUI – Software interface

LTPOWERANALYZER SOFTWARE

Present version 1.10.0.0

The image to the right is the main software interface screen/GUI.

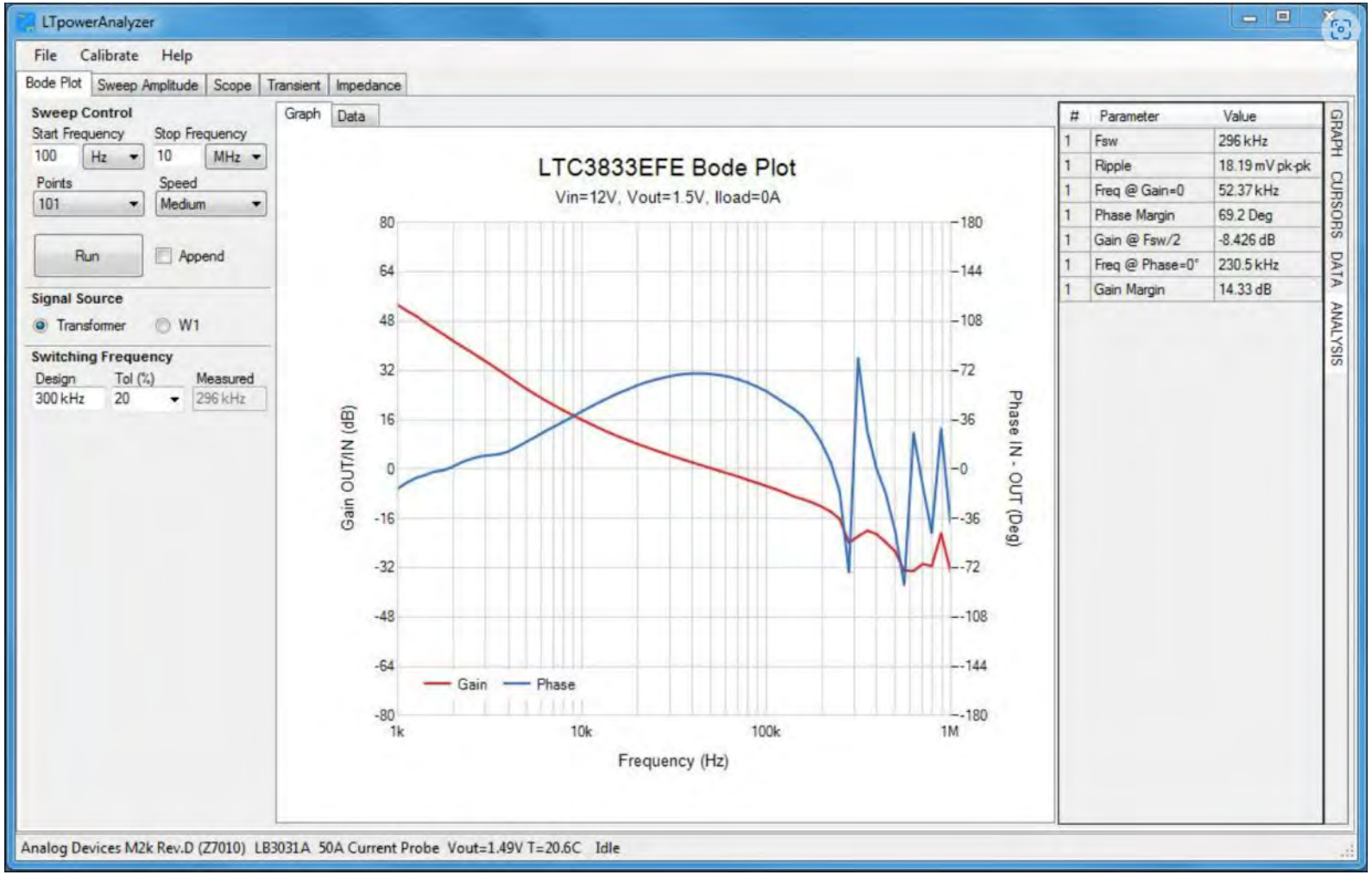
Note the control input settings on the left hand side of the graph including:

- Start/Stop Frequency
- Number of points to anayze
- Speed
- Signal Source Control
- Switching frequency of the DUT

Note the analysis data on the right side of the window content showing:

- Fsw
- Ripple
- Crossover Frequency
- Phase Margin
- Gain at half the switching frequency
- Phase crossover/0 degree frequency
- Gain Margin

Additional analysis tools are located on the vertical tabs on the far right of the window



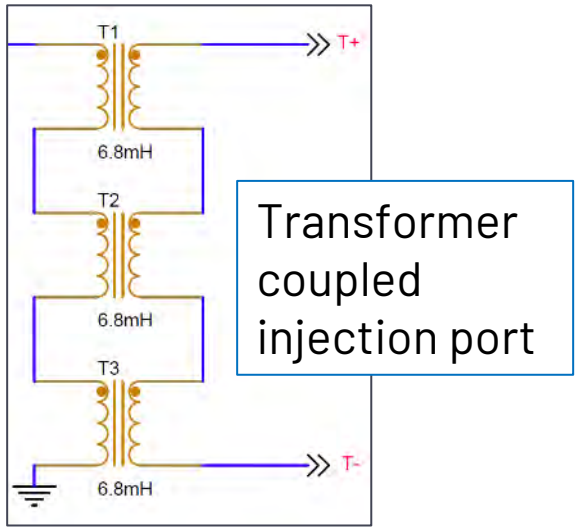
Bode Plot Tab

©2025 Analog Devices, Inc. All Rights Reserved.

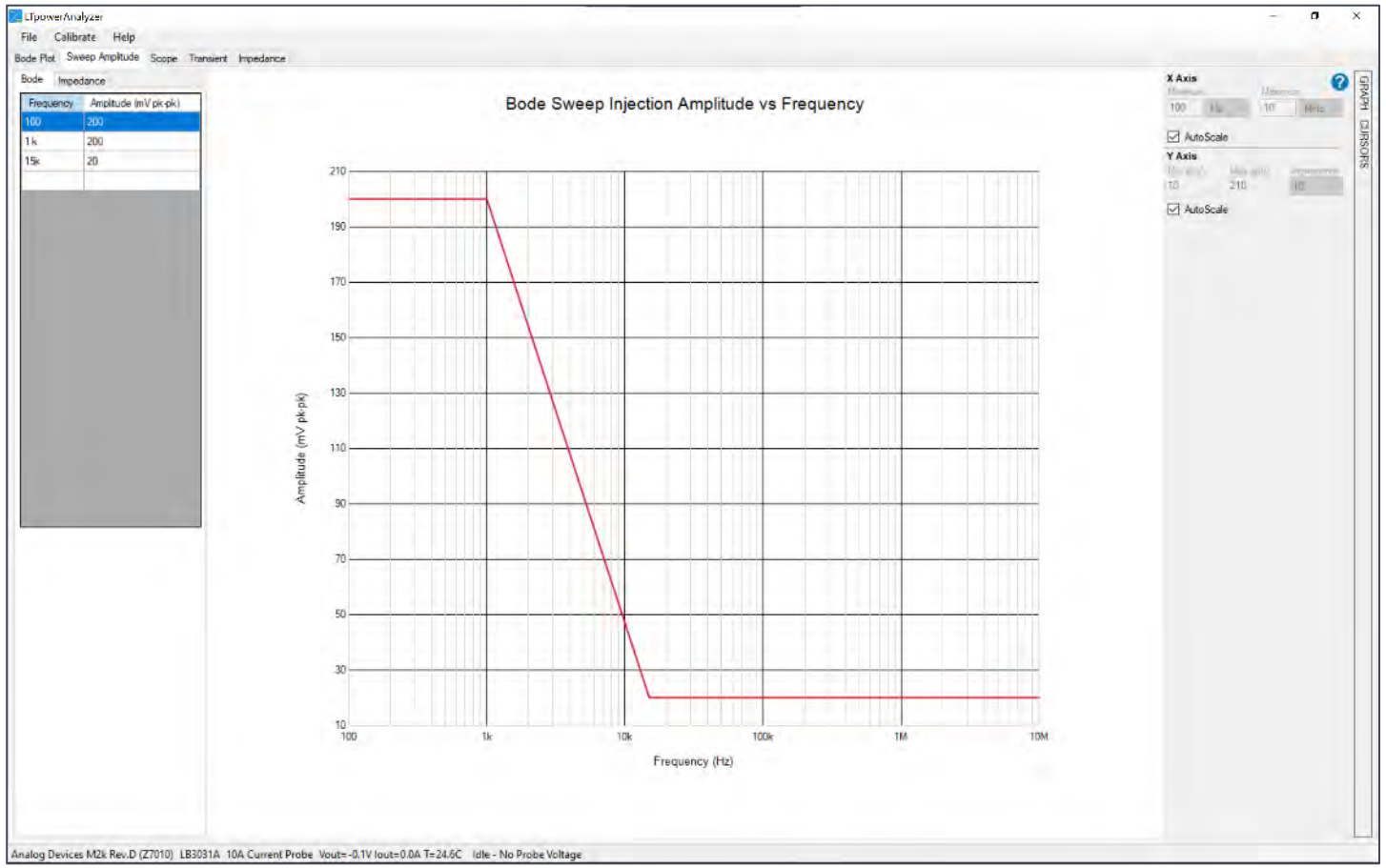
GUI – Software interface

SWEEP AMPLITUDE

- The Image on the right shows the Sweep Amplitude tab selected.
- The amplitude here is adjusted to make sure that there is sufficient output to perturbate the DUT's control loop.
- Amplitude is decreasing with frequency to prevents overdriving the control loop as the injection frequency increases.
- Note the manual limit selections on the right hand side of the window.



Transformer coupled injection port



Sweep Amplitude Tab

©2025 Analog Devices, Inc. All Rights Reserved.

GUI – Software interface

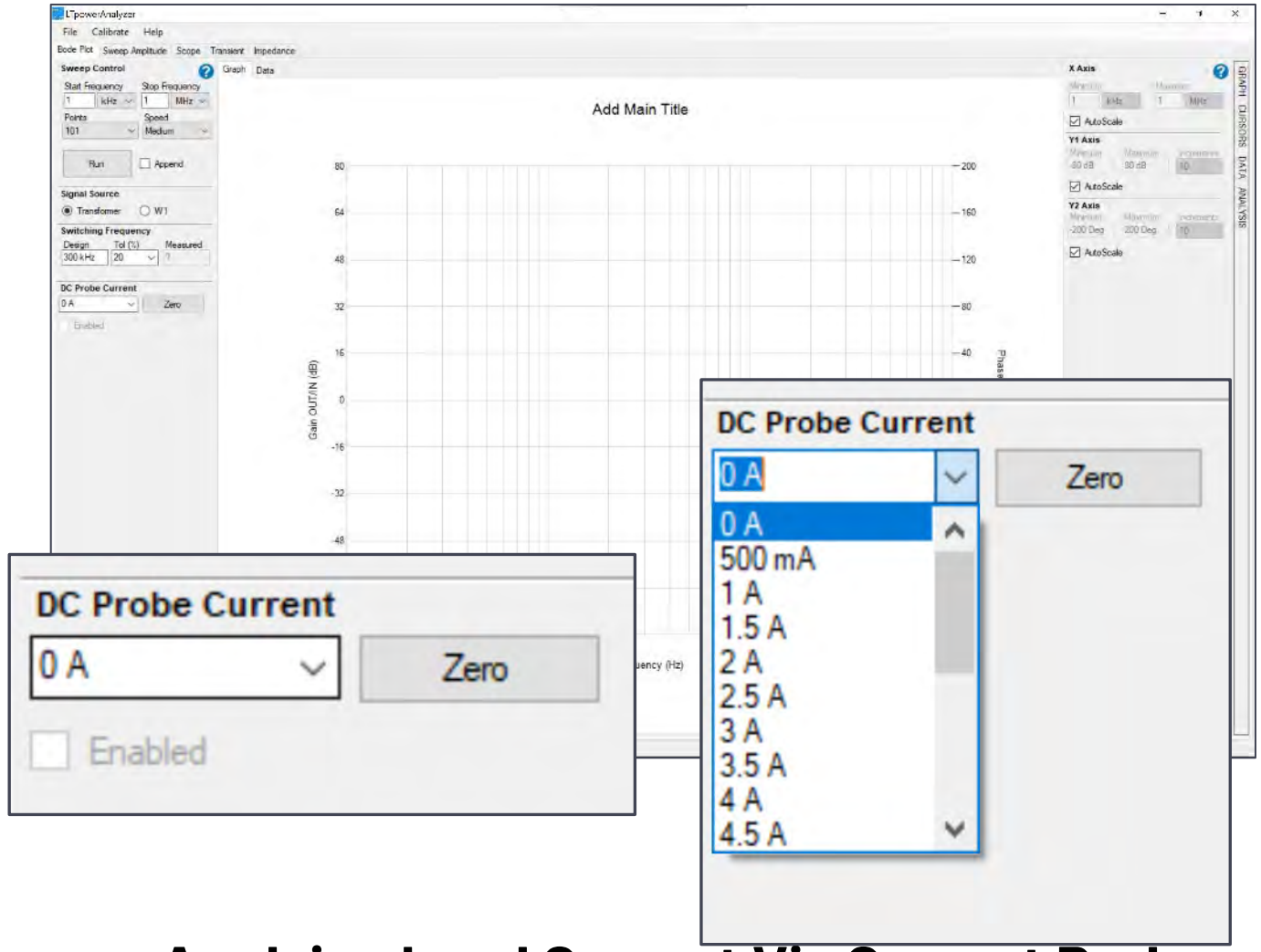
CURRENT PROBE OPERATION

In the image to the right, the controls used to operate the current probe as an electronic load.

Use the pulldown in order to select the desired current to bias the DUT output during test.

- Once the desired current is selected check the "**Enabled**" box. This will activate the output current.
- Post Bode sweep the current will automatically be returned to zero.
- The Current Probe is Power Limited to approximately 12W continuous.
  - The device will thermally protect and deactivate the output to prevent damage.

Note the included DUT has no loading. To prevent discontinuous operation. Remember to apply a load to the converter before taking BODE measurement.



Applying Load Current Via Current Probe

©2025 Analog Devices, Inc. All Rights Reserved.

GUI – Software interface

SCOPE

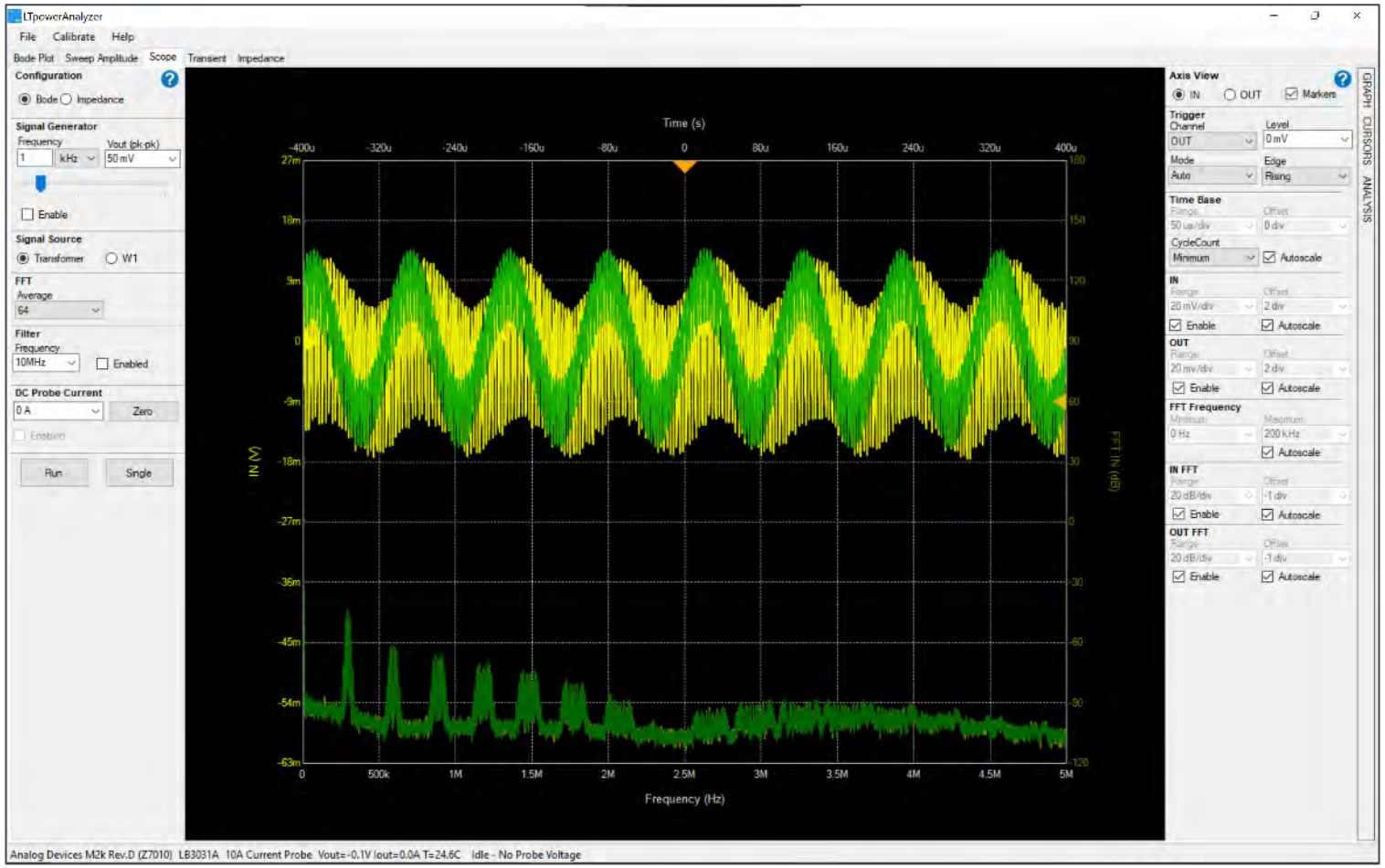
The Image on the right shows the Scope tab selected.

