



BodeCAD Tutorial

Program Installation

- Install SwitcherCAD
- www.linear.com => Design Support => Design Simulation => SwitcherCAD
- Install BodeCAD
- www.linear.com => Design Support => Design Simulation => BodeCAD

BodeCAD uses the SwitcherCAD's device symbols and libraries, and also use SwitcherCAD as the background simulation engine for Bode analysis. The installation order doesn't matter, as long as both programs are installed.

- Click on the program icon  to start.


BodeCAD™ 2.18 - [c:\Program Files\LTC\BodeCAD\sch...

File Analysis Help

MIN MAX

Device Selector

Select

lout 2 A

LTC3832
LTC3831
LTC3809-1
LTC3808
LTC3736
LTC1874
LTC1624
LTC1266
LTC1159.2.3

Find... Search

Opened Sch

Schematic Window

U1
MAX
VCC2
VCC1
GND
IFB
G1
0.1F
M3
SIB42SDY
SW
M1
Rset=10m
OUT
ITH
COMP
SENSE
GND
PGND
CTHP
15K
100P
CTH
10K
R21
3.5K
Iout 0.2m 0.2m

Control Panel

Sim AC Tran

Cycles 10 Pts 5

Fast Mode: Sweep

Delay Time:

Start Stop

Reset Open

Save

Waveform Window

c:\Program Files\LTC\BodeCAD\sch\LTC3832.BDT

120.0dB 80.0dB 40.0dB 0.0dB -40.0dB

180.0° 150.0° 120.0° 90.0° 60.0° 30.0° 0.0°

1kHz 10kHz 100kHz 1MHz

Status

Annotations:

- Device Selector
- Schematic Window
- Control Panel
- Waveform Window

Instructions:

- <= Either select a device from this list and click the [Start].
- <= Or use the [Open] button to load custom schematic

Schematic Procedure

1. Create schematic with SwitcherCAD

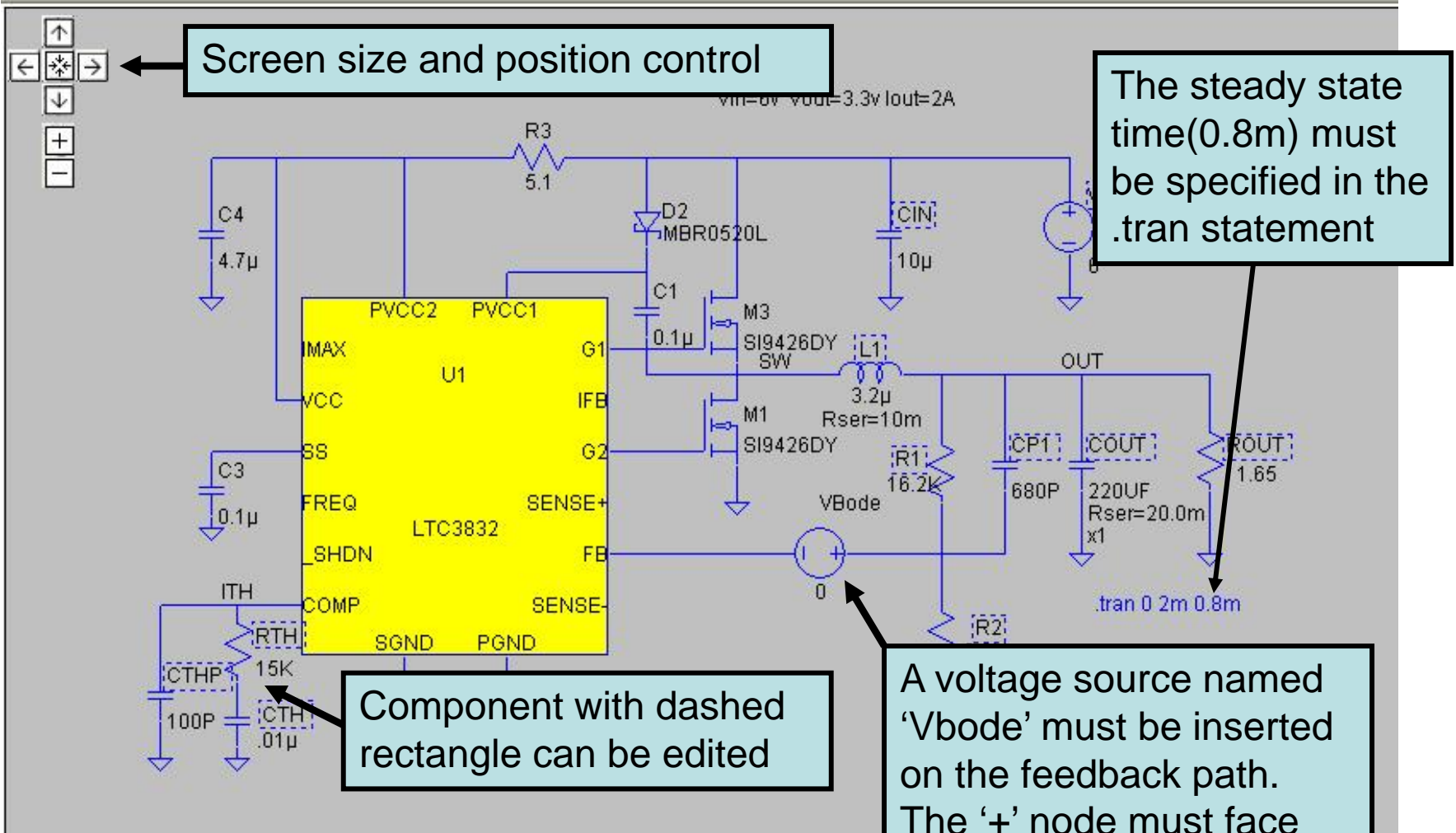
2. Simulate the schematic and mark the time to reach steady state

