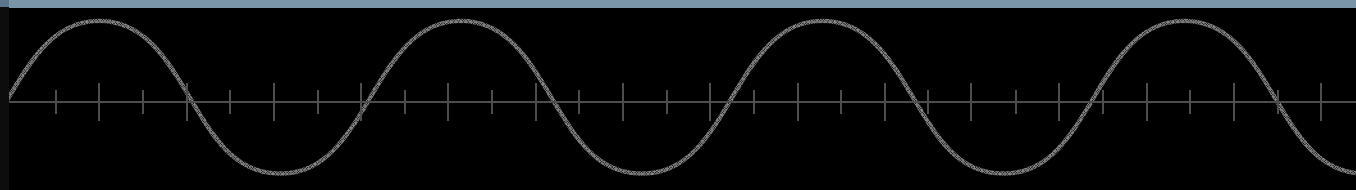
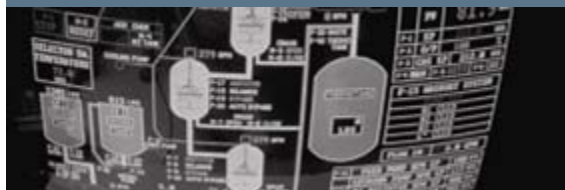


# Designing a Power Supply in Five Simple Steps

With **LTpowerCAD** Design Tool



# How People Do a “Paper Design”:

- For a **switching mode supply**:
  1. Define supply spec.
  2. Decide topology.
  3. Search for an IC (- **time consuming**)
  4. Calculate power components (- **time consuming and not optimum**)
  5. Search/select real components: L, C, FET... (-**time consuming & not optimum**)
  6. Guess efficiency/loss (- **difficult, inaccurate**)
  7. Guess or simulate for loop compensation. (- **difficult, inaccurate**)
  8. Draft a schematic.

- ☹ **Time consuming, difficult, inaccurate, not optimum.**
- ☹ **Requires good knowledge and skills.**
- ☹ **Hours or days of efforts!**

# LTpowerCAD Power Supply Design Tool

- **Free-download** at [www.linear.com/LTpowerCAD](http://www.linear.com/LTpowerCAD)
  - First released on 2014. Supports > 200 LTC ICs.
  - Hundreds/thousands power components.
- **Frequent updates / improvements.** (sync/release)
- **No internet bandwidth/speed limit.** - Runs on Windows PC with installation. Leverage powerful user PC with high security.
- **Developed by Power Engineers/Experts.**
- **Easy, fast and high quality designs.**

# LTpowerCAD Tool Simplifies Supply Design Task

## 5 Simple Steps:

1. Enters supply spec. to search for right solutions (**fast**).
2. Design tool guides users to select power components. (**fast & easy, optimum**).
3. Real time efficiency and loss optimization (**fast & easy, more accurate**)
4. Real time loop gain and transient design & optimization (**fast, easy and accurate**)
5. BOM summary and size estimation (**fast & easy**)
6. (OPT) Export to LTspice for dynamic simulation and schematic.

- ☺ **Fast, accurate with optimum results.**
- ☺ **Easy task** even for inexperienced designers.
- ☺ A “paper-design” can be done **in minutes!**

# Design a Supply in 5 Simple Steps:

## Step 1

Enter specs,  
search solution.

## Step 2

Power Stage  
Design.

