LTC3786 Supply Design Summary Report

Vin : 10V (min.), 12V (nom.), 14V (max.)

Output Rails : Vout1 = 34,91V / 12A (max.)

Project Name : Demo Board DC1641A

Project Date : 9/2014

Designer :

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LTC3786 Solution - Simplified Schematic

Vin : 10V (min.), 12V (nom.), 14V (max.)

Output Rails : Vout1 = 34,91V / 12A (max.)

LTC3786 - Low IQ, High Efficiency Synchronous Boost Controller

Linear Technology Demo Board DC1641A

VIN=4-22V, Vo=24V / Io=5A

(Depending on Thermal Condition, Derating may be Needed for Lower Vin Range)

Note : Calculations are based on Vin(nom) unless labeled otherwise.

See "design curves" for parameter changes vs. Vin

Project Name:	Demo Board DC1641A
Date:	9/2014
Designer:	

Min. Input Voltage For Full Power

VinD	12	V

Input Voltage

Vin Min.	10	V
Vin Nom.	12	V
Vin Max.	14	V

Inductor

Desired iL Ripple @ VinD	25	%
Sug. L	18,07	µH
L	10	µH
DCR	1,2	mΩ
MFR.	Wurth	
Part #	7443763540100	

iL Ripple % @ VinD	45	%
iL Ripple %	45	%
iL DC	35,29	A
iL Peak	43,18	A
iL Peak @ Vin min.	49,69	A

Current Limit

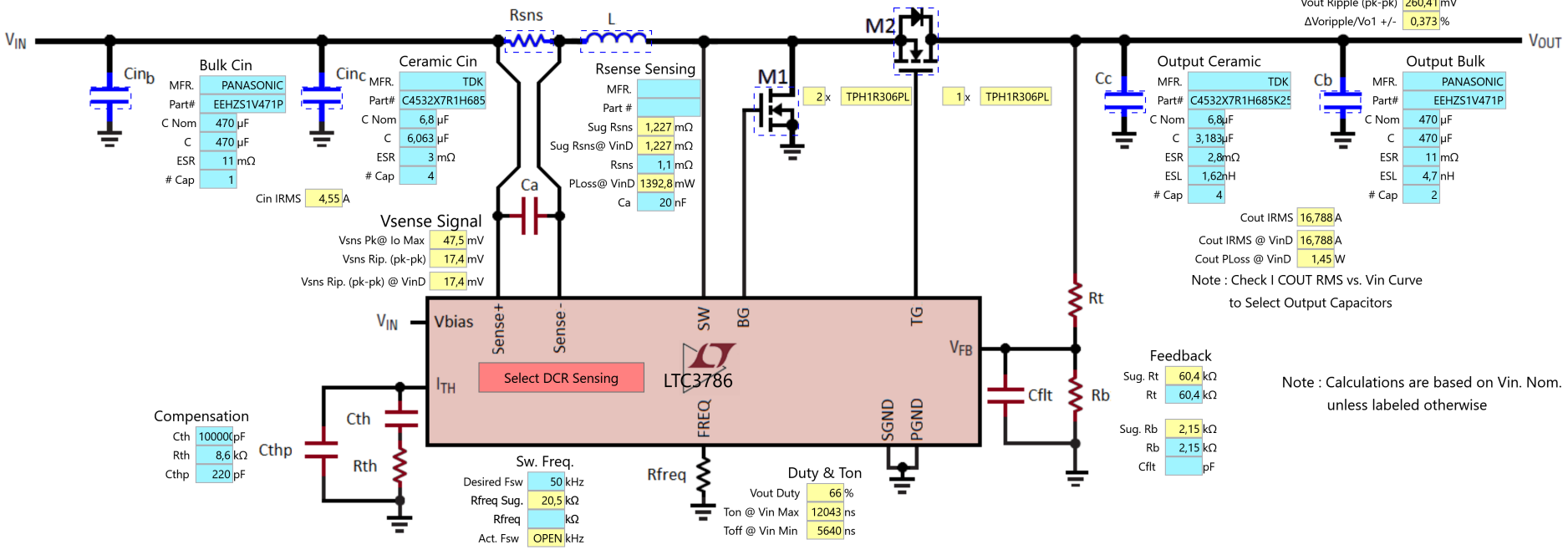
Target Io Limit Margin @ VinD	150	%
Target Io Limit @ VinD	18	A
Act. Io Limit @ VinD	20,5	A
Act. Io Limit	20,5	A
iL Pk@ Act. Io Limit	68,18	A