3. Add a voltage source, named Vbode with value 0, on the feedback path

4. Modify the .tran statement and add the time for steady state

5. Now the schematic can be used by BodeCAD

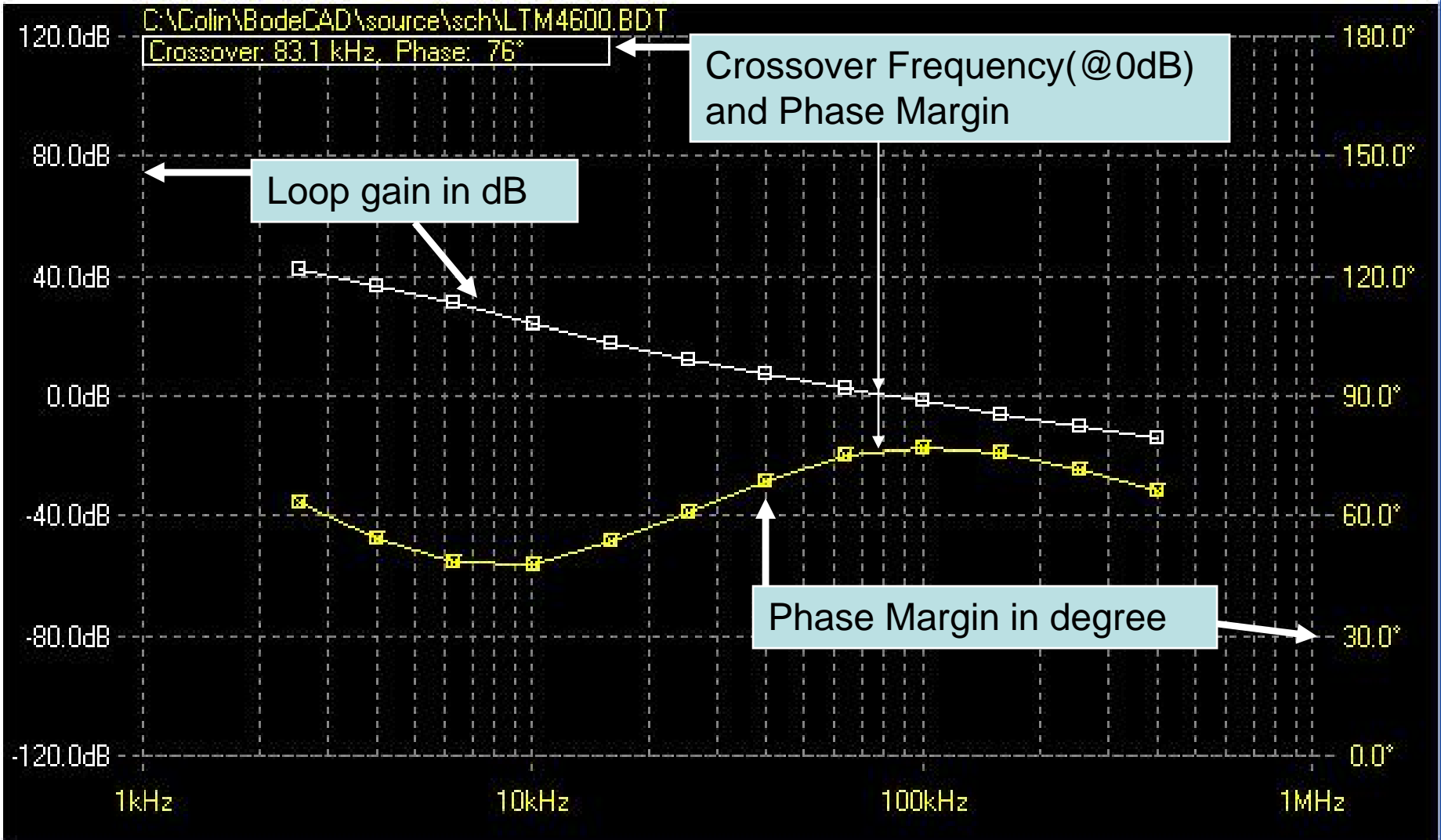
Schematic Window