Note that the control inputs for the scope operation is on the left side of the graph

- Configuration:
  - Bode or Impedance setup as the present connectivity arrangement.
    - Waveform will be applied to a voltage in the Bode selection [V input]
    - Waveform will be applied as a current signal on the DUT output in Impedance selection [I input]
- Impedance/Bode Signal generator
  - Assigns the frequency and amplitude to the signal generator
  - Enable – Turns the signal generator on/off
- FFT
  - Sets the averaging for the Fast Fourier Transform output waveform
- Filter
  - Set a rejection frequency

Note the Trigger and Graph Limit settings to the right of the graph

- Axis View
  - This allows selection of the displayed waveform
  - Markers bring up the cursors

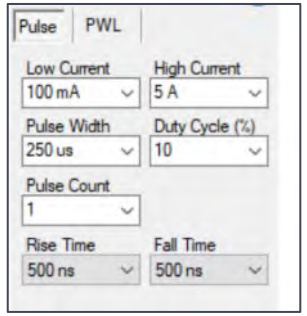


Scope Amplitude Tab

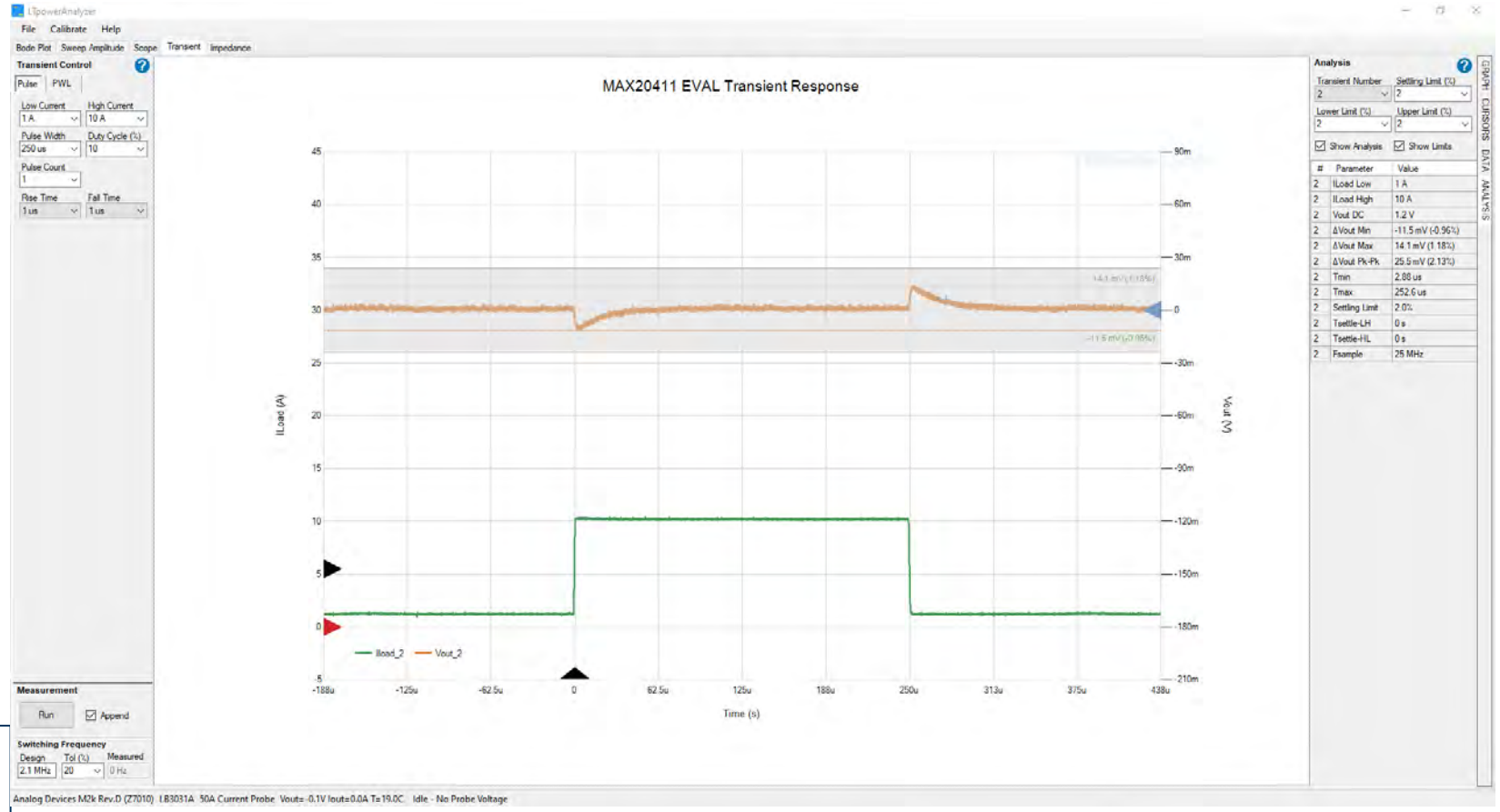
GUI – Software interface

TRANSIENT

- The Image on the right shows the Transient tab selected.
- Note “Show Limits” box is checked to the left of the graph
  - The status messages on the lower line of the window show present connection and state.
    - Note the 50A Current Probe Assembly is being used in this case
    - A maximum current of 10A has been programmed for the test
- The Pulse Selection is used to define the transient, but PWL could be used as well.
- The RUN button on the lower left executes the transient measurement.



The pulse tab is used to enter transient load parameters

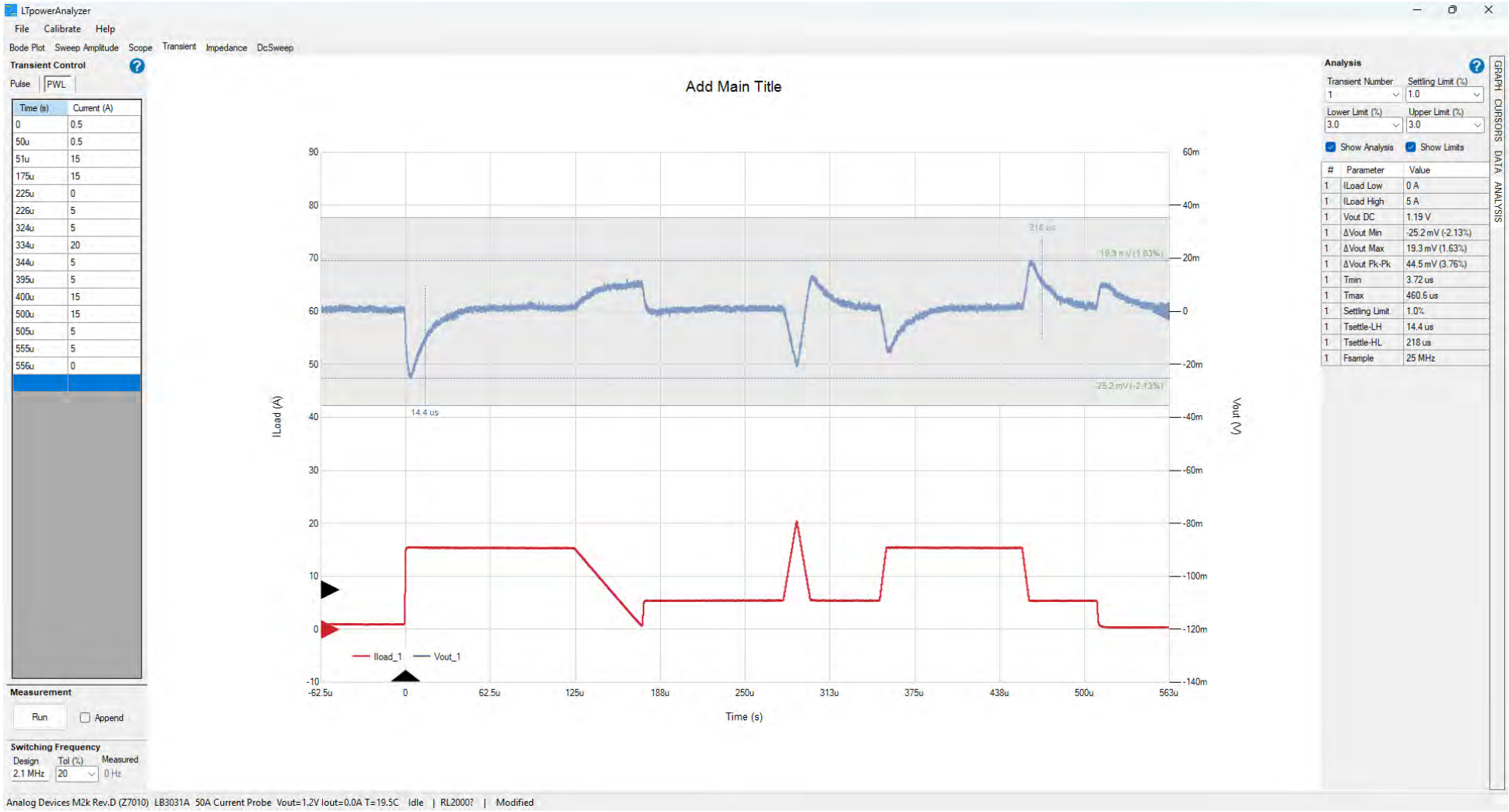


Transient Tab

©2025 Analog Devices, Inc. All Rights Reserved.

GUI – Software interface

PWL Transient testing

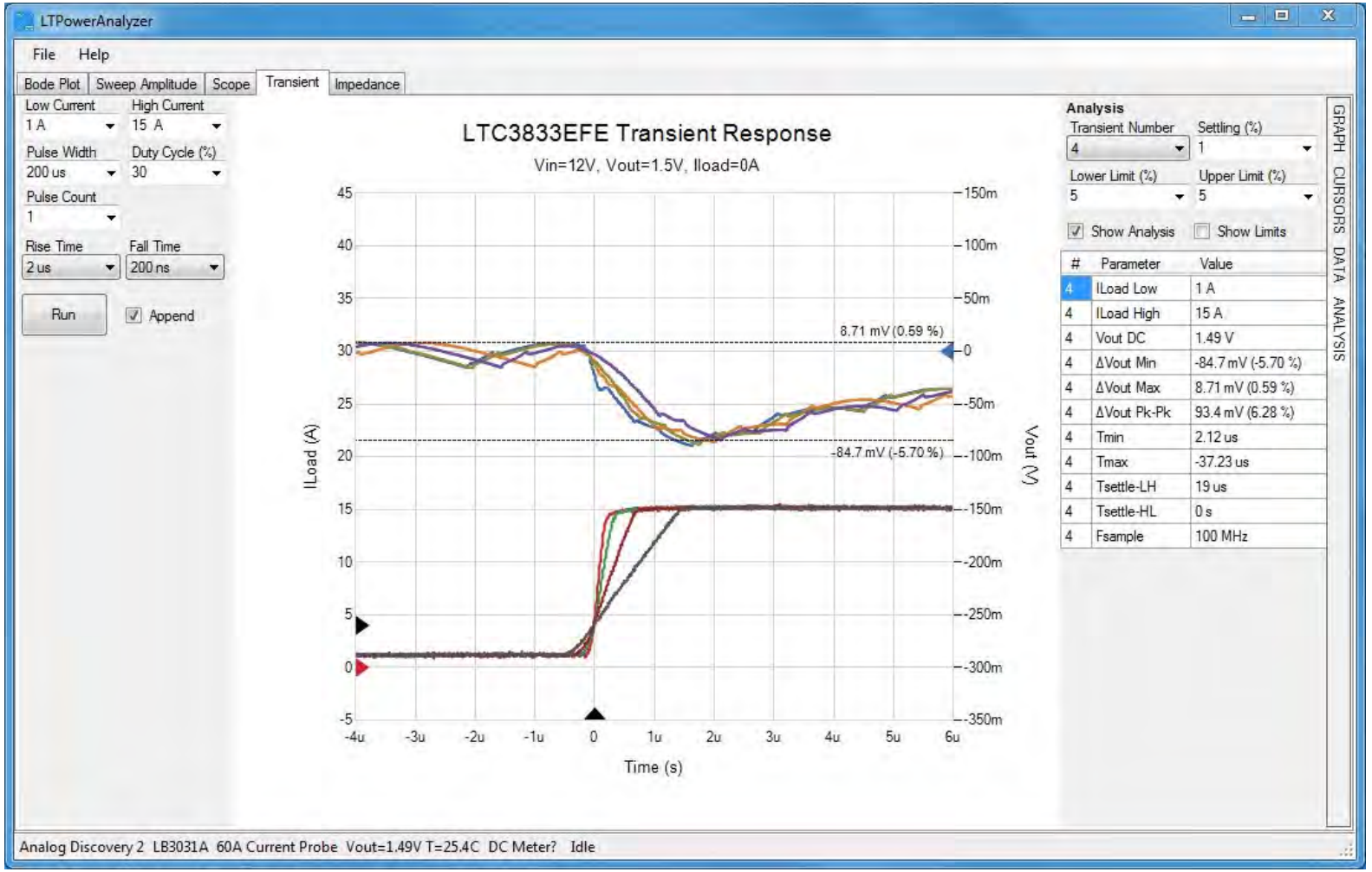


©2025 Analog Devices, Inc. All Rights Reserved.

GUI – Software interface

TRANSIENT

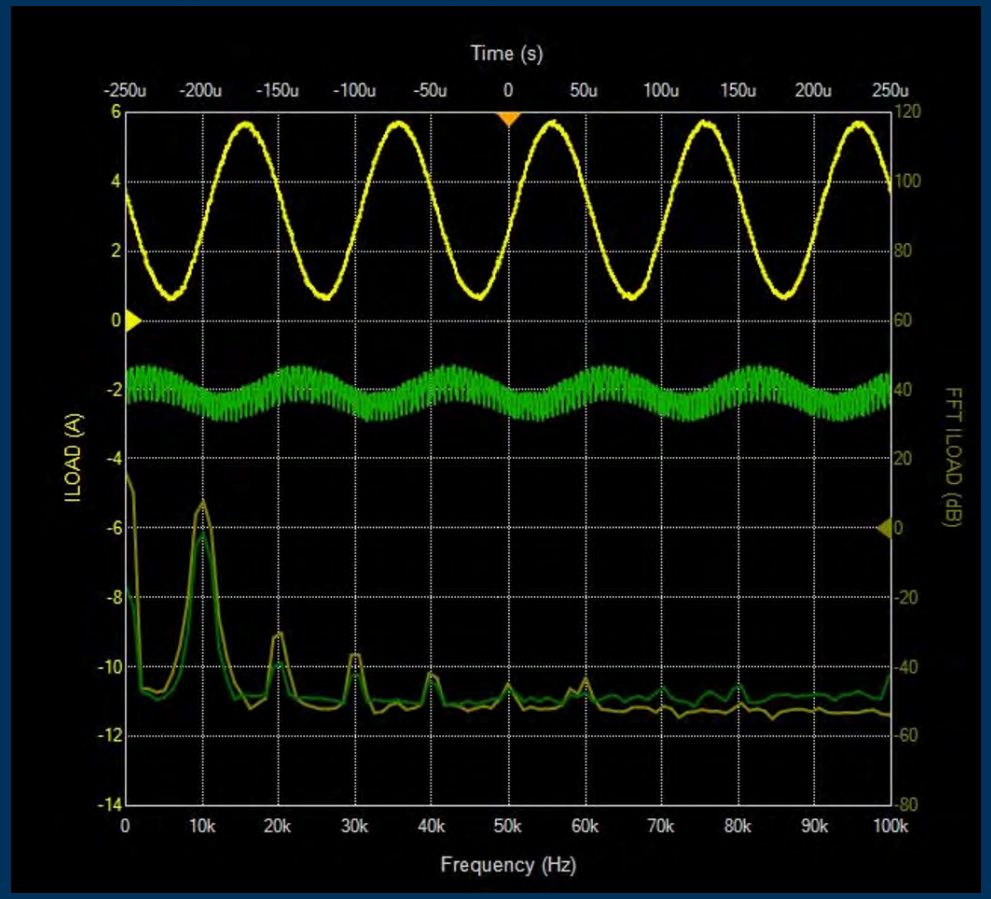
- In the example image on the right, note that the “APPEND” selection is checked.
- In this case varying edge rates of load application are examined and saved
  - The ‘append’ selection allows multiple measurements to be amalgamated for comparison and analysis.



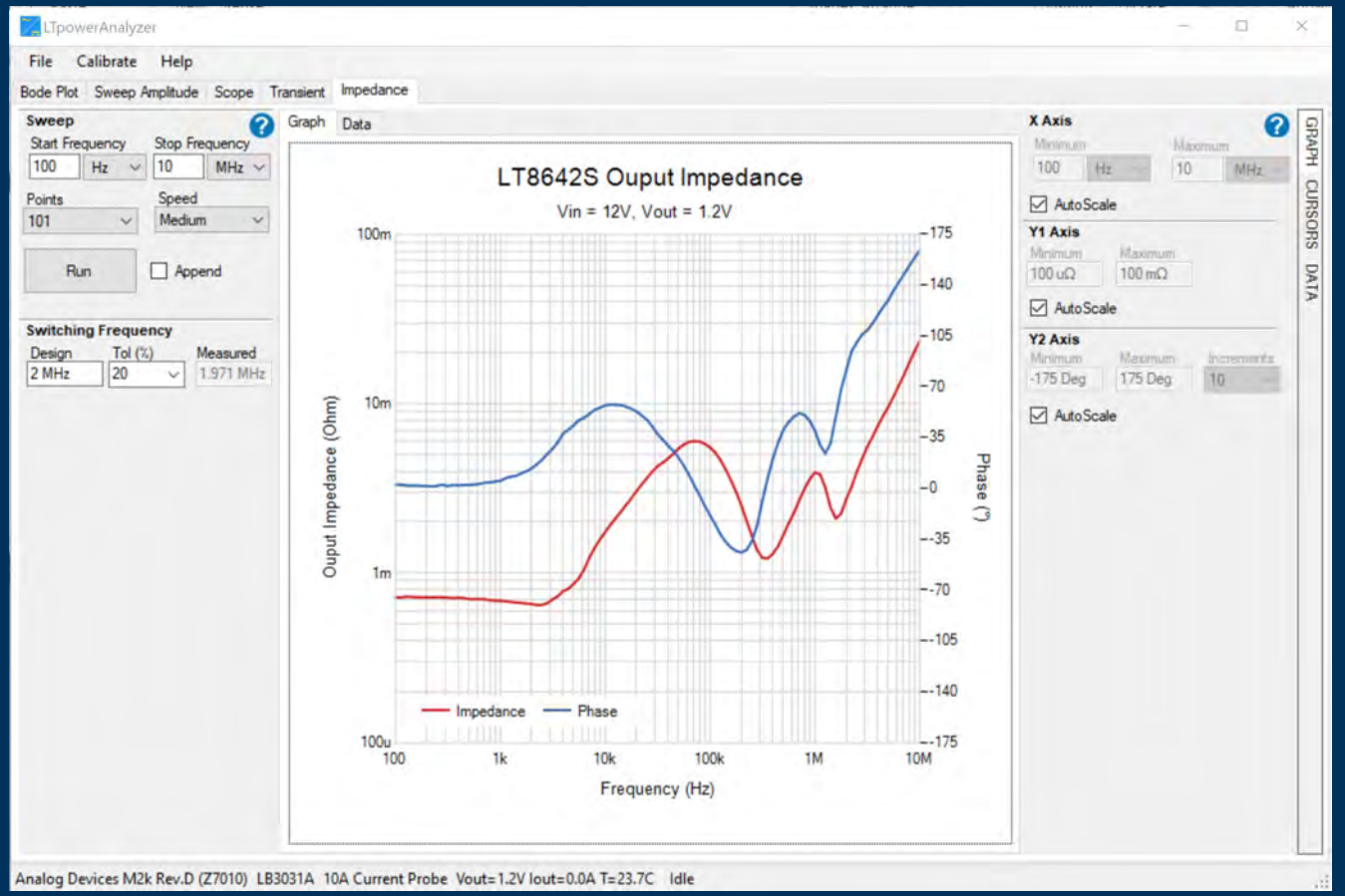
Transient Tab showing use of “APPEND” selection

©2025 Analog Devices, Inc. All Rights Reserved.