Output Current

Iout	12	A

Output Voltage

Vout Prog.	34,91	V
Vout Ripple @ VinD (pk-pk)	260,41	mV
ΔVoripple/Vo1 @ VinD +/-	0,373	%
Vout Ripple (pk-pk)	260,41	mV
ΔVoripple/Vo1 +/-	0,373	%



Bulk Cin

MFR.	PANASONIC	
Part#	EEHZS1V471P	
C Nom	470	µF
C	470	µF
ESR	11	mΩ
# Cap	1	
Cin IRMS	4,55	A

Ceramic Cin

MFR.	TDK	
Part#	C4532X7R1H685	
C Nom	6,8	µF
C	6,063	µF
ESR	3	mΩ
# Cap	4	

Rsense Sensing

MFR.		
Part #		
Sug Rsns	1,227	mΩ
Sug Rsns@ VinD	1,227	mΩ
Rsns	1,1	mΩ
PLoss@ VinD	1392,8	mW
Ca	20	nF

Vsense Signal

Vsns Pk@ Io Max	47,5	mV
Vsns Rip. (pk-pk)	17,4	mV
Vsns Rip. (pk-pk) @ VinD	17,4	mV

M1: 2 x TPH1R306PL

M2: 1 x TPH1R306PL

Output Ceramic

MFR.	TDK	
Part#	C4532X7R1H685K25	
C Nom	6,8	µF
C	3,183	µF
ESR	2,8	mΩ
ESL	1,62	nH
# Cap	4	

Output Bulk

MFR.	PANASONIC	
Part#	EEHZS1V471P	
C Nom	470	µF
C	470	µF
ESR	11	mΩ
ESL	4,7	nH
# Cap	2	

Cout IRMS	16,788	A
Cout IRMS @ VinD	16,788	A
Cout PLoss @ VinD	1,45	W

Note : Check I COUT RMS vs. Vin Curve to Select Output Capacitors

Feedback

Sug. Rt	60,4	kΩ
Rt	60,4	kΩ
Sug. Rb	2,15	kΩ
Rb	2,15	kΩ
Cflt		pF

Note : Calculations are based on Vin. Nom. unless labeled otherwise

Compensation

Cth	10000	pF
Rth	8,6	kΩ
Cthp	220	pF

Sw. Freq.