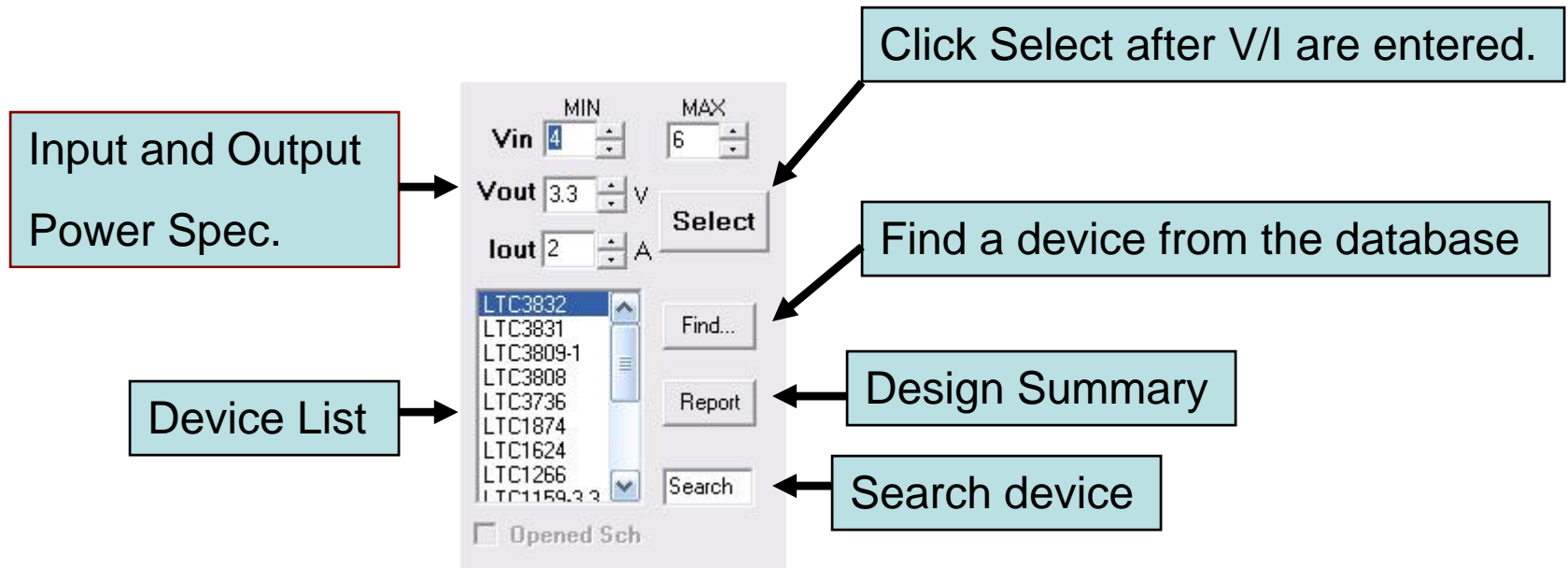
Operating Procedure

- The recommended procedure is to create the schematic with SwitcherCAD and use the [Open] command to load the file and click the [Start] to run, as simple as that.