## Step 3

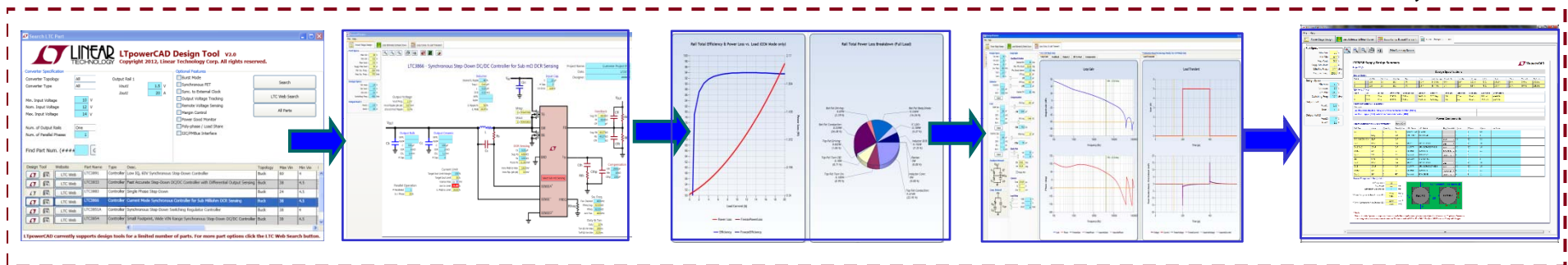
Efficiency &  
Loss

## Step 4

Loop  
& Transient

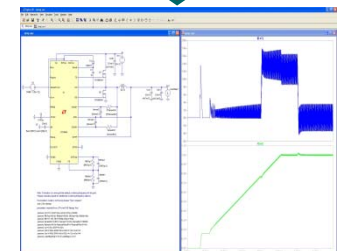
## Step 5

Summary,  
BOM, Size



LTpowerCAD

(OPT.)



LTspice™

Simulation

# LTpowerCAD Supply Design Example

- $V_{in} = 12V \pm 10\%$
- $V_o = 1.0V, I_o = 20A$
- Step Down Buck Converter

# Design Step 1 – Search Part for Spec.

LTpowerCAD II V2.3.3

**LINEAR TECHNOLOGY** LTpowerCAD Design Tool v2.3.3  
Copyright 2014, Linear Technology Corp. All rights reserved.

**2. Search**

**1. Enter spec.**

**3. Select IC and open a Tool**

Converter Specification

Converter Topology: Buck  
Converter Type: All  
Output Rail 1: Vout1 1 V, Iout1 20 A  
Min. Input Voltage: 10.8 V  
Nom. Input Voltage: 12 V  
Max. Input Voltage: 13.2 V  
Num. of Output Rails: One  
Num. of Parallel Phases: 1  
Find Part #: (####) [ ] Go

Optional Features

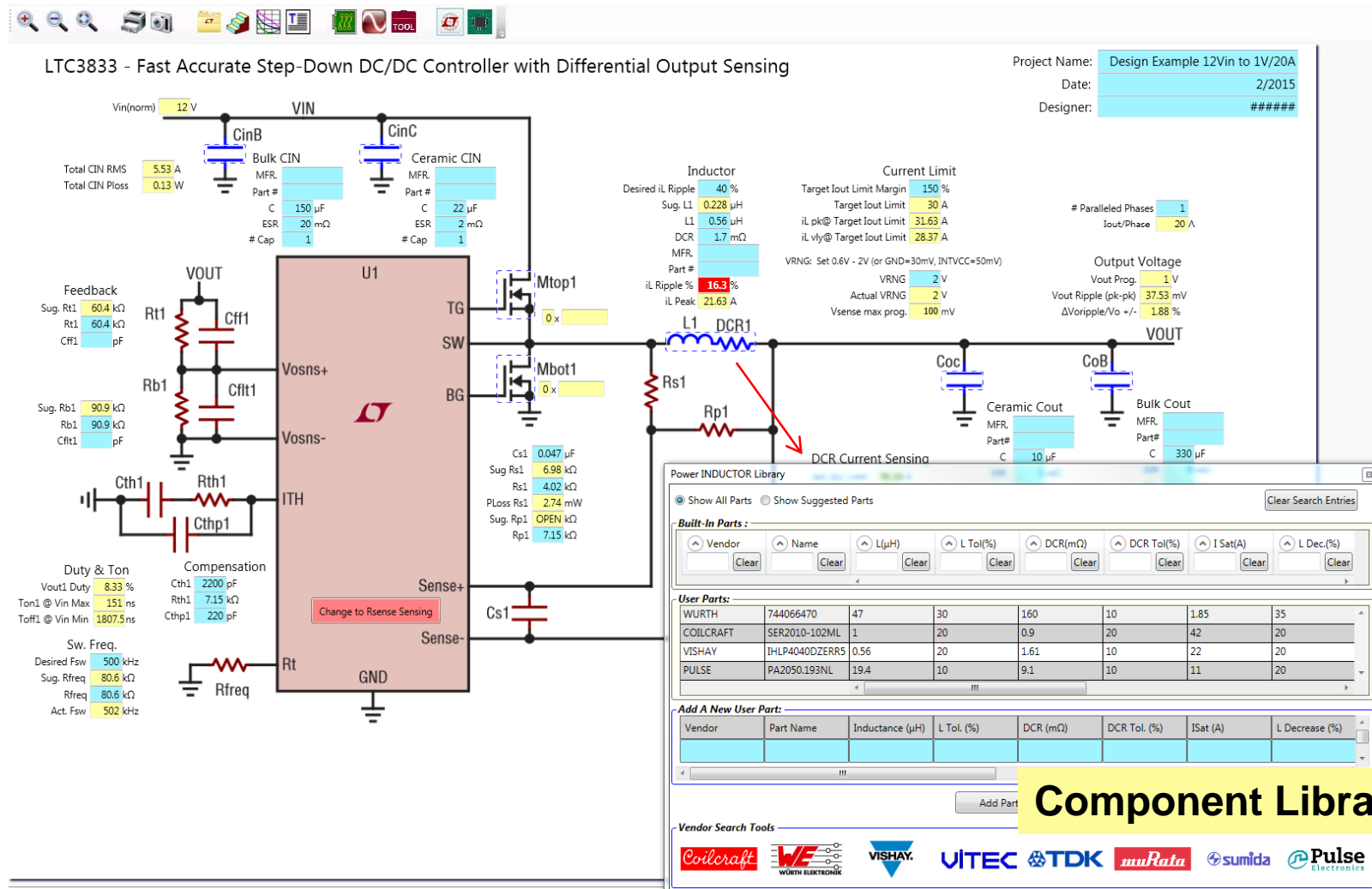
- ☐ Burst Mode
- ☒ Synchronous FET
- ☐ Isolated
- ☒ Run / Enable
- ☐ Sync. to External Clock
- ☐ Output Voltage Tracking
- ☐ Remote Voltage Sensing
- ☐ Margin Control
- ☒ Power Good Monitor
- ☐ Poly-phase / Load Share
- ☐ I2C/PMBus Interface