Output Impedance Measurement



LTpowerAnalyzer Impedance Waveforms



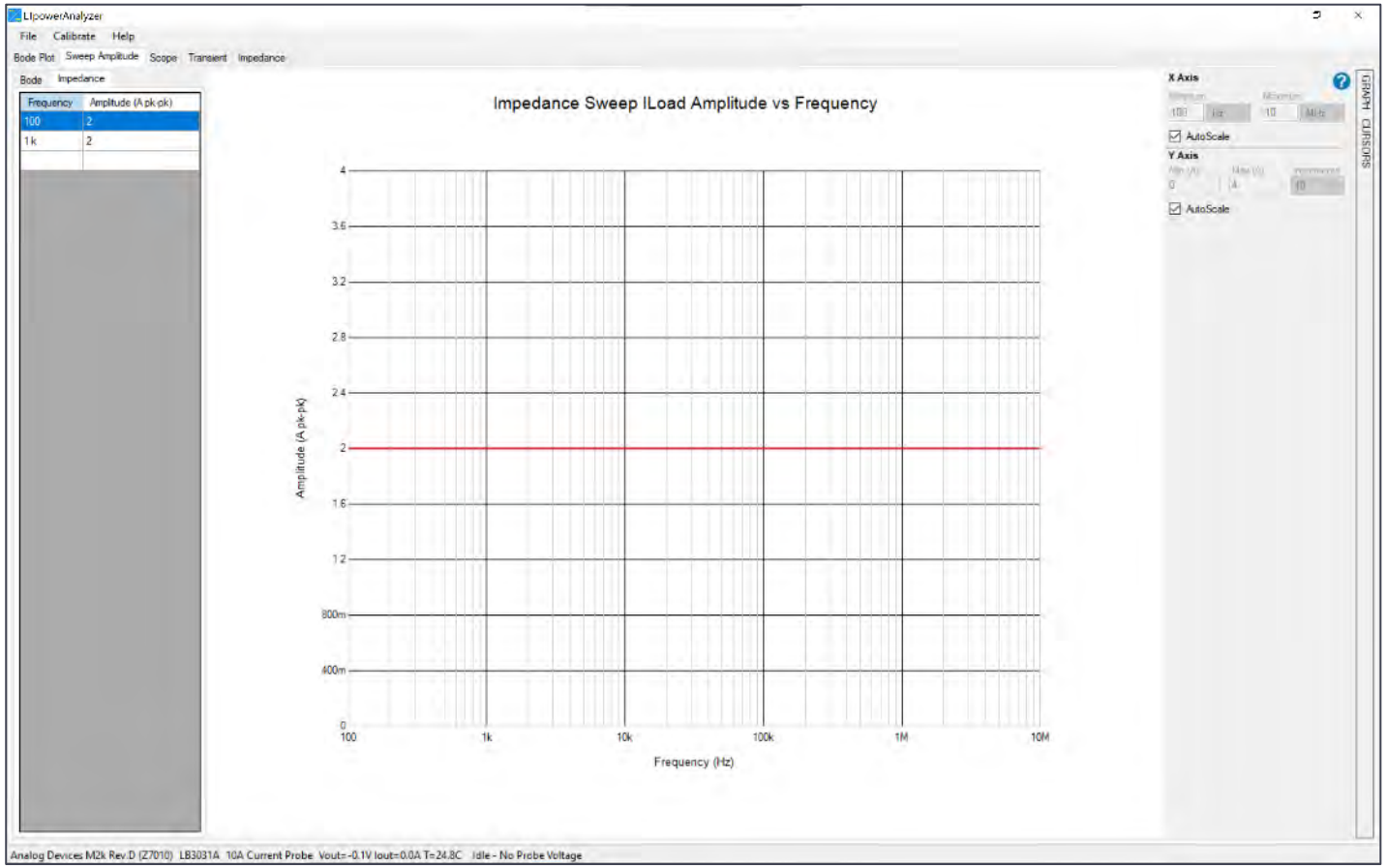
Output Impedance Measurement

©2024 Analog Devices, Inc. All Rights Reserved.

GUI – Software interface

SWEEP AMPLITUDE

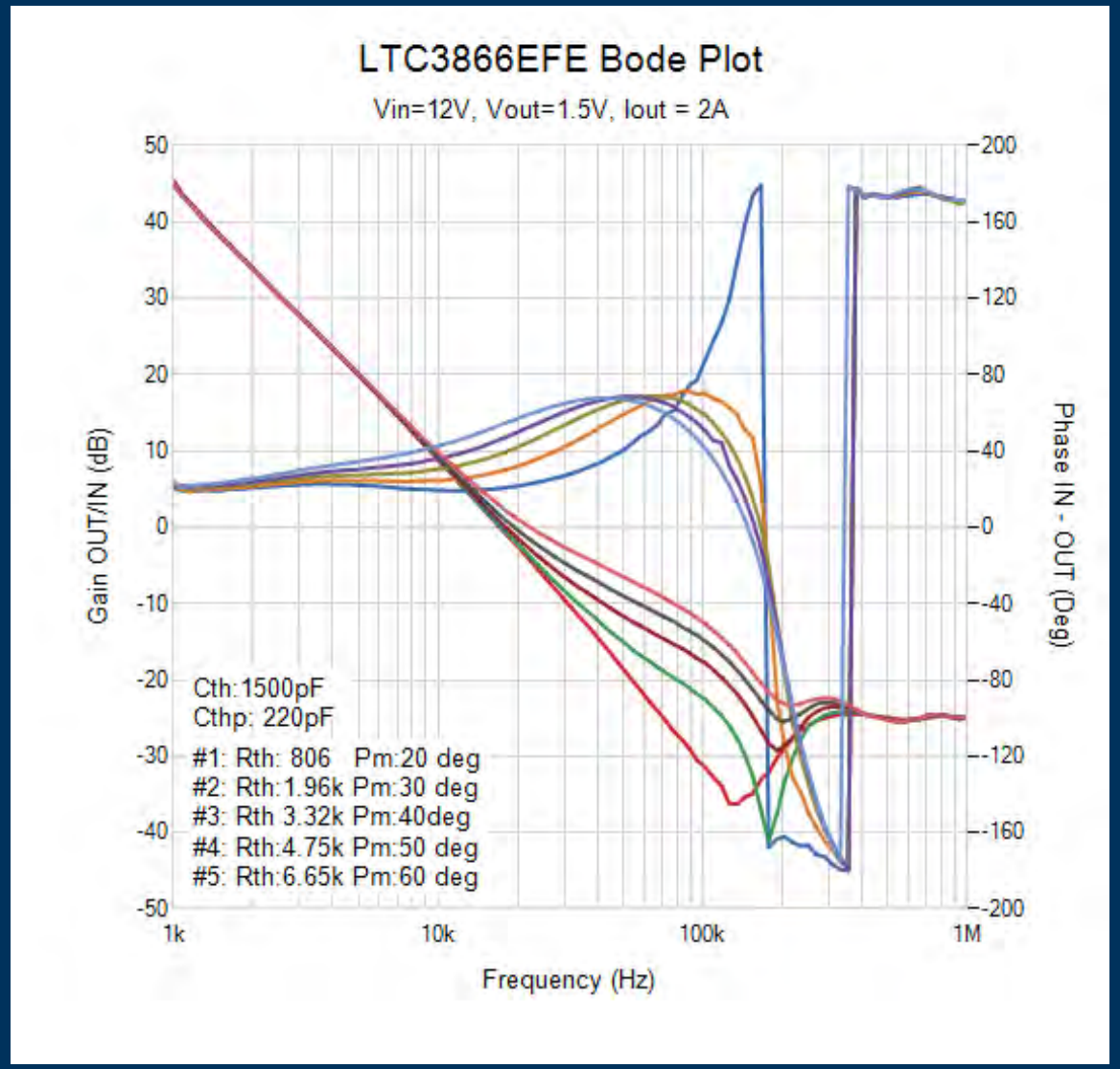
- The Image on the right shows the Sweep Amplitude tab selected. And the IMPEDANCE sub-tab selected
- This is where the output current used during impedance measurements will be applied using the Current Probe hardware
- The output is power protected so select an applicable current
  - Power at output < approx. 12W continuous.
  - Current Probe will drop out if thermal protection is activated.

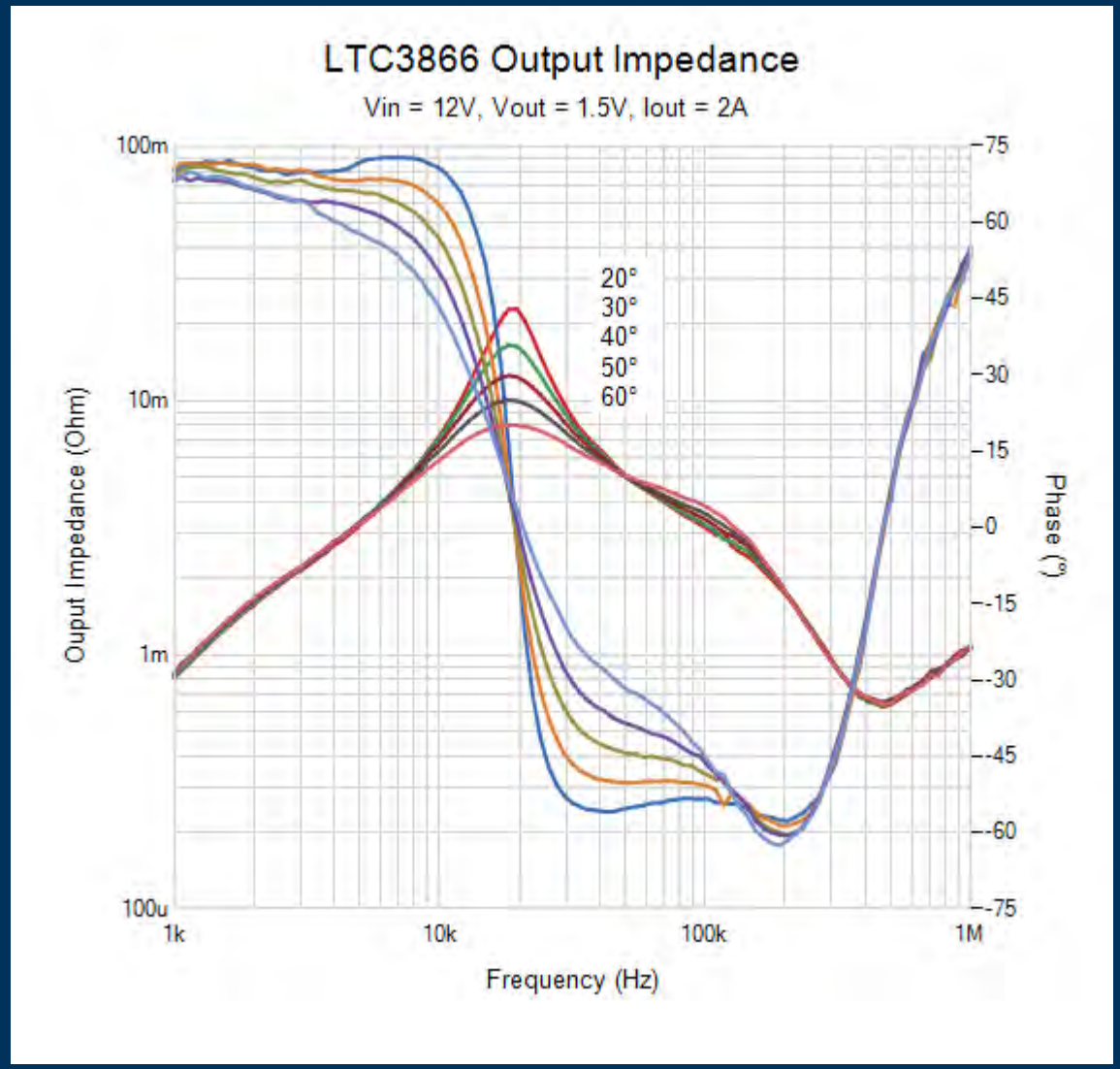


Sweep Amplitude Tab

©2025 Analog Devices, Inc. All Rights Reserved.

Measuring Phase Margin From Output Impedance





©2024 Analog Devices, Inc. All Rights Reserved.

GUI – Software interface

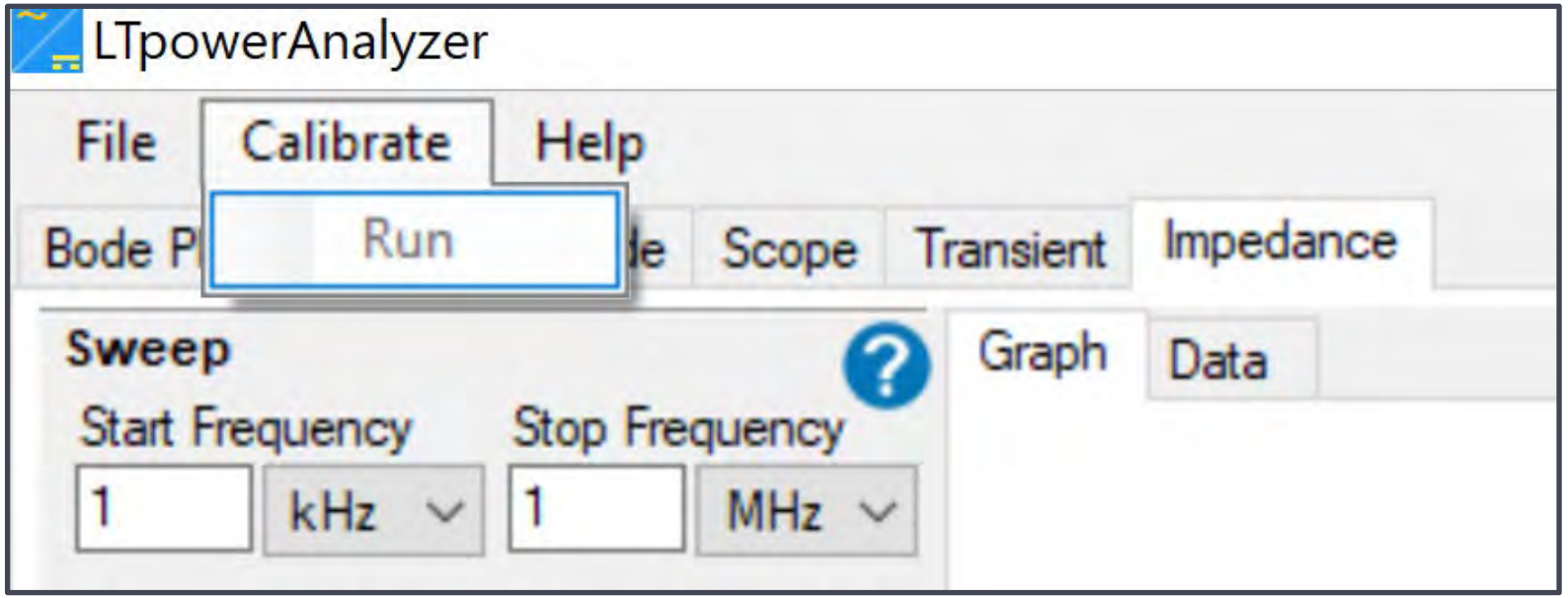
CALIBRATE OFTEN

The ADALM2000 is an excellent, low-cost test and measurement kit that is capable of high precision.

- It is sensitive to self-heating and ambient temperature changes.

There is a menu item named “calibrate”. This function should be selected and executed periodically throughout PowerAnalyzer operation.

- As the unit is plugged in and under quiescent power it will become more stable over time.
- It is still a good idea to make sure to execute this step during operation at regular intervals.



CALIBRATE OFTEN

©2025 Analog Devices, Inc. All Rights Reserved.