Waveform Window



Device Selector



Find – Device Database

The screenshot shows a 'Device Parameters' dialog box with the following settings:

- Vin_min: 4 V
- Vin_max: 6 V
- Isw: 2 A
- Vout_min: 3.3 V
- Vout_max: 3.3 V
- I supply: [] mA
- I shutdown: [] uA
- Monolithic:
- Dual Output:
- Synchronous:
- Tracking:
- Temperature: E, I, H
- Package: SSOP-16
- Frequency: <200Khz
- Topology: Buck

The results list contains the following device numbers:

- LT1976
- LT3434
- LT3724
- LT3800
- LTC1778
- LTC1778-1

Buttons: Show Device, Exit

6 total

Find device with multiple conditions to narrow the device search.

Input/Output Power

Topology

Package

Device Type

Operating Temperature

Device summary at the bottom

Control Panel - Sim

The image shows a software control panel for simulation, titled 'Control Panel - Sim'. It features three tabs: 'Sim', 'AC', and 'Tran'. The 'Sim' tab is active. The panel includes the following controls:

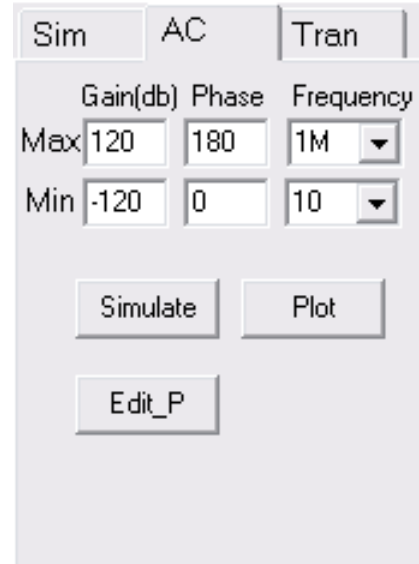
- Min Freq: 1kHz (dropdown menu)
- Max Freq: 200kHz (dropdown menu)
- Cycles: 10 (text input)
- Pts: 5 (dropdown menu)
- Fast Mode: Sweep
- Delay Time: (text input)
- Buttons: Start, Stop, Reset, Open, Save

Callouts with arrows point to specific controls:

- 'Start the simulation' points to the 'Start' button.
- 'Clear the old data points and start fresh' points to the 'Reset' button.
- 'Freq. range for bode simulation' points to the 'Min Freq' and 'Max Freq' dropdowns.
- 'Load external schematic for Bode analysis' points to the 'Open' button.

Control Panel -AC

The fast AC analysis uses the proprietary model to estimate the frequency response. It is not as accurate as the simulation-based analysis. It is only provided for a quick reference and doesn't cover all the parts. The simulation approach is always better than the fast AC.



The screenshot shows a software control panel for AC analysis. It features three tabs: 'Sim', 'AC', and 'Tran', with 'AC' currently selected. Below the tabs, there are three columns of controls: 'Gain(db)', 'Phase', and 'Frequency'. The 'Gain(db)' column has 'Max' and 'Min' labels with input fields containing '120' and '-120' respectively. The 'Phase' column has an input field containing '180' and another containing '0'. The 'Frequency' column has two input fields, the top one containing '1M' and the bottom one containing '10', both with dropdown arrows. At the bottom of the panel, there are three buttons: 'Simulate', 'Plot', and 'Edit_P'.

Control Panel - Tran

The fast TRAN analysis uses the proprietary model to estimate the transient response. It is not as accurate as the simulation-based analysis. It is only provided for a quick reference and doesn't always converge. The SwitcherCAD should always be used for this kind of analysis.

	Y (v)	X (ms)	Current
Max	3.307	0.000	2
Min	3.289	1.999	1.80
Div	5	5	

Analysis Menu

Two-Node Analysis: Bode plot of any two names nodes

View Bode Data: Load the *.BDT and view bode result. The BDT can be imported by Excel, too.