Search [ ]  
LTC Web Search  
All Parts  
☒ Always Keep Search Page Open

Design Tool	Website	Part Name	Type	Desc.	Topology	Max Vin	Min V
[ ]	LTC Web	LTC3807	Controller	Low IQ, Single Phase 38Vin 24Vo Synchronous Step-Down Controller	Buck	38	4
[ ]	LTC Web	LTC3810	Controller	100V Valley Current Mode Synchronous Buck Regulator Controller	Buck	100	0.8
[ ]	LTC Web	LTC3810-5	Controller	60V Valley Current Mode Synchronous Buck Regulator Controller	Buck	60	0.8
[ ]	LTC Web	LTC3812-5	Controller	60V Valley Current Mode Synchronous Buck Regulator Controller	Buck	60	0.8
[ ]	LTC Web	LTC3833	Controller	Fast Accurate Buck Controller with Remote Vo Sense, Valley I-mode	Buck	38	4.5
[ ]	LTC Web	LTC3851A-1	Controller	Synchronous Step-Down Switching Regulator Controller	Buck	38	4
[ ]	LTC Web	LTC3866	Controller	Integrated 5V Gate Drive	Buck	38	2.7
[ ]	LTC Web	LTC3867	Controller	Single Phase Current Mode Buck Controller, <1mOhm DCR sensing, remote Vo sensing	Buck	38	4.5
[ ]	LTC Web	LTC3867	Controller	38Vin Sync-Buck Controller with Remote Vo sense and nonlinear control	Buck	38	4

LTpowerCAD currently supports design tools for a limited number of parts. For more part options click the LTC Web Search button.