LTpowerAnalyzer New Features



Compensation Probe

EVAL-LTPA-COMPRB

LTpowerAnalyzer Compensation Probe

Buy Now

Overview | Documentation & Resources | Software | Related Hardware

User Guide
Rev. 0
1 View All

Evaluation Software
1 View All









Overview

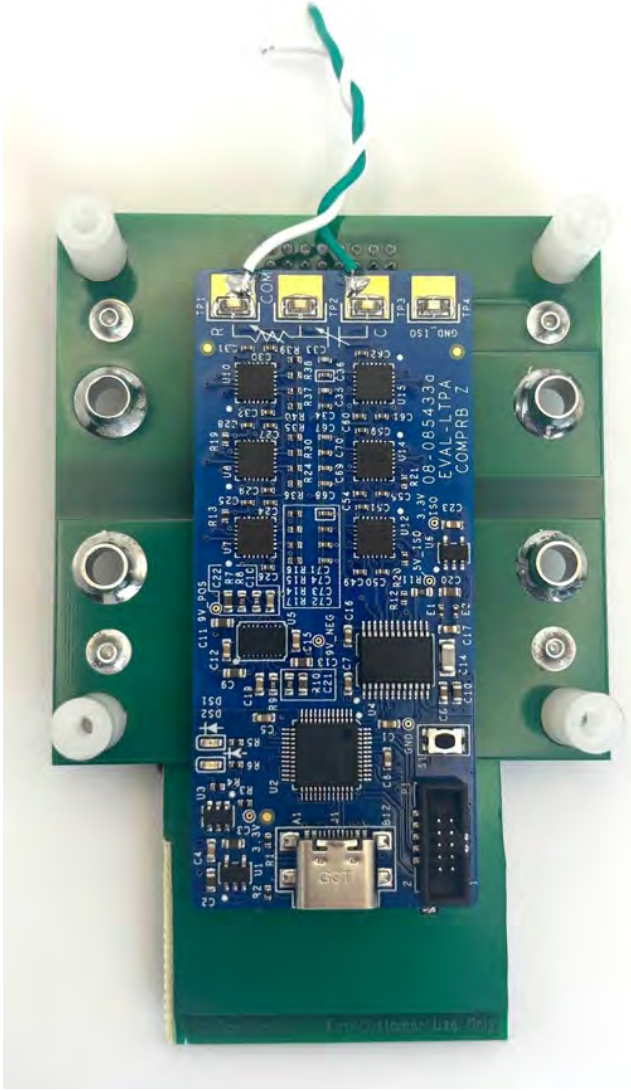
Features and Benefits | Product Details

- Programmable Series Resistance
  - Range: 511 Ω to 100 kΩ
  - Tolerance: ±1% (≤55 kΩ), ±2% (>55 kΩ)
- Programmable Series Capacitance
  - Range: 5 pF to 39 nF
  - Tolerance: ±25% (<100 pF), ±10% (≥100 pF)
- USB-C Interface
- Small form-factor (2.82” x 1.25”)

Markets and Technologies

Instrumentation and Measurement Solutions

Power Solutions



©2025 Analog Devices, Inc. All Rights Reserved.

RL2000 Efficiency Meter



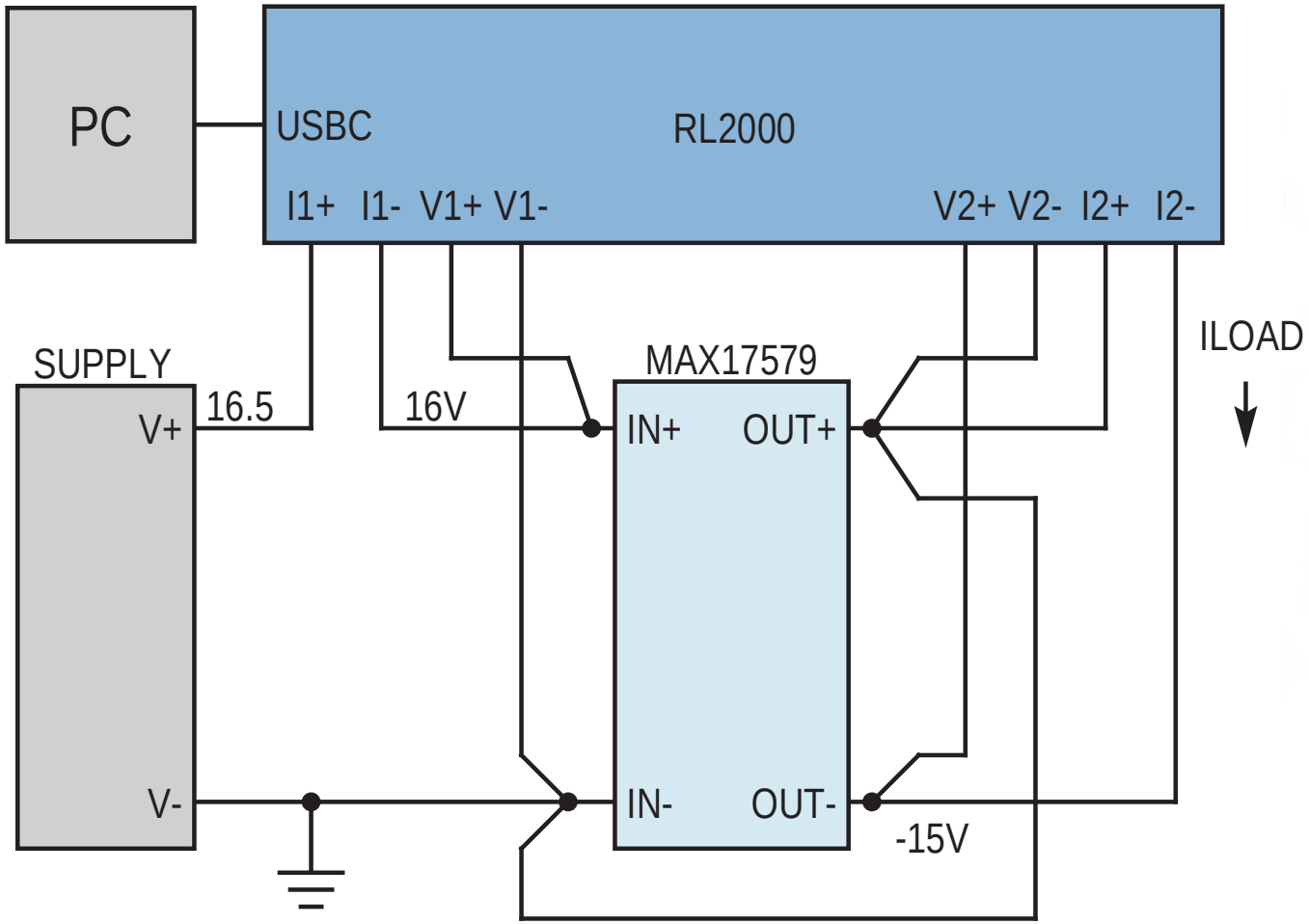
Voltmeters
Range: ± 125V
Resolution: 100nV
Z: 2 MΩ
Accuracy: 0.01% reading + 0.01% range

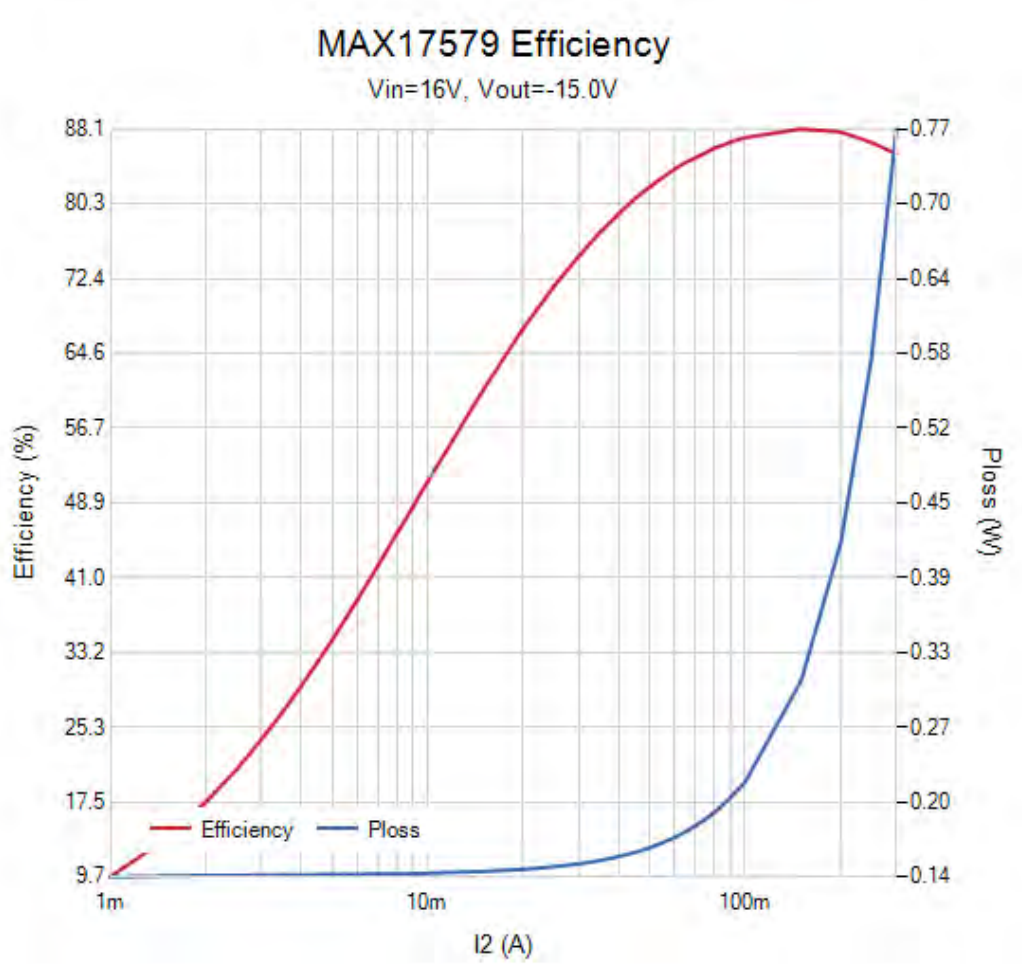
Current Meter
Ranges: 10µA, 100µA, 1mA, 10mA, 100mA, 1A, 10A, 30A
Resolution: 10nA, 10nA, 100nA, 1µA, 10µA, 100µA, 1mA, 1mA
Accuracy: 0.025% reading + 0.01% range
Programmable Voltage Drop: 0 – 5V
Max Heatsink Temperature: 80°C

Current Load
Ranges: 10µA, 100µA, 1mA, 10mA, 100mA, 1A, 10A, 30A
Resolution: 10nA, 10nA, 100nA, 1µA, 10µA, 100µA, 1mA, 1mA
Accuracy: 0.025% reading + 0.01% range
Vout max: 75V
Power max: 150W
Max Heatsink Temperature: 80°C

©2025 Analog Devices, Inc. All Rights Reserved.

RL2000 Efficiency Meter





©2025 Analog Devices, Inc. All Rights Reserved.

RL2000 Efficiency Meter

EVAL-LTPA-RL2000

LTpowerAnalyzer DC Efficiency Meter

Overview | Documentation & Resources | Software | Related Hardware

User Guide
Rev. 0
1 View All

Evaluation Software
1 View All



Overview

Features and Benefits | Product Details

- Two Isolated Voltage Measurement Channels
  - Range: ±125 V
  - Resolution: 1 mV
  - Impedance: 2 MΩ
- One Isolated Current Measurement Channel with Programmable Voltage Drop
  - Range: 10 µA, 100 µA, 1 mA, 10 mA, 100 mA, 1 A, 10 A, 30 A
  - Resolution: 10 nA, 10 nA, 100 nA, 1 µA, 10 µA, 100 µA, 1 mA, 1 mA
  - Accuracy: 0.025% Reading + 0.01% Range
  - Voltage Drop Range: 0 V to 5 V
- One Isolated Programmable Current Load
  - Range: 10 µA, 100 µA, 1 mA, 10 mA, 100 mA, 1 A, 10 A, 30 A
  - Resolution: 10 nA, 10 nA, 100 nA, 1 µA, 10 µA, 100 µA, 1 mA, 1 mA
  - Accuracy: 0.025% Reading + 0.01% Range
  - Maximum Power: 150 W
- Automatic Temperature Monitoring and Thermal Management
- Multiple meters can be used to support multi-input or high current (>30 A) applications.
- USB-C Interface

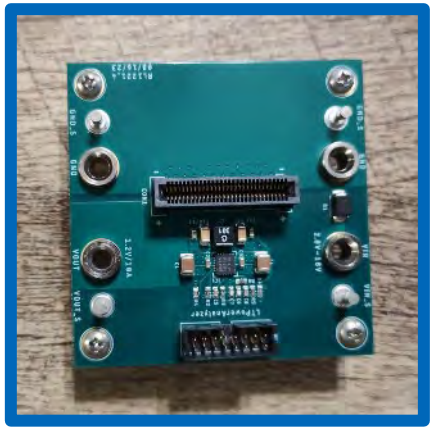
©2025 Analog Devices, Inc. All Rights Reserved.

LTpowerAnalyzer First Measurements

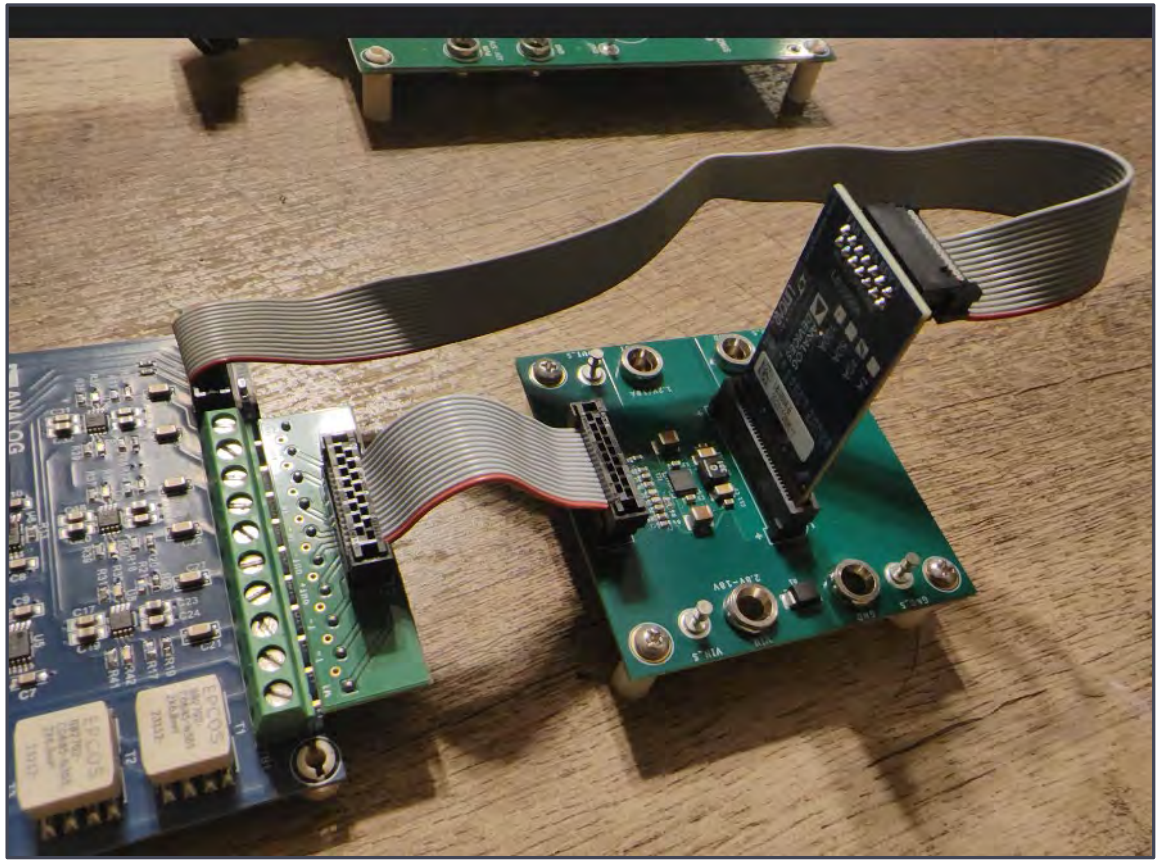


First Measurements

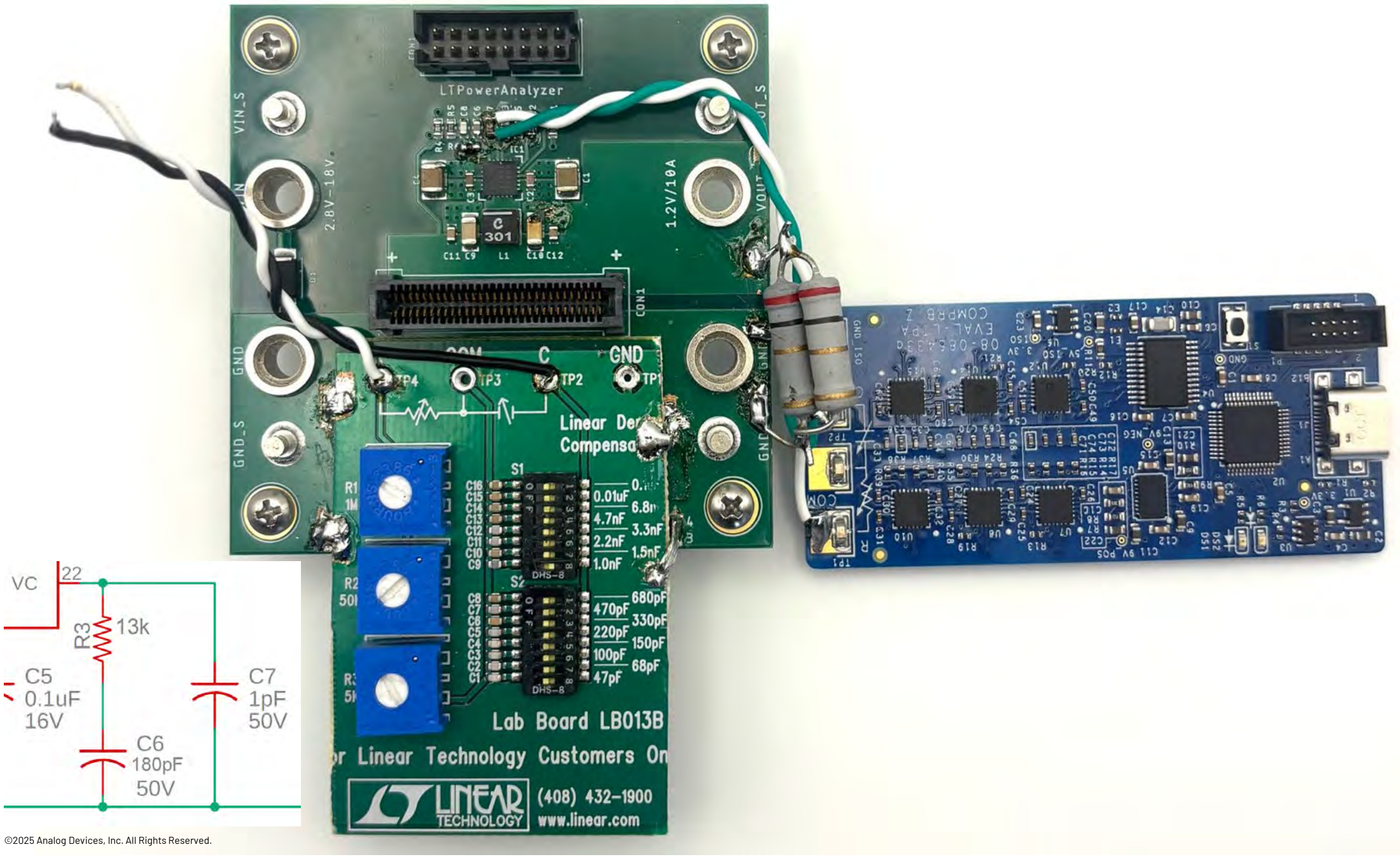
TAKING MEASUREMENTS USING THE INCLUDED LT8642S HARDWARE



- SETUP STEPS [Image of setup on Lower Right]
  - The Main Board Connector Block Should be inserted and screwed into the main board terminal block.
  - A 10A Current Probe should be plugged into the 60-pin vertical card edge port included on the DUT. [**CON1**]
    - **NOTE POLARITY MARKINGS ["+"]**
    - This provides the output for transient and DC loading, and impedance measurement.
  - **14-pin Ribbon** should be plugged in between main board and Current Probe [long ribbon]
  - **16-pin Bode ribbon** should be plugged into the Main Board Connector Block 16-pin connector and the DUT **LTpowerAnalyzer** connector.
    - The Main Ribbon Receiver should be inserted and fixed into the terminal block of the main board per the image to the right.
- Main power should be available via a bench or lab supply. [not included with kit]



©2025 Analog Devices, Inc. All Rights Reserved.