Parameter Sweep: Sweep parameter with multiple simulations.

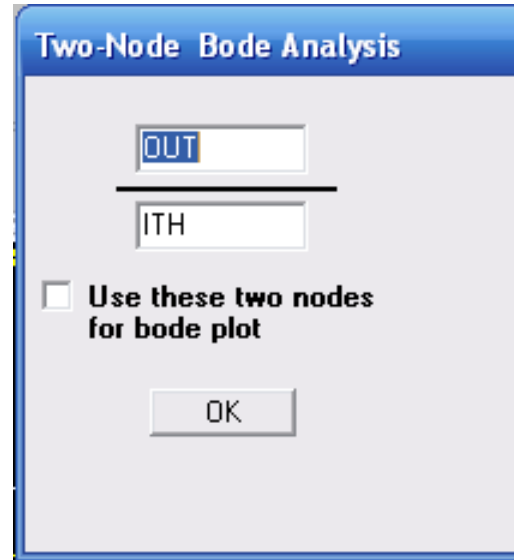
Graph Options: Edit the graph scale and display options.

Edit Params: Edit the parameter for AC and TRAN simulations

Add Startup: add the 'startup' keyword at the end of .tran statement

Two-Node Analysis

The node name must be defined on the schematic first. Enter the two names and click the box to enable two-node analysis.



The dialog box titled "Two-Node Bode Analysis" contains two input fields. The first field contains the text "OUT" and is positioned above a horizontal line. The second field contains the text "ITH". Below these fields is a checkbox that is currently unchecked, with the label "Use these two nodes for bode plot". At the bottom of the dialog is an "OK" button.

Parameter Sweeping

The image shows the LTspice AC simulation interface with a parameter sweep configuration. The main window displays a Bode plot with magnitude and phase curves. A central text box provides the sweep parameters: Name: Cout, Min: 200u, Max: 600u, Steps: 3. A 'Sweep' dialog box is open, showing the same parameters. The simulation control panel on the left has the 'Sweep' checkbox checked. A 'Click [Start] and see result below' box points to the 'Start' button. A 'Click' box points to the 'Sweep' checkbox. The Bode plot shows magnitude curves for three different capacitor values (1, 2, 3) and phase curves for the same values. The magnitude curves show a peak around 10kHz and then roll off. The phase curves show a phase shift from 60.0 degrees to 0.0 degrees.

Click [Start] and see result below

Click

Enter Name: Cout
Min: 200u
Max: 600u
Steps: 3

Sweep

Top Level Component
Name: Cout
Min: 200u
Max: 600u
Steps: 3
OK

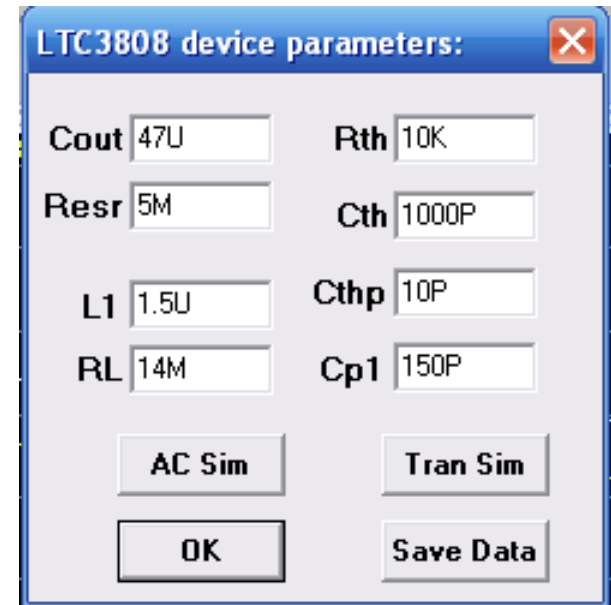
0.0dB
-40.0dB
-80.0dB
-120.0dB

1kHz 10kHz 100kHz 1MHz

60.0°
30.0°
0.0°

Parameter Editing

Schematic component names must match the keywords in the dialog box to be editable. For example: The output capacitor must be named 'Cout' and the main inductor 'L1'. The compensation components are Rth, Cth and Cthp. See HELP for details.