Desired Fsw	50	kHz
Rfreq Sug.	20,5	kΩ
Rfreq		kΩ
Act. Fsw	OPEN	kHz

Duty & Ton

Vout Duty	66	%
Ton @ Vin Max	12043	ns
Toff @ Vin Min	5640	ns

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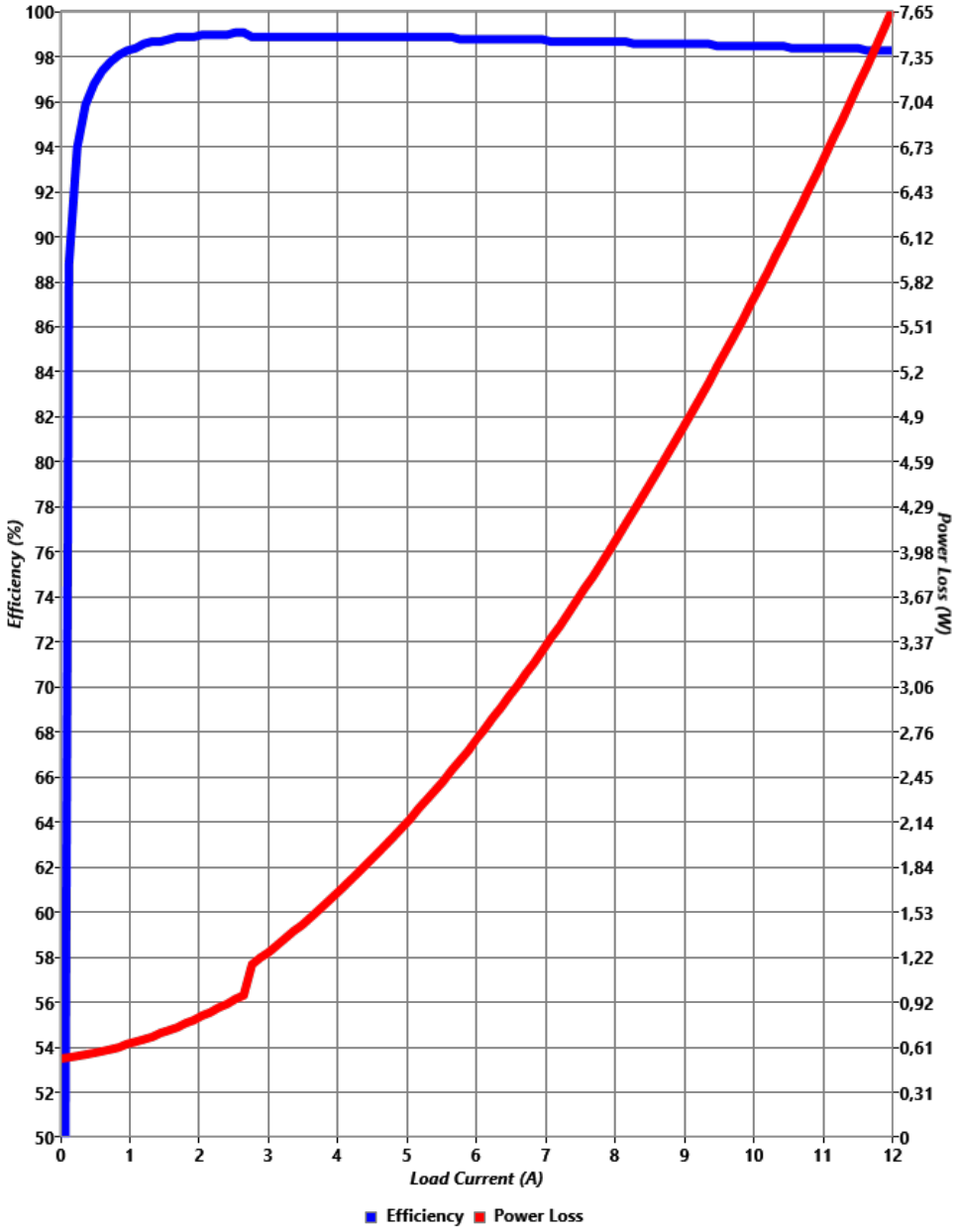
LTC3786 Solution - Efficiency & Loss Estimations