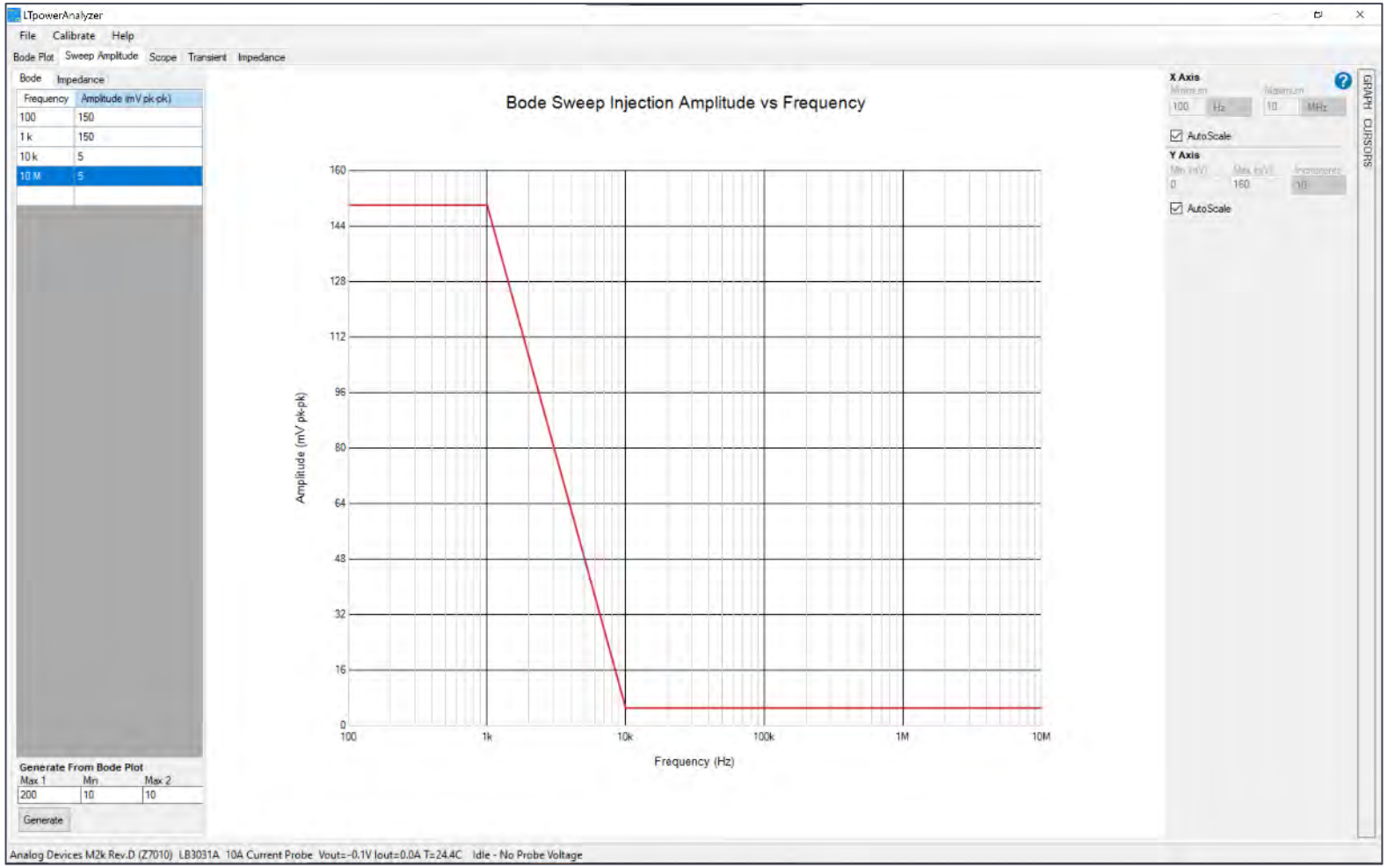


©2025 Analog Devices, Inc. All Rights Reserved.

First measurements

SWEEP AMPLITUDE

- Select the Bode sub tab
- Set the following values in **SWEEP AMPITUDE** for the following measurement.
  - **150 mV pk-pk@ 100 Hz**
  - **150 mV pk-pk@ 1 KHz**
  - **5mV pk-pk@ 10KHz**
  - **5 mV pk-pk@ 10MHz**
- This will produce an output of 150mV pk-pk from 100Hz to 10KHz
- At 80KHz+ the amplitude will be 5mV pk-pk
- The output amplitude will be linearly interpolated between 10KHz and 80KHz
  - Starts @ 150mV
  - Ends @ 5mV
- The display should appear similar to the screen capture on the right



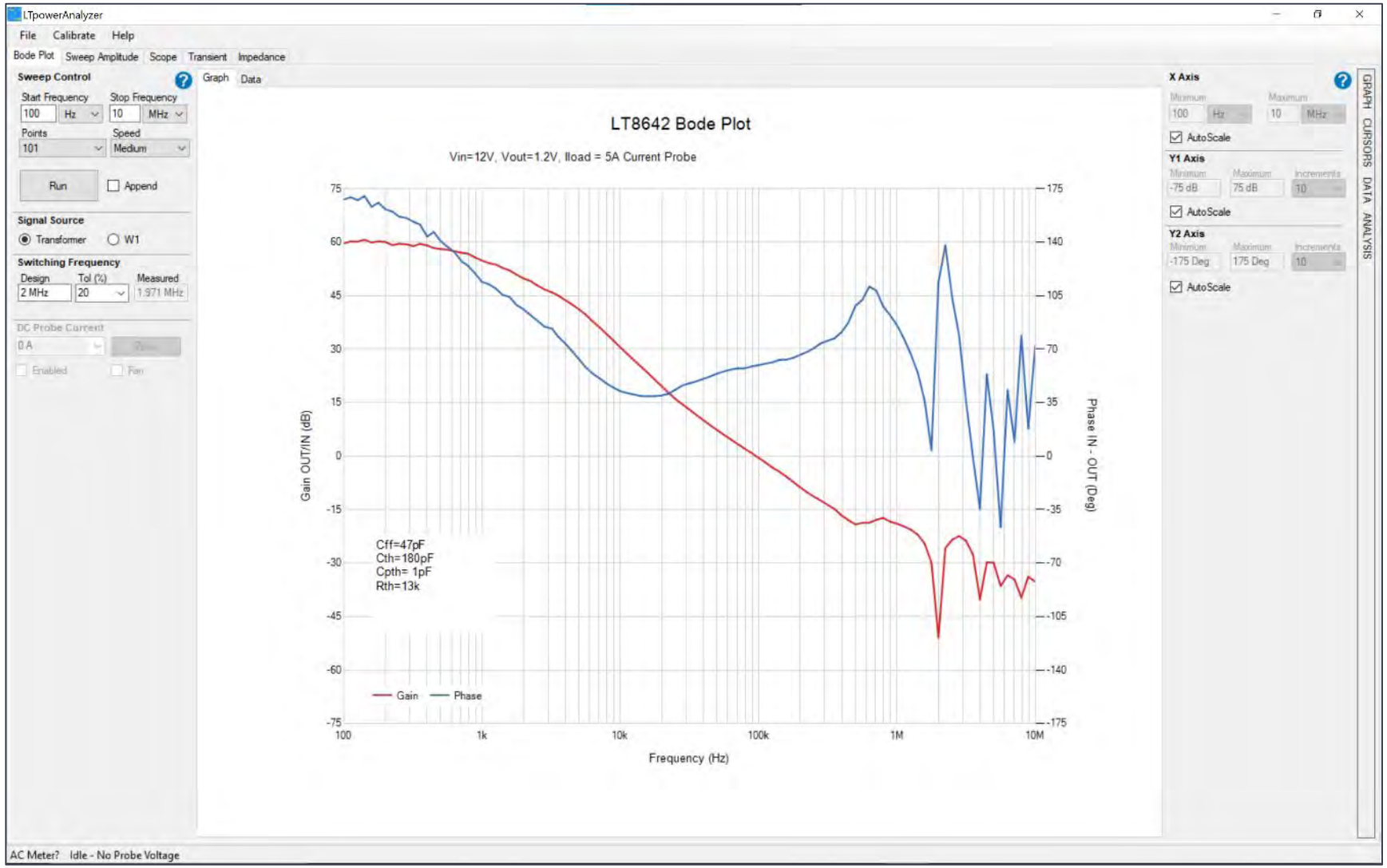
Sweep Amplitude Settings

©2025 Analog Devices, Inc. All Rights Reserved.

First measurements

BODE PLOT EXECUTION

- **Calibrate!**
- Set the control fields in the **BODE** tab to the following values.
  - **Start Freq: 100 Hz**
  - **Stop Freq: 10 MHz**
- **Select Points: 101**
- **Select Speed: Medium**
- **Signal Source: Transformer**
- Set the Switching Frequency Field to
  - **2 MHz**
  - **Tol(%): 20**
- **Calibrate!**
- Apply power to the DUT
- Press the **RUN** button
- The measurement should appear similar to the image on the right

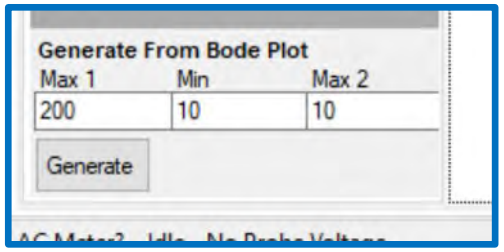


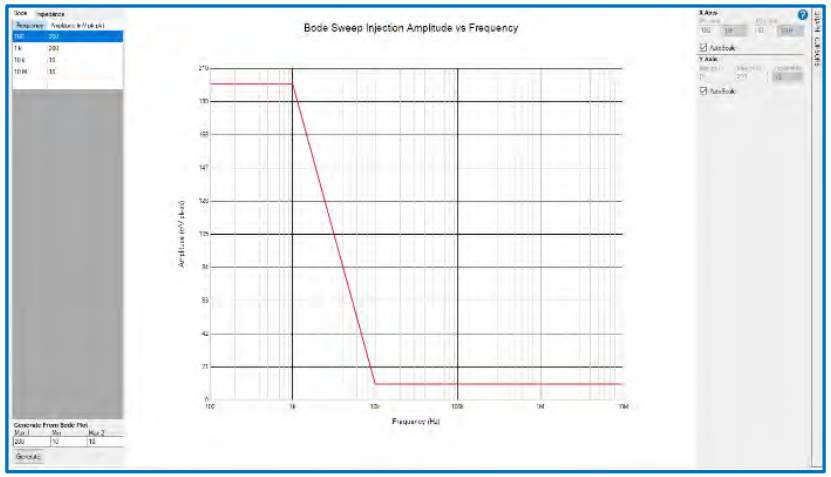
©2025 Analog Devices, Inc. All Rights Reserved.

First measurements

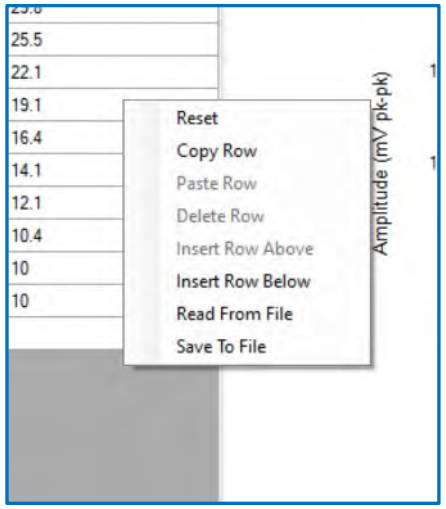
SWEEP AMPLITUDE AUTOMATIC SWEEP AMPLITUDE GENERATION

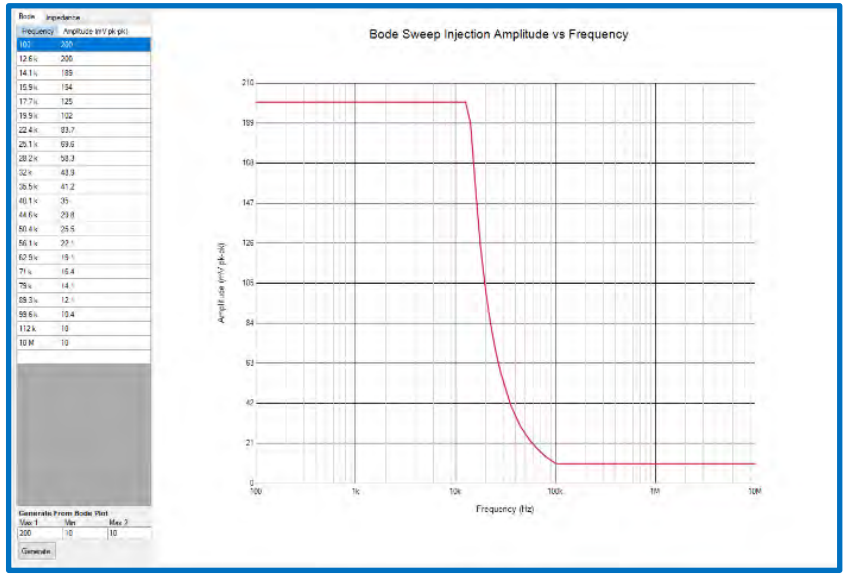
- After the initial sweep, the tool can make an analytic determination of the necessary output level from the injector across varying frequency in order to maximize the SNR of the measurement.
- At the bottom-left corner of the sweep amplitude screen press the “generate” button.
- An automatically generated curve will result based on the results of the initial Bode Plot.
  - Rerun the Bode with the new settings.
- To reset the settings float the cursor over the table and right click. Select “RESET”. This will reset the table to the default values.





Initial Sweep Amplitude Setting





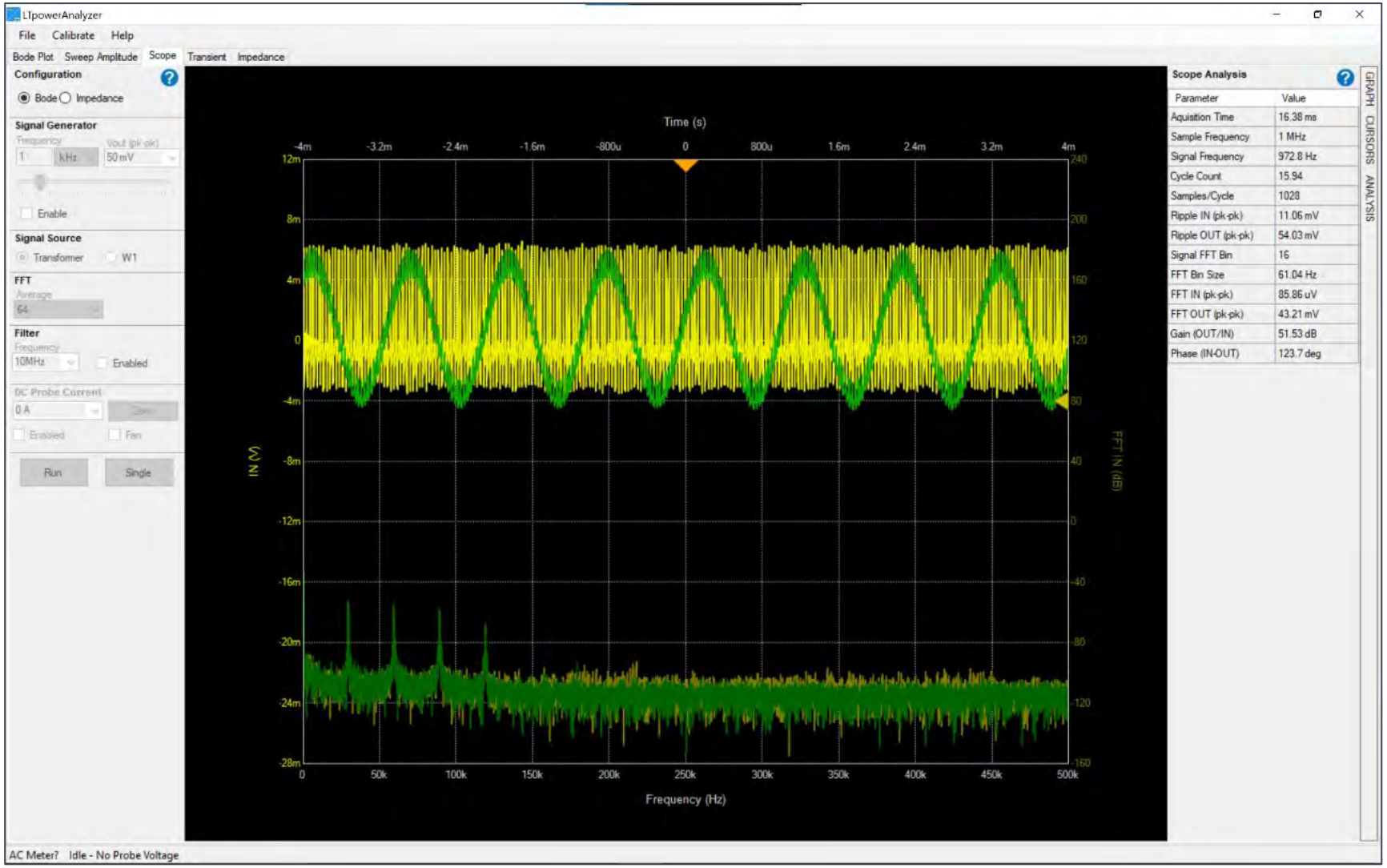
Generated Sweep Amplitude Settings

©2025 Analog Devices, Inc. All Rights Reserved.