# Design Step 2 – Power Stage Design

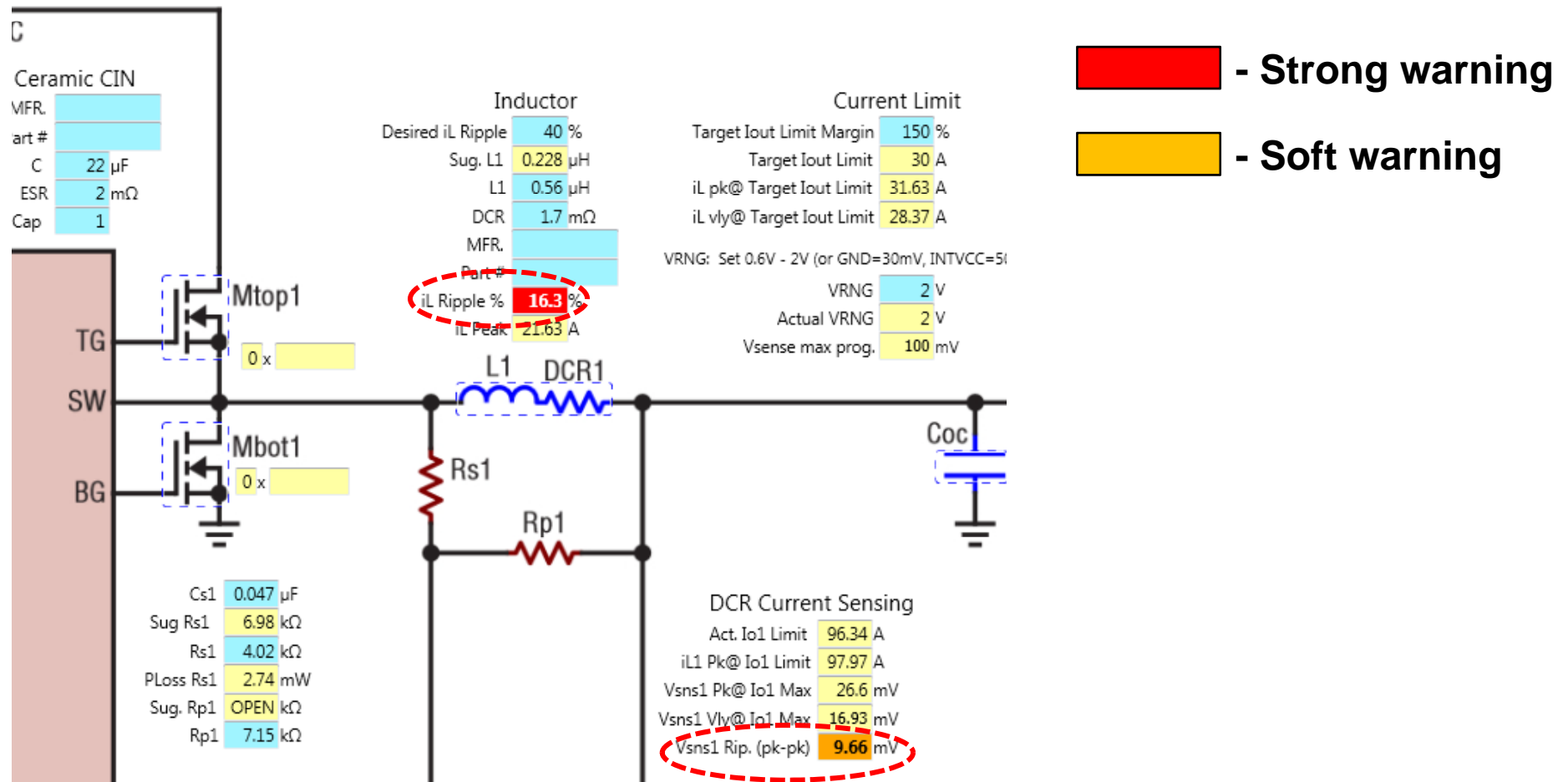


  - Recommended values

  - User entered values

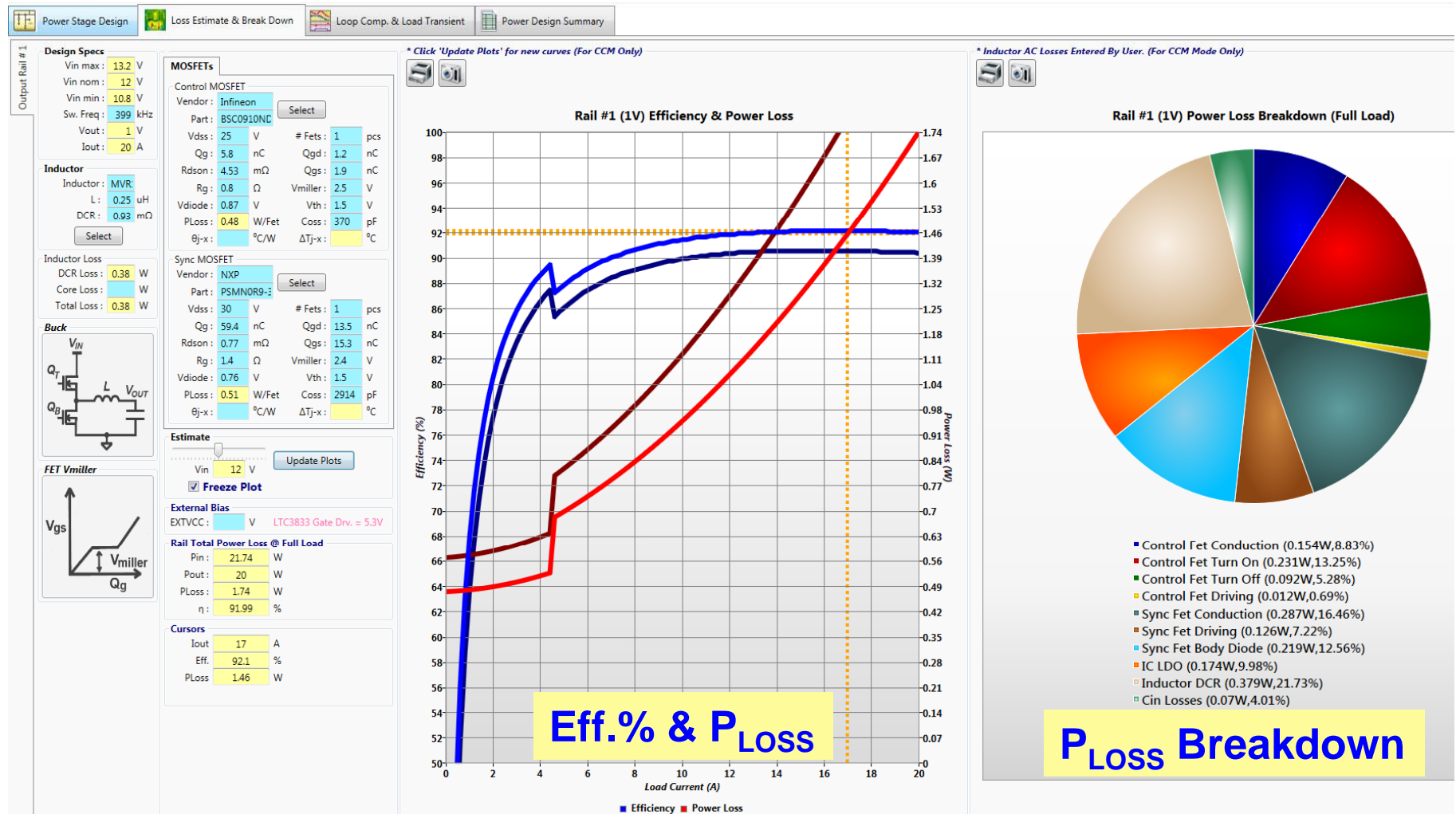


# Design Step 2 – Power Stage – Design Warnings



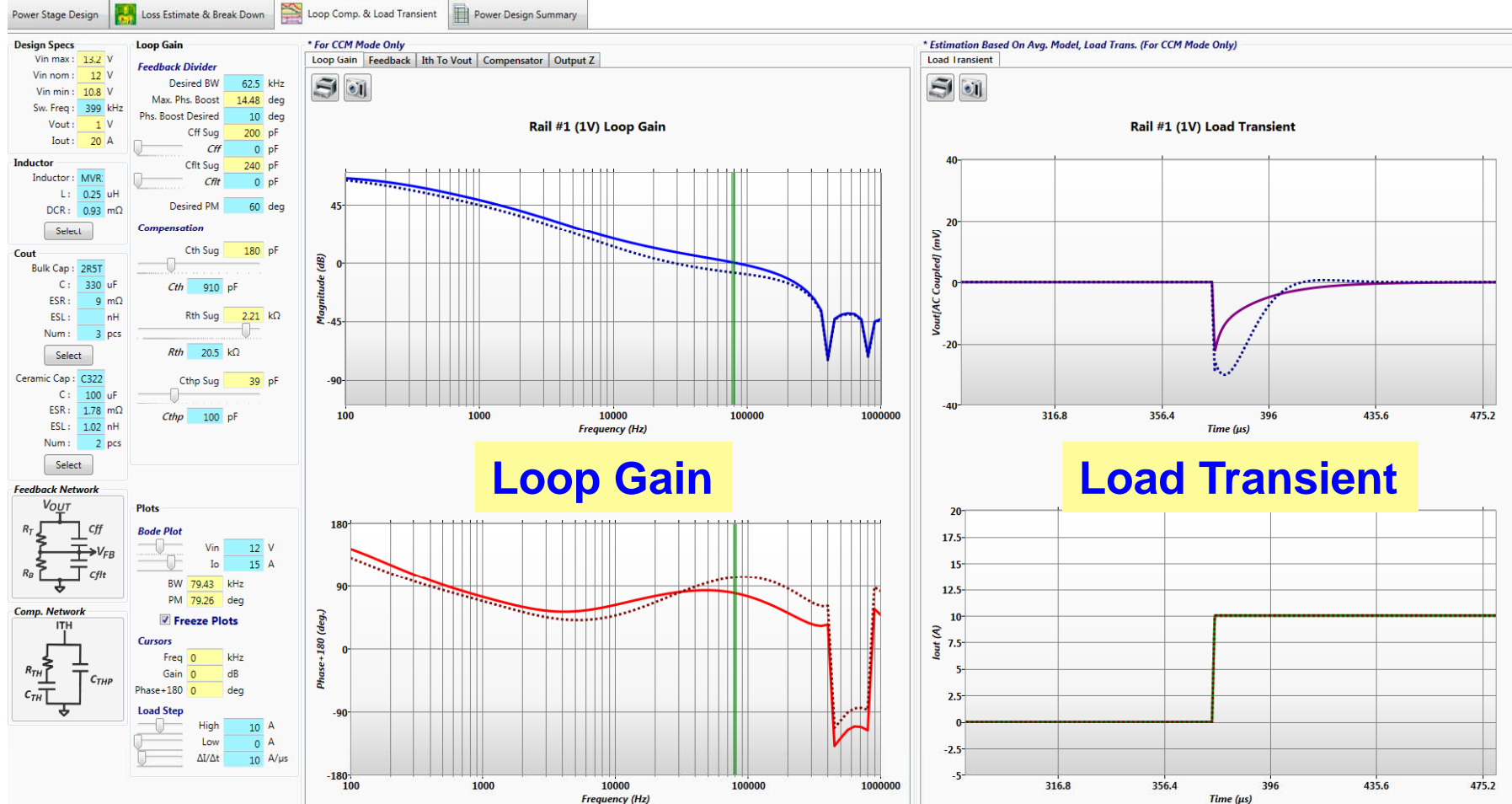
- Automatic warnings guide users for proper values

# Design Step 3 – Efficiency & Loss Optimization



- Real time estimation/comparison for optimum efficiency

# Design Step 4 – Loop and Transient Design



- Real time loop design and transient optimization  
(All IC loop models have been verified on LTC demo boards)

# Design Step 5 – Summary, BOM and Size

Loss Estimate & Break Down
Loop Comp. & Load Transient
Power Design Summary

## Summary Report

### LTC3833 Supply Design Summary

**Project Info:** Ref Design 12Vin to 1V/20A, 10/2014, H.Z.

**Design Specifications**

**Steady State :**

Rail #	Vin Min.	Vin Nom.	Vin Max.	Fsw	Vo	ΔVo rip. p-p	ΔVo rip.%	Io Max	ΔILp-p	ΔIL%	iLpk
1	10.8 V	12 V	13.2 V	399 kHz	1 V	7.82 mV	0.4 %	20 A	9.19 A	45.9 %	24.59 A