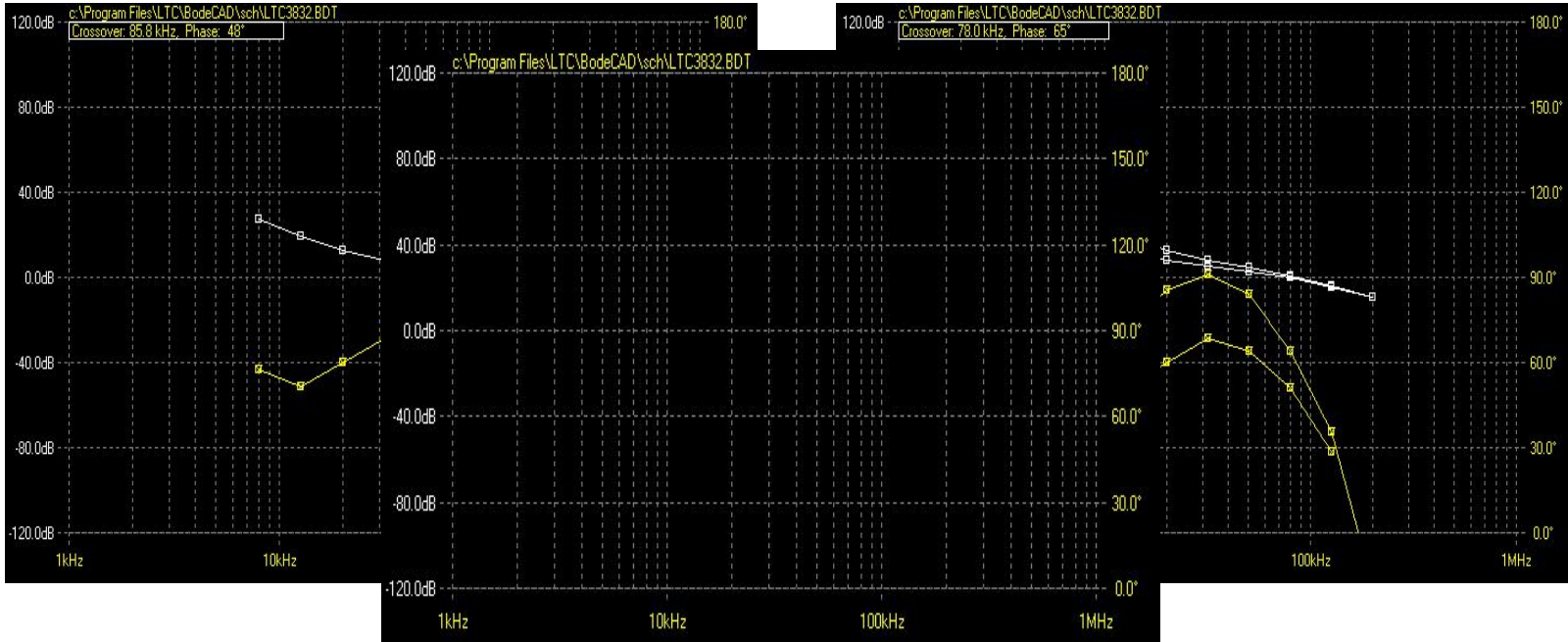
The screenshot shows a dialog box titled "LTC3808 device parameters:" with a close button (X) in the top right corner. The dialog contains several input fields for component values, arranged in two columns. The left column contains: Cout (47U), Resr (5M), L1 (1.5U), and RL (14M). The right column contains: Rth (10K), Cth (1000P), Cthp (10P), and Cp1 (150P). Below the input fields are four buttons: "AC Sim", "Tran Sim", "OK", and "Save Data".

Cout	47U	Rth	10K
Resr	5M	Cth	1000P
L1	1.5U	Cthp	10P
RL	14M	Cp1	150P

AC Sim Tran Sim

OK Save Data

Set Screen Background (Right mouse click in waveform window)



First run with $C_{out}=220\mu F$

Second run $C_{out}=560\mu F$

[Reset] click

Set Screen Background click

See BodeCAD HELP for detailed information.

Send your question and schematic to chsi@linear.com
for assistance.