First Measurements

SCOPE OPERATION

- Select the **SCOPE** tab
- Select **BODE** Configuration
- In the **Signal Generator** section enter the following:
  - **Frequency:** 1 kHz
  - **Vout (pk-pk):** 50 mV
- **Select the following:**
  - **Signal Source:** Transformer
  - **FFT: Average:** 64
  - **Filter:** 10 MHz, Disabled [no filtering]
  - **DC Probe Current:** 0 A, Disabled [no DC current into Current Probe]
- Press the **RUN** button
- The measurement should appear similar to the screen capture on the right

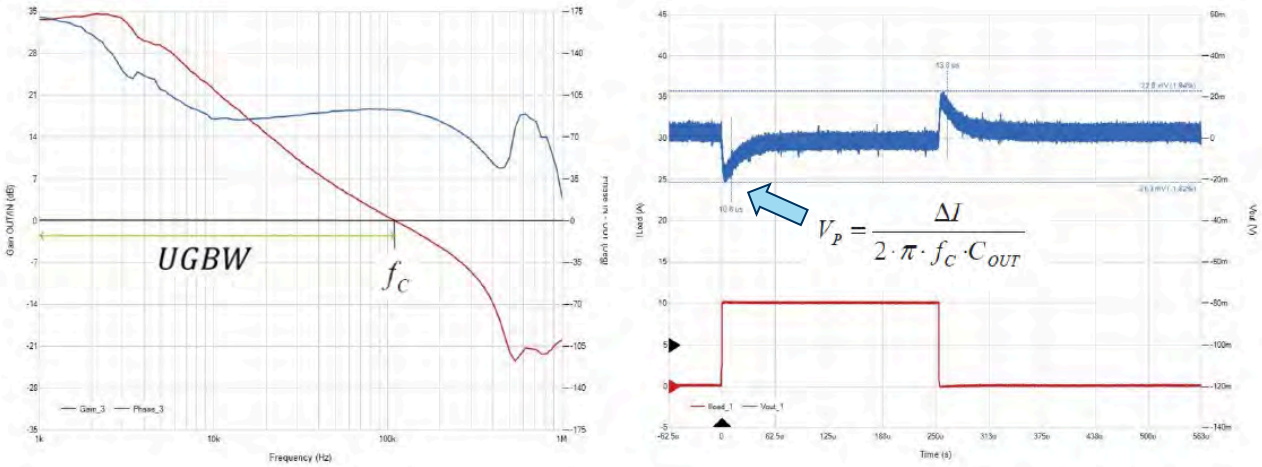


©2025 Analog Devices, Inc. All Rights Reserved.

Transient Testing

What matters?

- The Bode Plot and transient load step to predict stability and transient load step response



Increasing UGBW (Fc) OR Cout reduces Vp. Increasing Cout is a cost problem but also a control problem as it can limit the crossover frequency (Fc):

$$UGBW\,(Hz) = \frac{gm * Rcomp}{2\pi * Rcs * Cout}$$

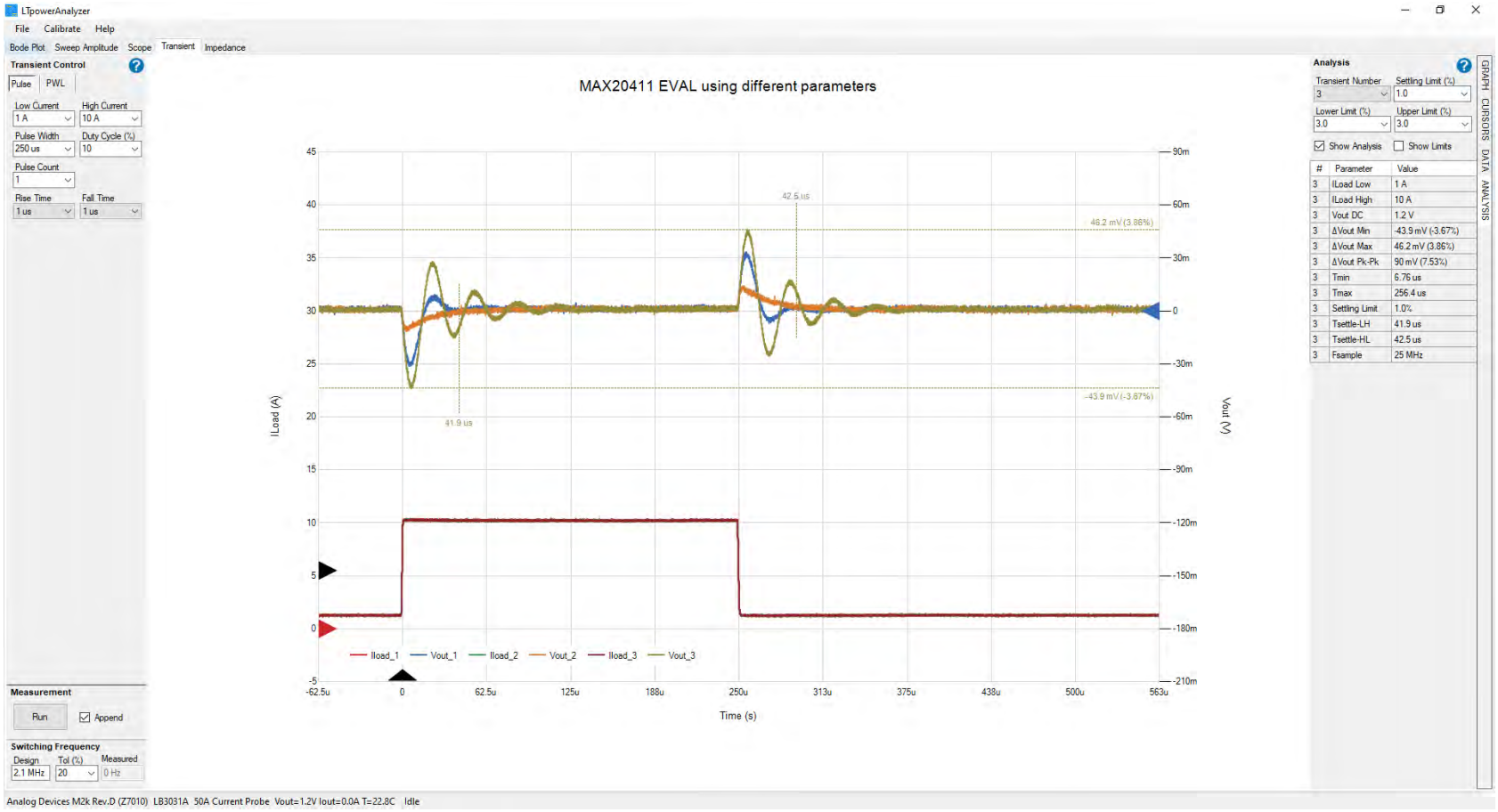
©2025 Analog Devices, Inc. All Rights Reserved.

Transient Testing

TRANSIENT TESTING

In the example to the right, the Current Probe was used to transiently excite the output at varying currents with "**Append**" checked.

Its easy to see how the response varies as Rcomp and gm change.



©2025 Analog Devices, Inc. All Rights Reserved.

Transient Testing

BODE PLOT

- The image to the right shows the output of the MAX20411-EVAL converter when Bode analysis was run.
- The analysis was made while changing IC parameters via JCOM GUI.



©2025 Analog Devices, Inc. All Rights Reserved.

Output Impedance

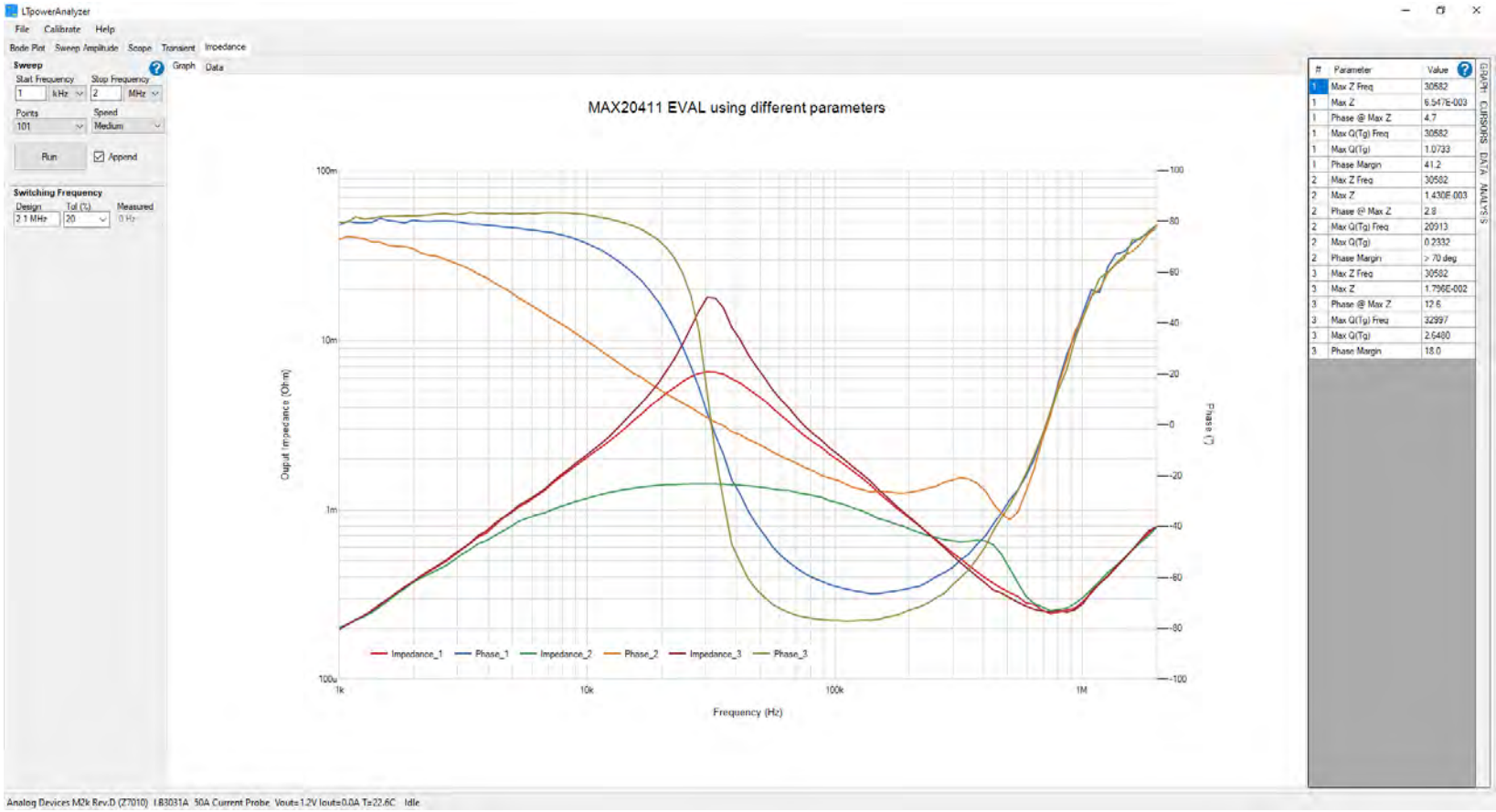
OUTPUT IMPEDANCE TESTING

The screen shot on the right shows the output of an Output Impedance sweep on the MAX20411-EVAL board.

A 3A amplitude was used for this plot.

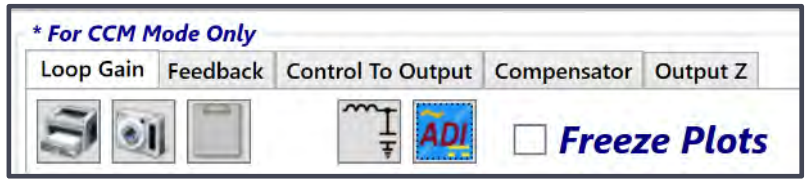
Bode | Impedance

Frequency	Amplitude (A pk-pk)
100	3
1 k	3

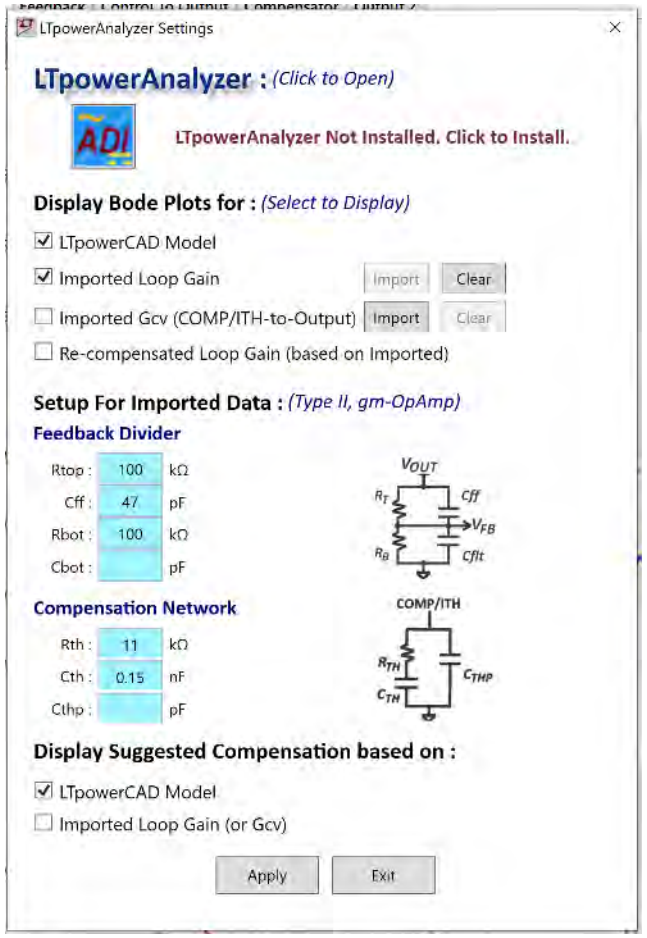


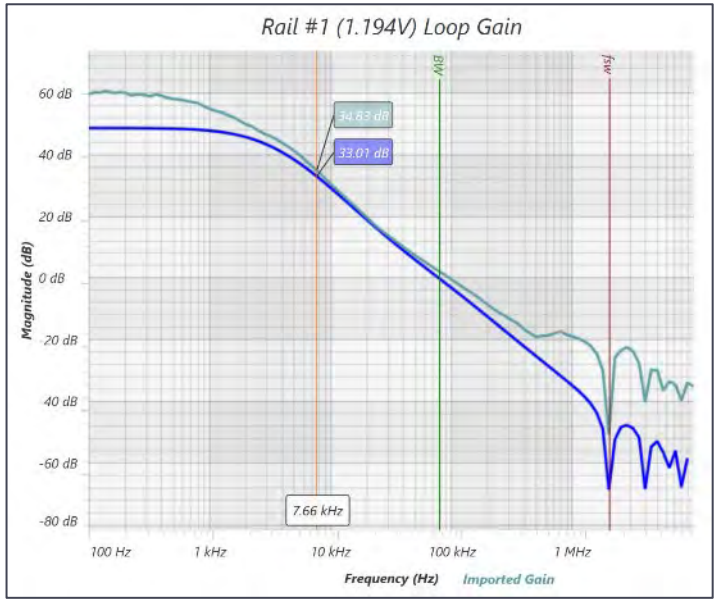
©2025 Analog Devices, Inc. All Rights Reserved.