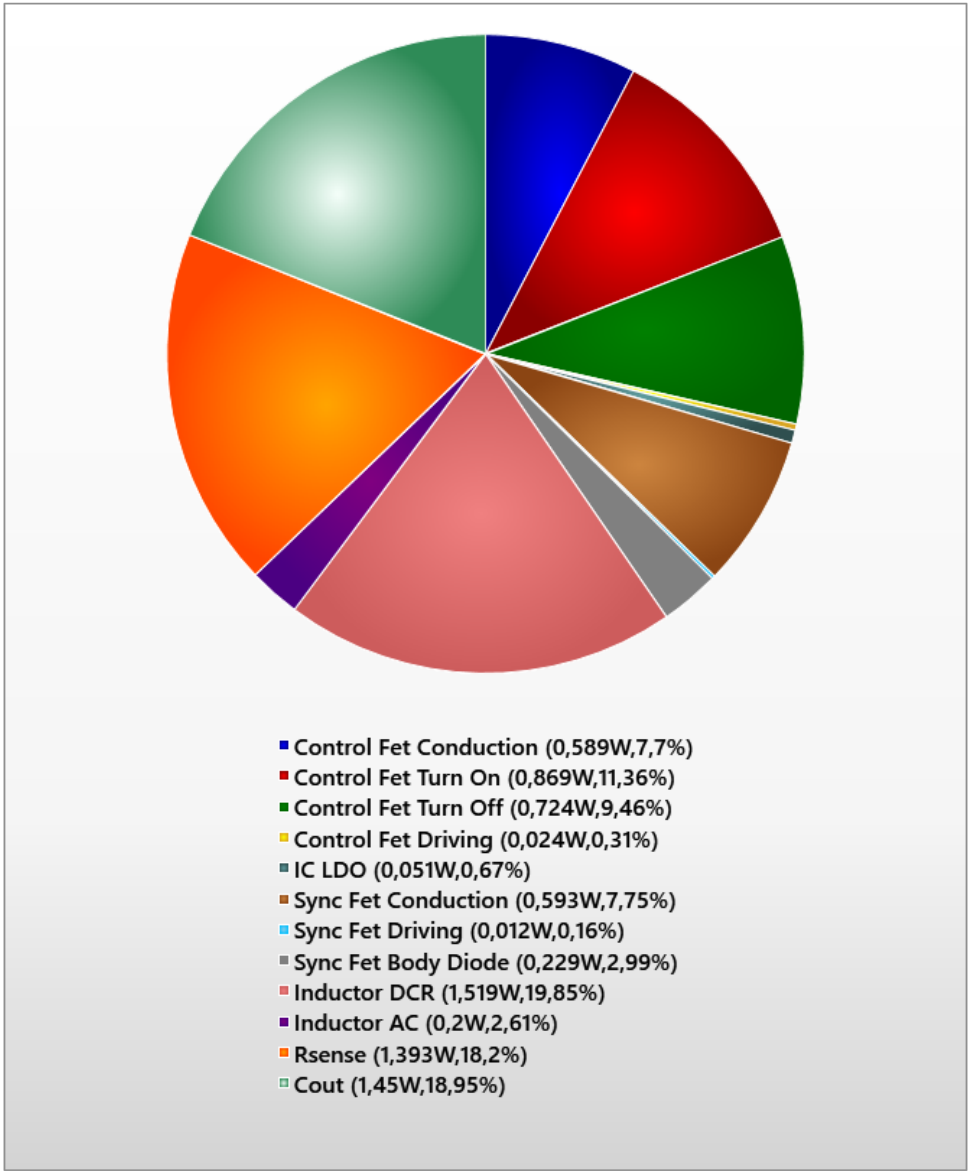
Rail # 1 : Vin = 12V, Vout1 = 34,91V

** Estimations For CCM Mode Only. Inductor AC Losses Entered by User*

Rail #1 (34,91V) Efficiency & Power Loss



Rail #1 (34,91V) Power Loss Breakdown (Full Load)



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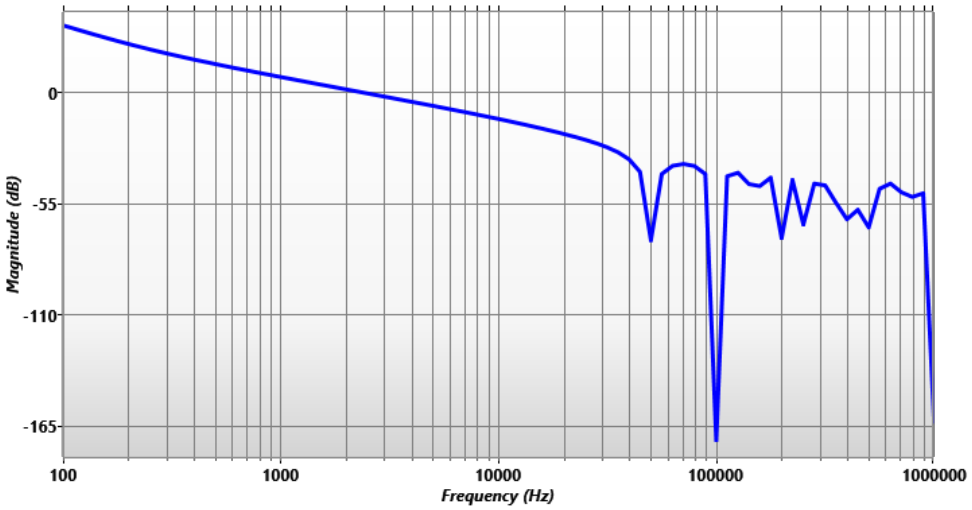
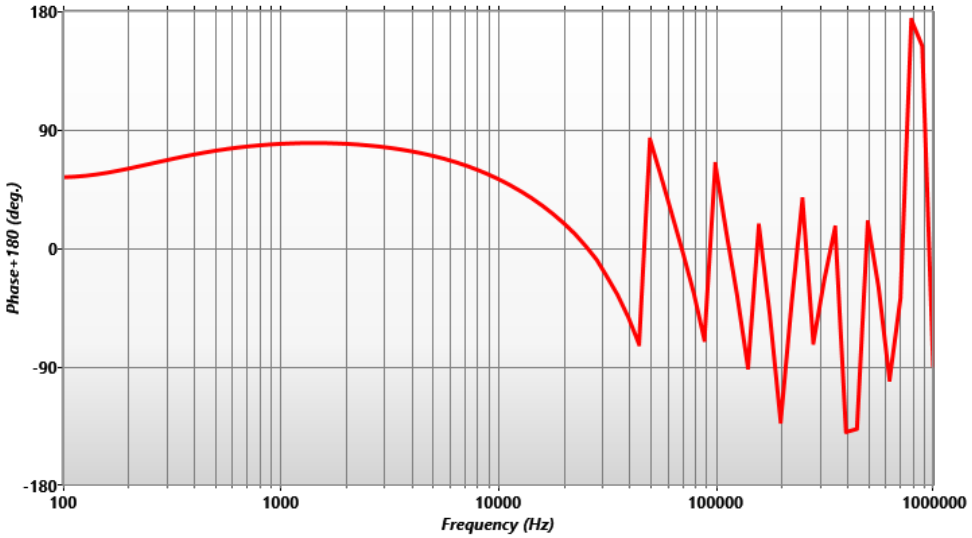
LTC3786 Solution - Loop Gain & Load Transient Estimations