**Efficiency and Loop :**

Rail #	Vo	Iomax	Eff.@Iomax	PLoss@Iomax	Loop BW	Loop PM	Step Low	Step High	Step Slew	ΔVo@Step	ΔVo@Step %
1	1 V	20 A	91.99 %	1.741 W	79.43 kHz	79.26 deg	0 A	10 A	10 A/μs	22.1 mV	+/-2.2 %

**Recommendations and Warnings :**

Message

## Summary

**Power Components**

**Power Components Bill Of Materials :** Export BOM

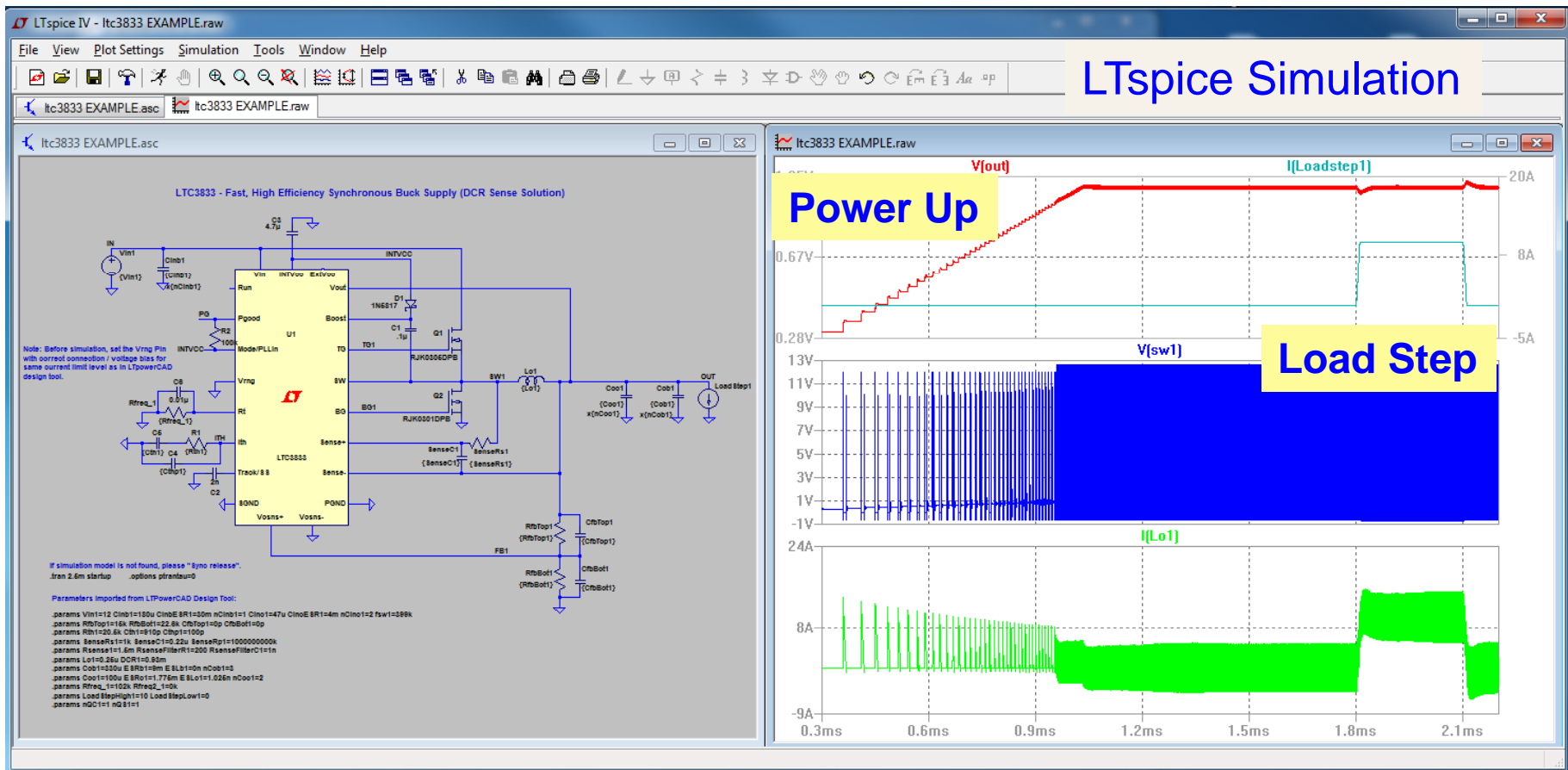
Ref. Des.	Value	Quantity	Description	Mfr. Name	Mfr. Part #	Pkg. (Imperial)	L(mm)	W(mm)	H(mm)	User Note
U1		1	IC	LINEAR TECH	LTC3833		4	3	0.8	
Lo1	0.25μH	1	IND	COILCRAFT	MVR1251T-251		11.5	9.75	5.1	
Cinb1	180μF	1	CAP	PANASONIC	165VP180MX	F8	10.3	10.3	7.9	
Cinc1 Cinc2	47μF	2	CAP	MURATA	GRM32ER61C476KE15	1210	3.2	2.5	1.7	
Cob1 Cob2 Cob3	330μF	3	CAP	SANYO	2R5TPE330M9	D2E	7.3	4.3	1.8	
Coc1 Coc2	100μF	2	CAP	TDK	C3225X5R0J107M	1210	3.2	2.5	1.7	
Qcontrol1	25V	1	FET	Infineon	BSC0910NDL_Q1		6.35	5.35	1.1	
Qsync1	30V	1	FET	NXP	PSMN0R9-30YLD		6	5	1.7	