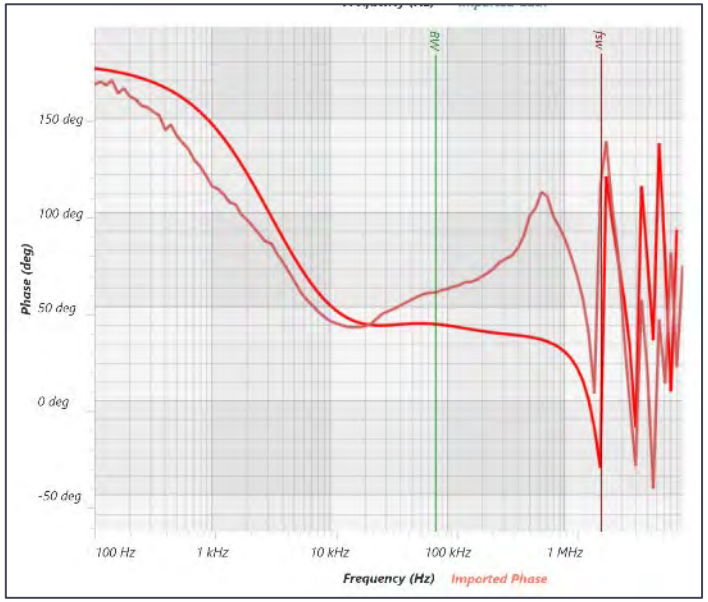
LTPowercad integration

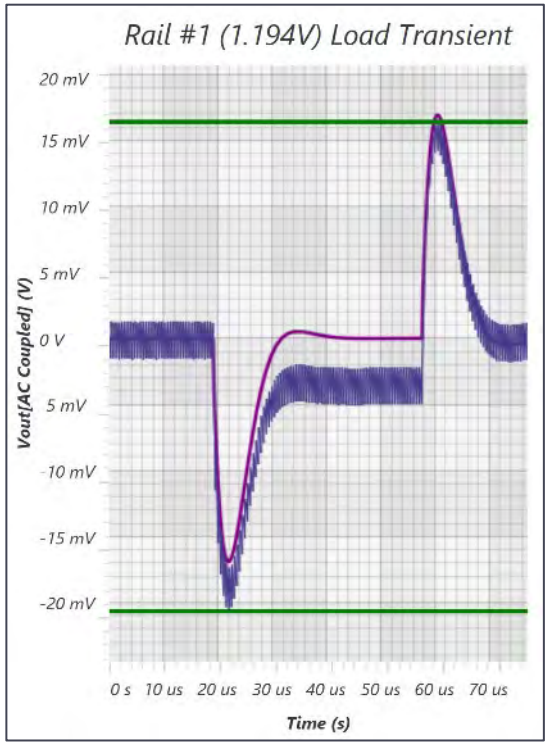


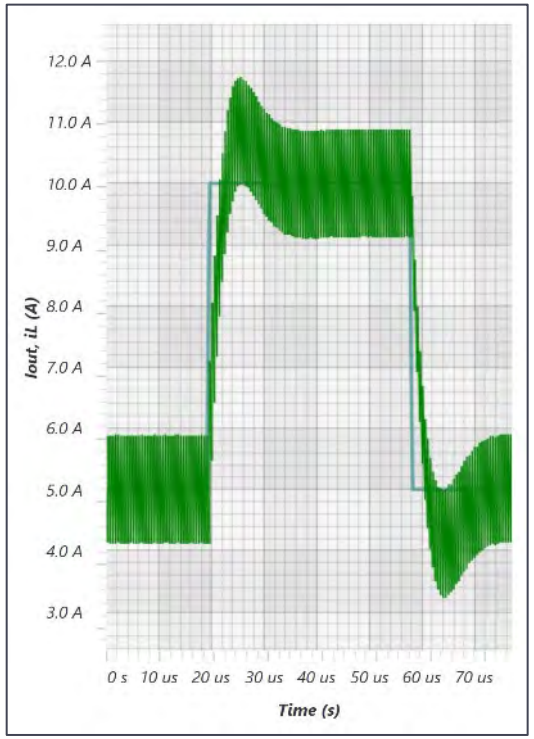








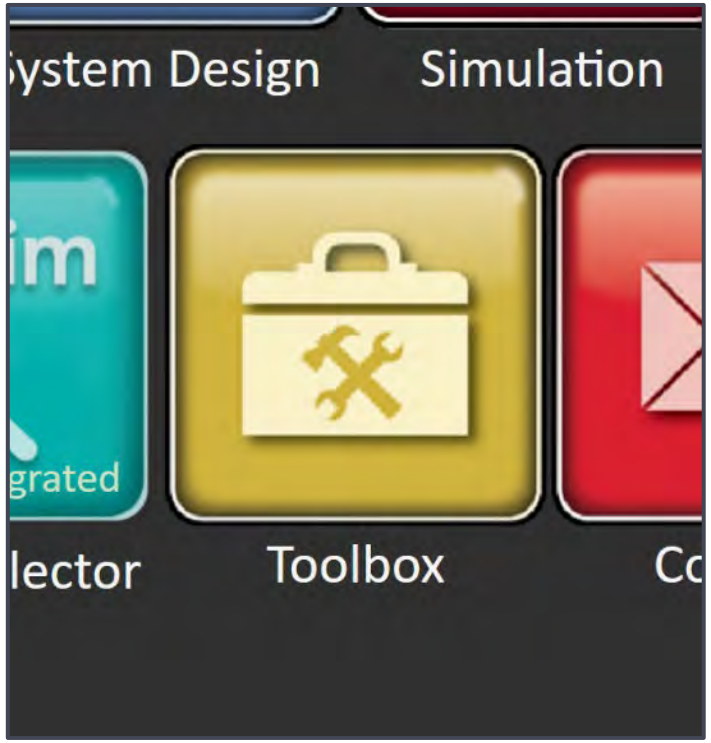


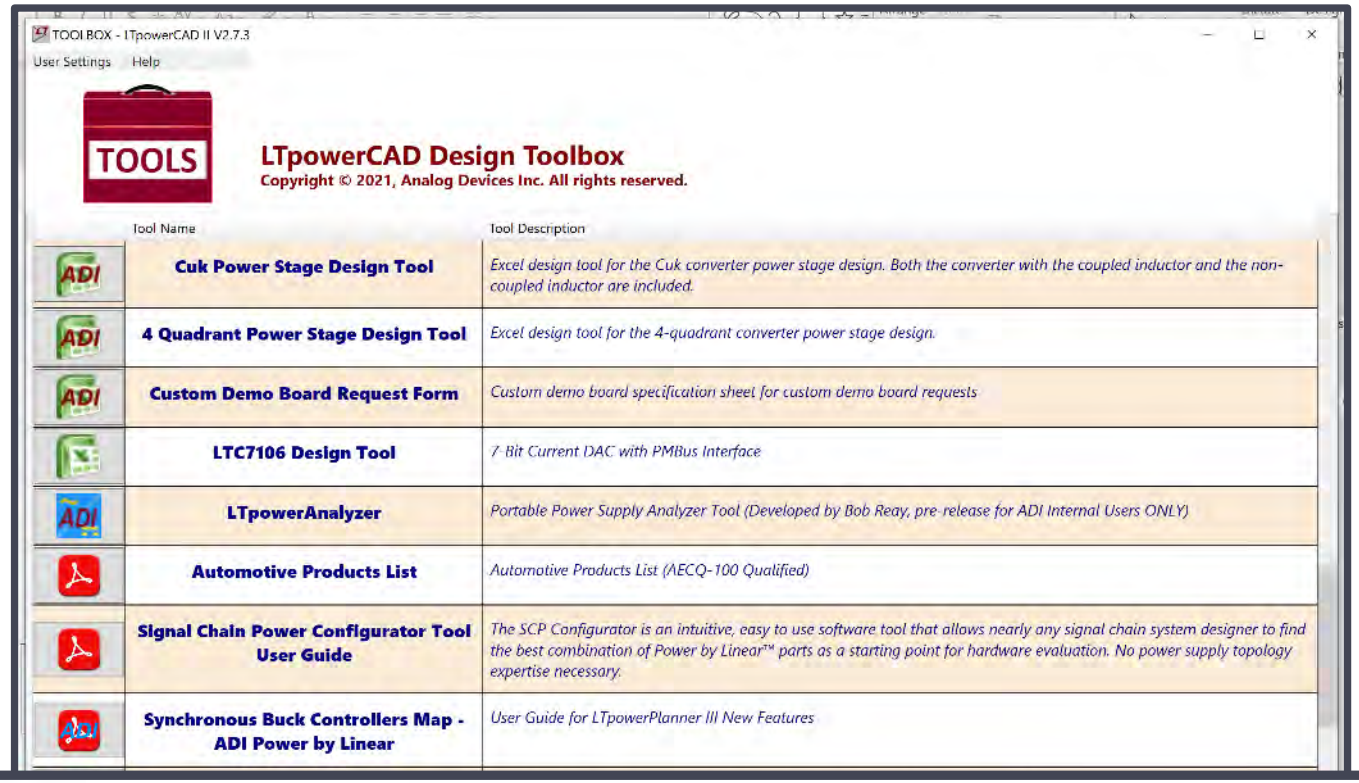


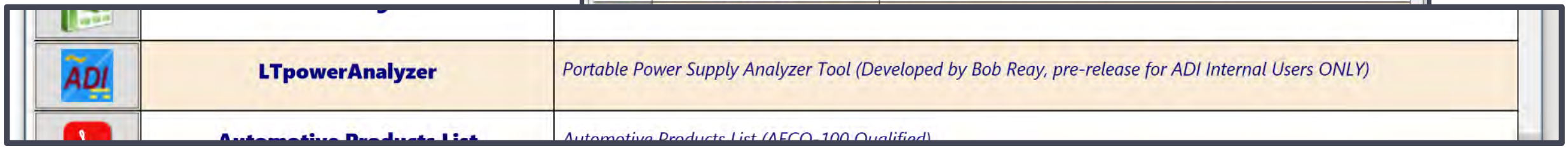
©2025 Analog Devices, Inc. All Rights Reserved.

How to get the software

THE LINK TO DOWNLOAD THE SOFTWARE CAN BE FOUND IN THE LTPOWERCAD TOOLBOX MENU





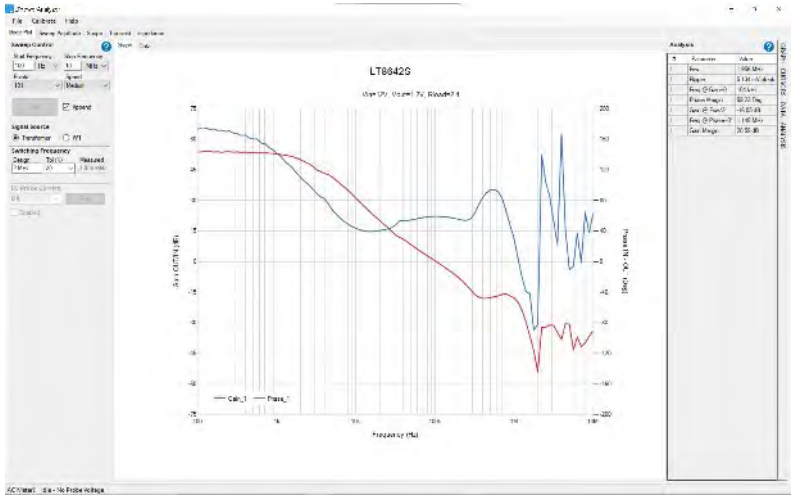


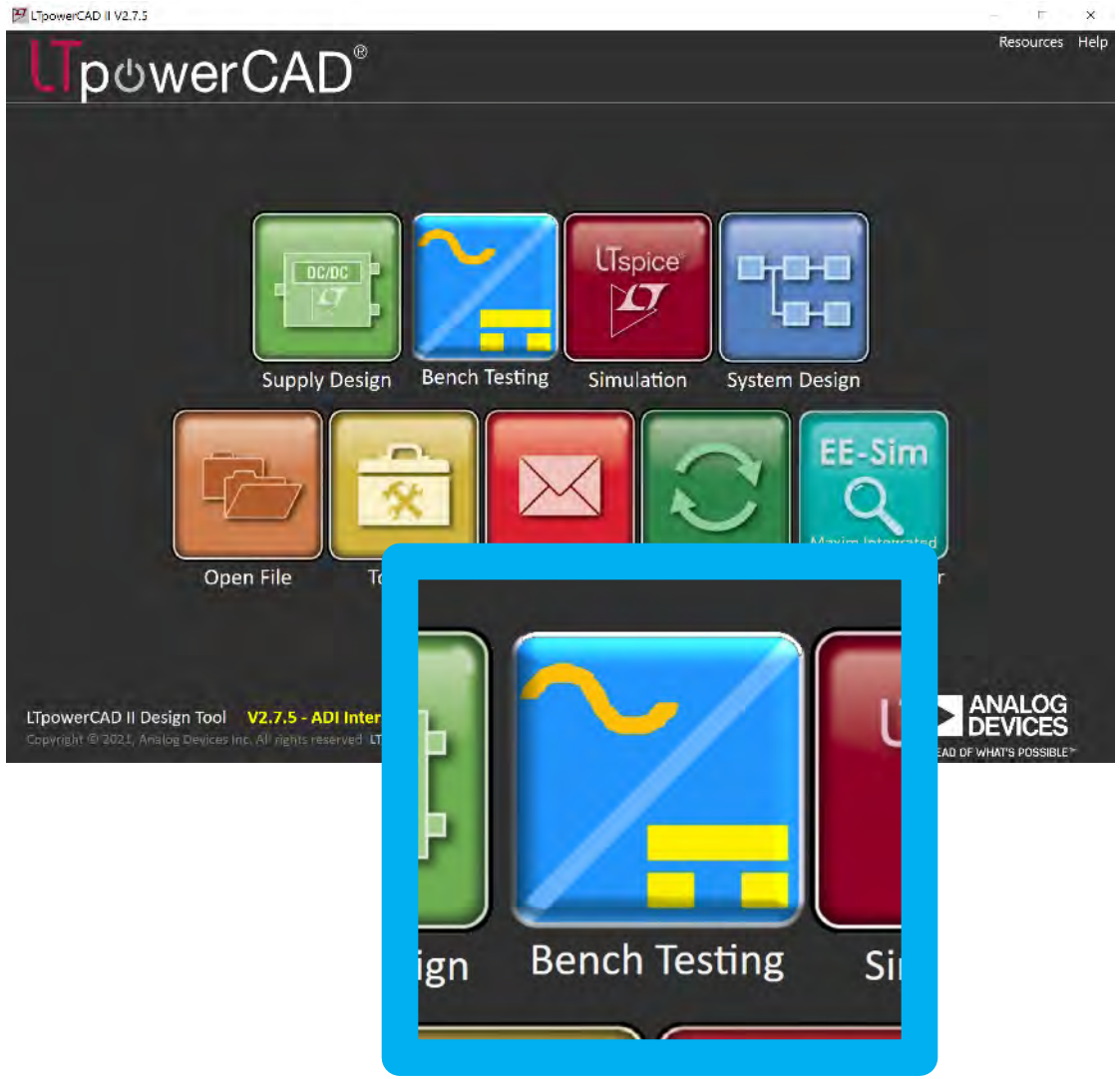
©2025 Analog Devices, Inc. All Rights Reserved.

How to get the software

THE LTPOWERCAD MENU

- Post installation the LTPowerCAD menu will contain the “Bench Testing” button.
- This button will start the LTpowerAnalyzer software package.



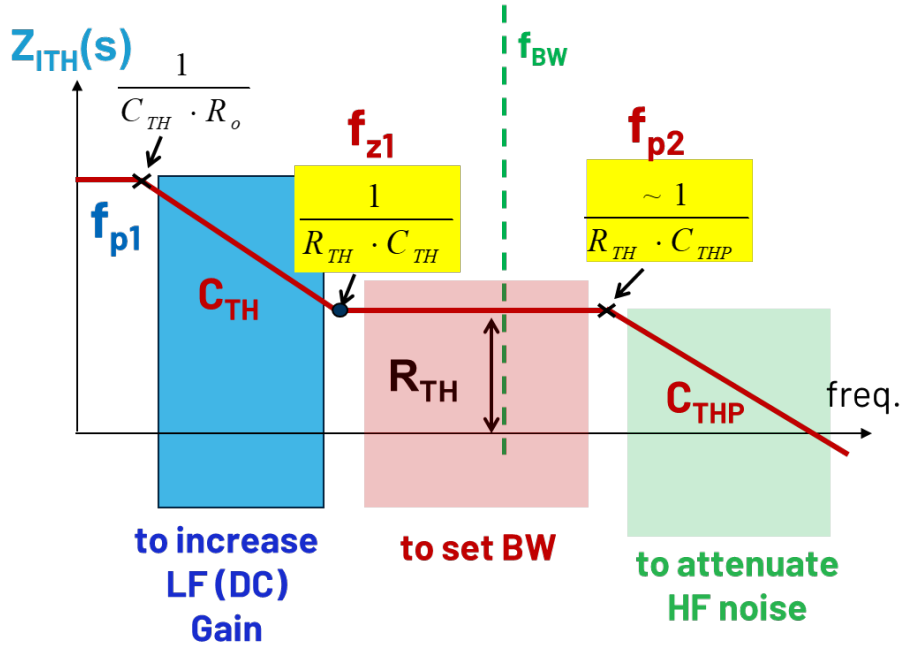


©2025 Analog Devices, Inc. All Rights Reserved.

Conclusion



Putting It All Together

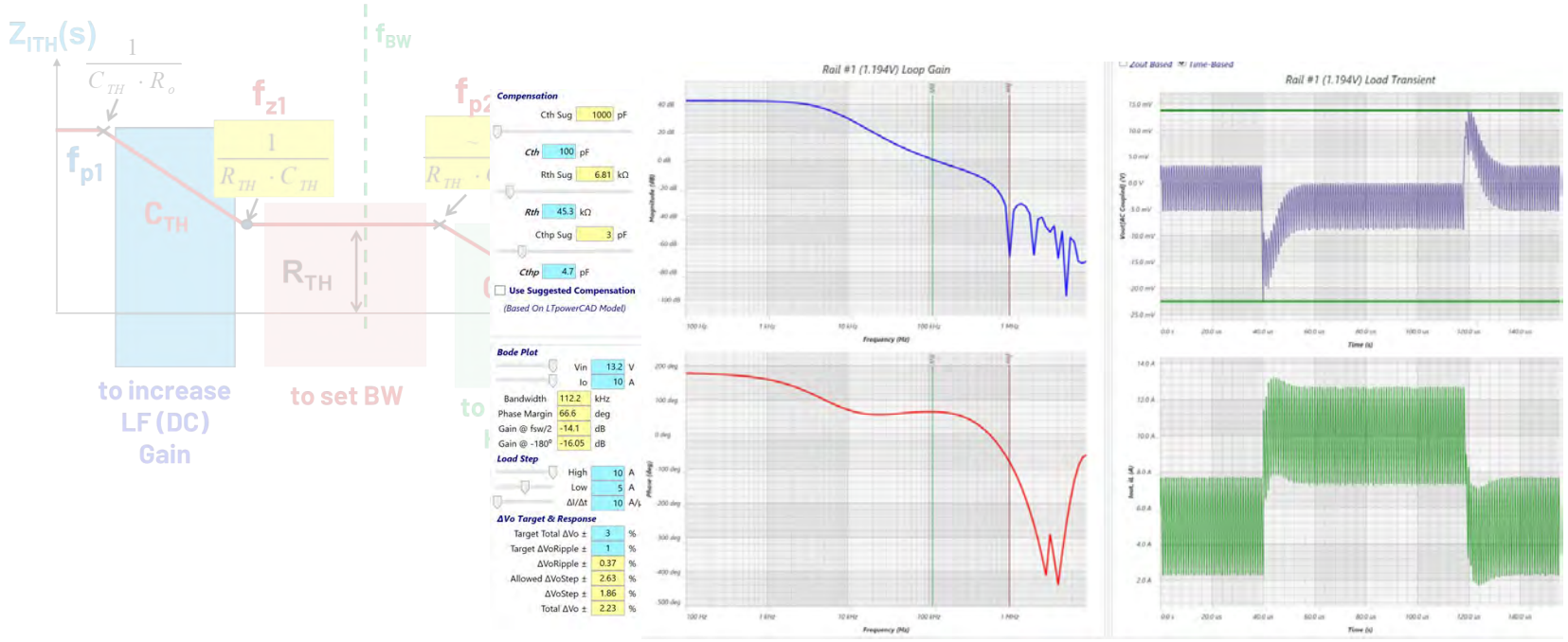


THEORY

- Helpful for understanding how compensation values affect Bode plot
- No need to remember formulas – ADI tools take care of that

©2025 Analog Devices, Inc. All Rights Reserved.