Rail # 1 : Vin = 12V, Vout1 = 34,91V, Iout1 = 1A

** Estimations For CCM Mode Only. Estimations Based On Small Signal Avg. Model*

Rail #1 (34,91V) Loop Gain





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LTC3786 Solution - Summary

LTC3786 Supply Design Summary

Project Info: *Demo Board DC1641A, 9/2014*

Design Specifications

Steady State :

Rail #	Vin Min.	Vin Nom.	Vin Max.	Fsw	Vo	ΔVo	ΔVo%	Io Max	ΔiLp-p	ΔiL%	iLpk	Duty Max	Ton min.	Toff min.
1	10 V	12 V	14 V	50 kHz	34,91 V	260,41 mV	0,4 %	12 A	15,77 A	45 %	43,18 A	71,8 %	12043 ns	5640 ns

Efficiency and Loop :

Rail #	Vo	Iomax	Eff.@Iomax	PLoss@Iomax	Loop BW	Loop PM
1	34,91 V	12 A	98,21 %	7,653 W	2,24 kHz	77,74 deg

Recommendations and Warnings :

Message

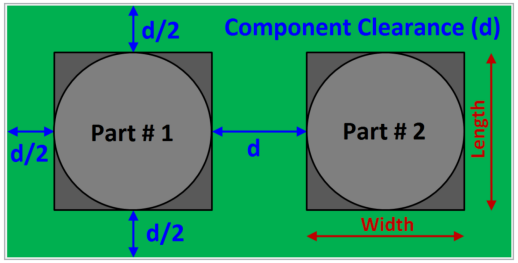
Power Components

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	LTC3786		3	3	0,8	
Lo1	10µH	1	IND	Wurth	7443763540100		19,81	19,56	7,4	
Cinb1	470µF	1	CAP	PANASONIC	EEHZS1V471P		10	10	16,8	
Cinc1 Cinc2 Cinc3 Cinc4	6,8µF	4	CAP	TDK	C4532X7R1H685K250KB		4,5	3,2	2,8	
Cob1 Cob2	470µF	2	CAP	PANASONIC	EEHZS1V471P		10	10	16,8	
Coc1 Coc2 Coc3 Coc4	6,8µF	4	CAP	TDK	C4532X7R1H685K250KB		4,5	3,2	2,8	
Rsense1	1,1mΩ	1	RES				5	2,5	0,74	
Mctrl1 Mctrl2	60V	2	FET	TOSHIBA	TPH1R306PL		5,2	6,3	1	
Msync1	60V	1	FET	TOSHIBA	TPH1R306PL		5,2	6,3	1	

Power Components Footprint :

# Components	17	
Max. Height	16,8	mm
Component Clearance (d)	1	mm
* Power Components Area (Excludes ICs)	1132,4	mm^2
	1,755	in^2
* Power Components Area (Includes ICs)	1148,4	mm^2
	1,78	in^2



**** Notes :***

1. ***The calculated power component area is only the simple sum of component footprint areas with given clearance, assuming all power components are on the same side of PCB. It is NOT the final PCB size with layout design.***
2. ***Component count should change with the number of paralleled phases.***