## Size

Parameter	Value	Unit
# Components	12	
Max. Height	7.9	mm
Component Clearance (d)	1	mm
* Power Components Area (Excludes ICs)	541.5	mm <sup>2</sup>
	0.839	in <sup>2</sup>
* Power Components Area (Includes ICs)	561.5	mm <sup>2</sup>
	0.87	in <sup>2</sup>

# (Optional) Step 6 – Export to LTspice Circuit

- To see detailed waveforms and transient performances



(Key LTpowerCAD design tool values are exported to LTspice)

# Design “Shortcut” – Solution Library

The screenshot displays the LTSPICE software interface. On the left, a circuit diagram for the LTC3833 is shown, including components like resistors (Rt1, Rb1, Rth1), capacitors (Cf1, Cth1, Cthp1), and a feedback network. The circuit is powered by a 12V source (Vin(nom)). The output voltage (VOUT) is shown. The circuit parameters are listed on the left: Total CIN RMS is 5.53 A, Total CIN Ploss is 0.07 W, Feedback Sug. Rt1 is 15 kΩ, Rt1 is 15 kΩ, Cff1 is pF, Sug. Rb1 is 22.6 kΩ, Rb1 is 22.6 kΩ, Cff1 is pF, Duty & Ton Vout1 Duty is 8.33 %, t1 @ Vin Max is 190 ns, tff1 @ Vin Min is 2274.2 ns, Compens. Cth1 is 910 pF, Rth1 is 20.5 kΩ, Cthp1 is 100 pF.

The Solutions Library window is open, showing a table of built-in solutions for the LTC3833. The table has columns for LTC Part Name, Solution Name, Vin [min] (V), Vin [nom] (V), Vin [max] (V), Rail Voltage(s) (V), Output Current(s) (A), and Description. The table lists several solutions, including Datasheet P30, Datasheet P36, DC1516A-A, DC1516A-B, DC1640A-A, DC1640A-B, and Reference Design 12Vin to 1Vo 20A.

The User's Solutions section is also visible, showing a table with columns for LTC Part Name, Solution Name, Vin [min] (V), Vin [nom] (V), Vin [max] (V), Rail Voltage(s) (V), Output Currents(s) (A), Description, and File Name. The table lists a solution named "Ref. Design 5-26Vin to 3.3V 6A" with a description of "Small size, DCR sense" and a file name of "LTC3833 Ref. Design 5-".

A yellow box with the text "Existing design solution library" is overlaid on the User's Solutions section.

At the bottom of the Solutions Library window, there are fields for "New Solution Name" and "New Solution Description", and buttons for "Save New Solution", "Import Solution", and "Overwrite Selected Solution".

- Many solutions/designs are already in “solution library”. Users can add/build their solutions too.
- Leverage existing designs.
- Quick start point of a new design!

# Summary

**LTpowerCAD tool makes your job easier.**

- Save time.
- Easy steps.
- High quality designs.

Questions? - [LTpowerCAD@linear.com](mailto:LTpowerCAD@linear.com)