Putting It All Together

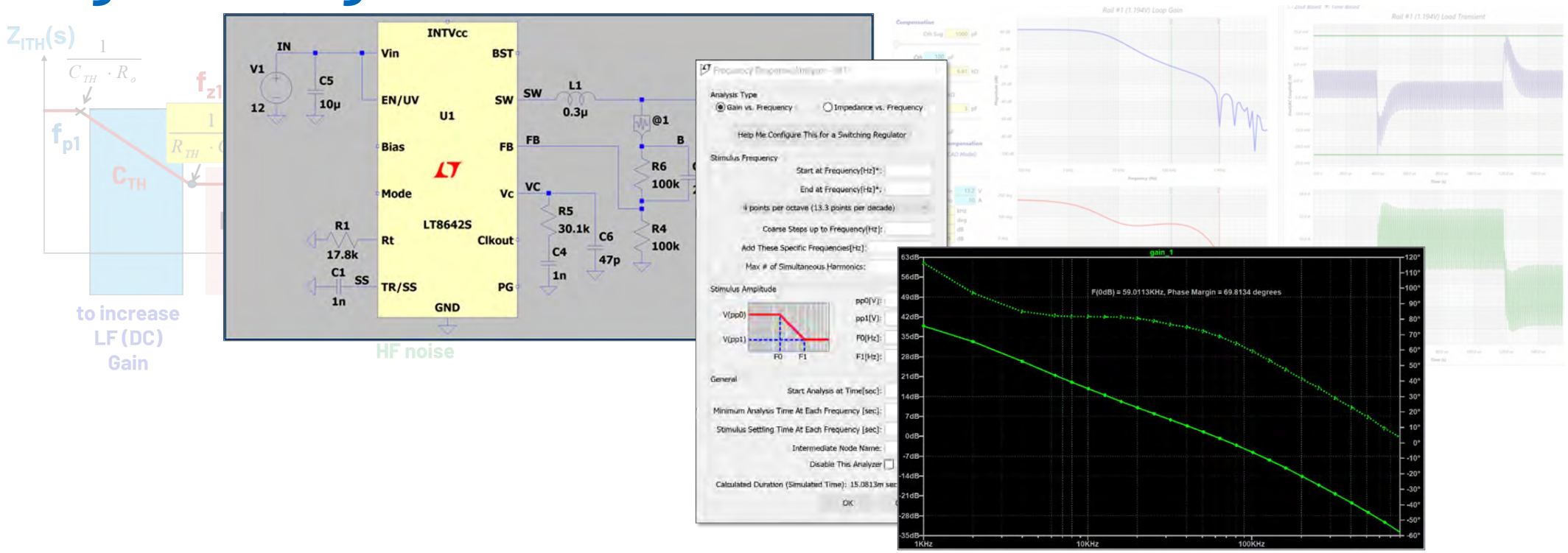


LTpowerCAD

- Select best ADI part based on performance requirements
- Determine passives to meet specs
- Iterate compensation for stability & transient response

©2025 Analog Devices, Inc. All Rights Reserved.

Putting It All Together

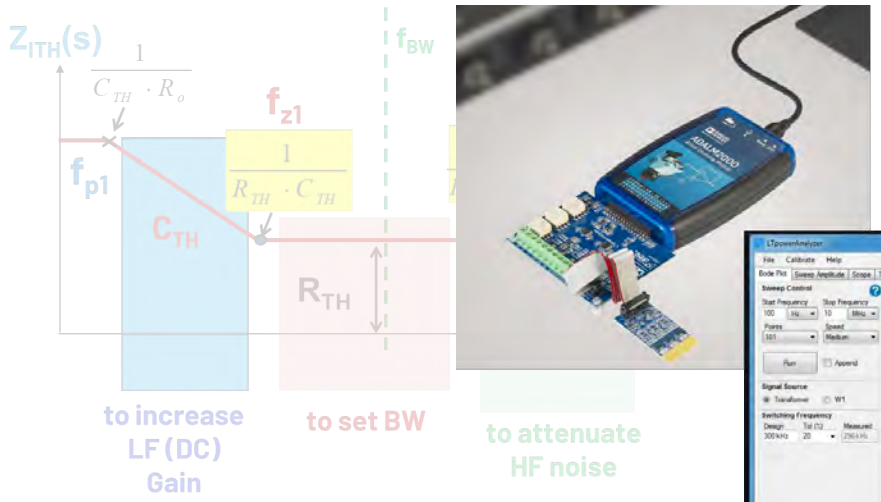


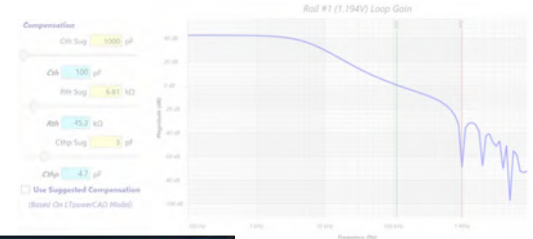
LTspice

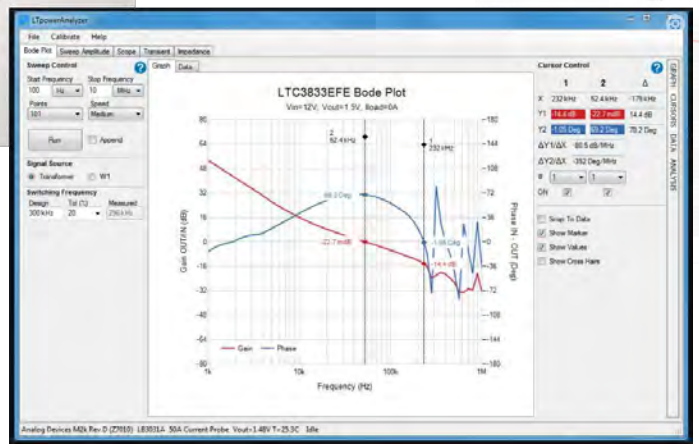
- Use when complex output cap arrangements or no LTpowerCAD model
- Simulate non-standard transients or other events
- Analyze more complex topologies or circuits (filters)
- Analyze specific waveforms

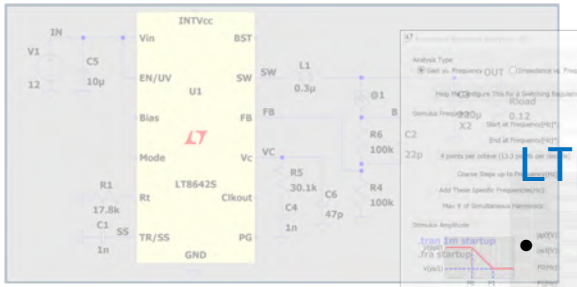
©2025 Analog Devices, Inc. All Rights Reserved.

Putting It All Together







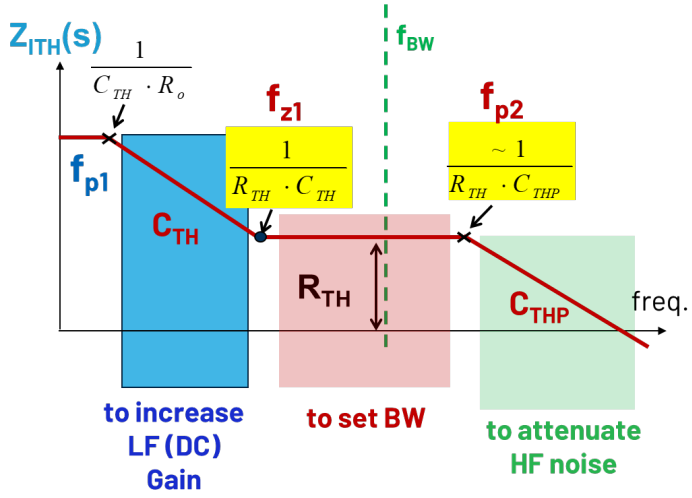


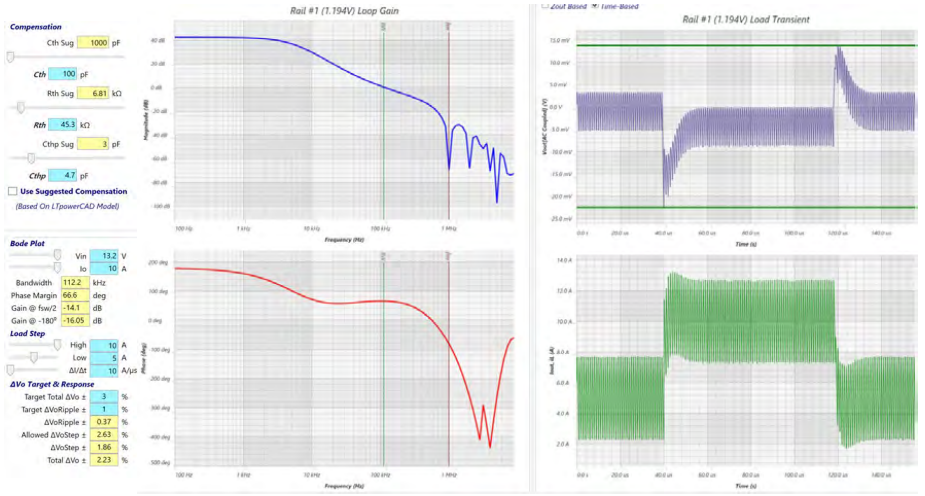
LTpowerAnalyzer

- Measure/verify stability and transient performance
- Adjust compensation as needed on actual hardware
- More measurement capabilities coming

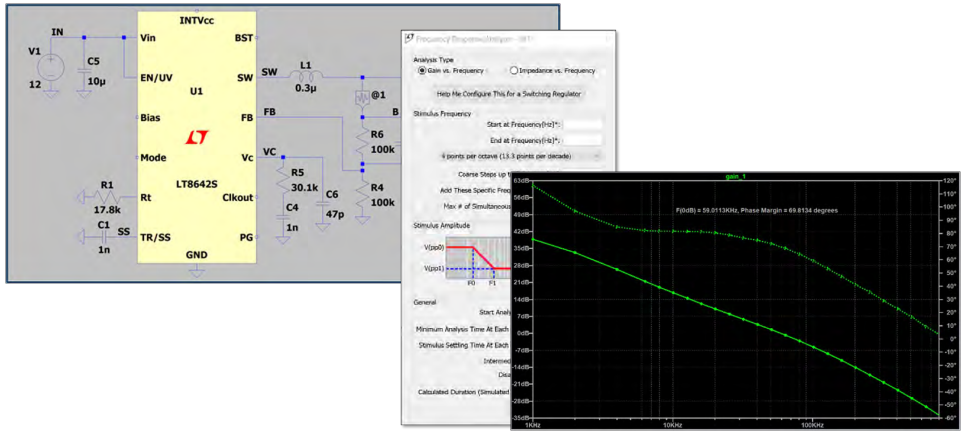
©2025 Analog Devices, Inc. All Rights Reserved.

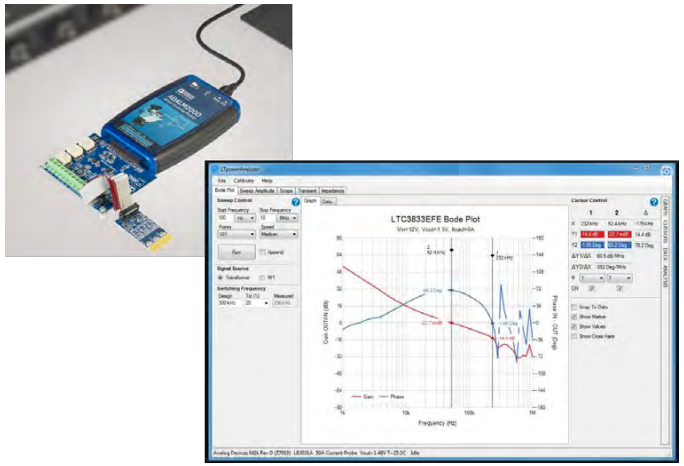
Putting It All Together





COMPREHENSIVE TOOL SET & FLOW FOR RAPID DESIGN, IMPLEMENTATION & VALIDATION





©2025 Analog Devices, Inc. All Rights Reserved.

Conclusion

Calculate/Simulate

- Reduce time to hardware and increase likelihood of success in virtual world
- Look at parameters/behaviors not possible on real hardware
- BUT…only as accurate as models (all parts and board parasitics)
- Simulation ≠ Verification

©2025 Analog Devices, Inc. All Rights Reserved.

Conclusion

Calculate/Simulate

- Reduce time to hardware and increase likelihood of success in virtual world
- Look at parameters/behaviors not possible on real hardware
- BUT…only as accurate as models (all parts and board parasitics)
- Simulation ≠ Verification

Test/Verify

- Measured data (taken correctly) in real world is the gospel
- Confirm performance with all known and unknown parasitics
- Recompensate if needed

©2025 Analog Devices, Inc. All Rights Reserved.

Conclusion

Calculate/Simulate

- Reduce time to hardware and increase likelihood of success in virtual world
- Look at parameters/behaviors not possible on real hardware
- BUT…only as accurate as models (all parts and board parasitics)
- Simulation ≠ Verification

Test/Verify

- Measured data (taken correctly) in real world is the gospel
- Confirm performance with all known and unknown parasitics
- Recompensate if needed

Update Models to Match Measured Data

©2025 Analog Devices, Inc. All Rights Reserved.

Conclusion

Calculate/Simulate

- Reduce time to hardware and increase likelihood of success in virtual world
- Look at parameters/behaviors not possible on real hardware
- BUT…only as accurate as models (all parts and board parasitics)
- Simulation ≠ Verification

Test/Verify

- Measured data (taken correctly) in real world is the gospel
- Confirm performance with all known and unknown parasitics
- Recompensate if needed

Update Models to Match Measured Data

- Why? Will updating models change your final design?

©2025 Analog Devices, Inc. All Rights Reserved.

Conclusion

Calculate/Simulate

- Reduce time to hardware and increase likelihood of success in virtual world
- Look at parameters/behaviors not possible on real hardware
- BUT…only as accurate as models (all parts and board parasitics)
- Simulation ≠ Verification

Test/Verify

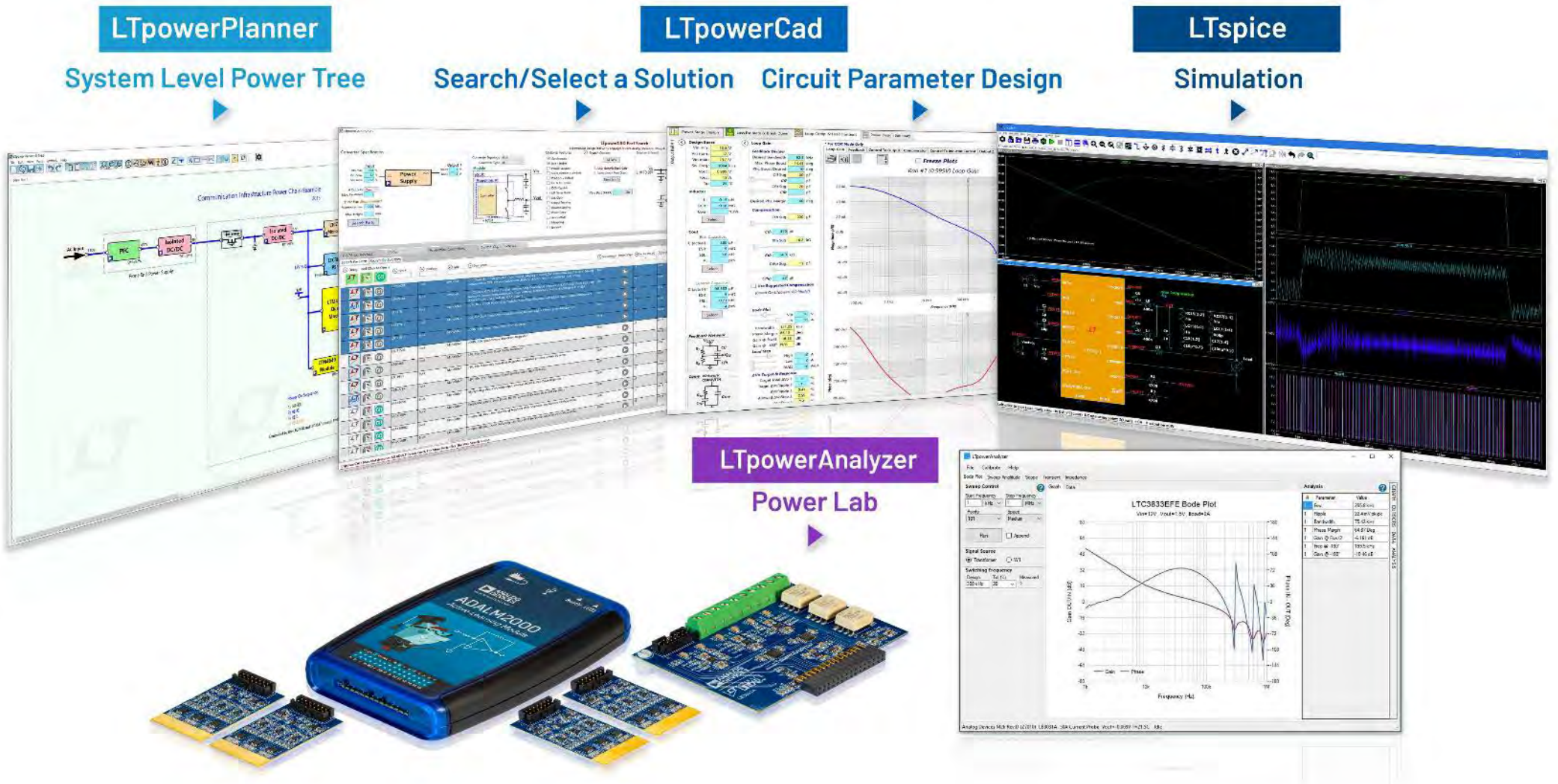
- Measured data (taken correctly) in real world is the gospel
- Confirm performance with all known and unknown parasitics
- Recompensate if needed

Update Models to Match Measured Data

- Why? Will updating models change your final design?
- Return to simulation if unexpected behavior observed

©2025 Analog Devices, Inc. All Rights Reserved.

Closing the Loop on Power Supply Design!



©2025 Analog Devices, Inc. All Rights Reserved.