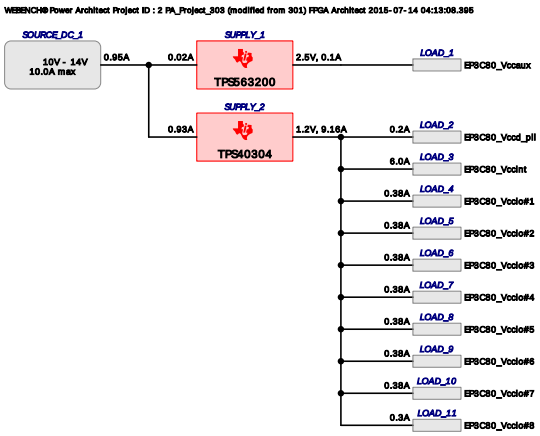
WEBENCH® Power Architect



Project Report

Project : 4166583/2 : PA_Project_303 (modified from 301)
Created : 2015-07-14 04:13:08.395
Optimize project optFactor=3

Project Summary

1.	Total System Efficiency	84.106 %
2.	Total System BOM Count	27.0
3.	Total System Footprint	298.0 mm2
4.	Total System BOM Cost	$3.77
5.	Total System Power Dissipation	2.124 W

--> Launch WEBENCH Power Architect.

Power Supplies

#	Name	NSID	Description	Vout	Iout	Efficiency	Foot-print	Cost	Design	Page
1.	SUPPLY_1	TPS563200	Switcher : 17V, 3A,6-pin, Low Iq Synchronous buck converter with Advanced Eco-mode	2.5 V	0.1 A	87.7%	76	$1.01	27	4
2.	SUPPLY_2	TPS40304	Switcher : Synchronous Buck Controller	1.2 V	9.16 A	84%	222	$2.76	28	9

Power Loads

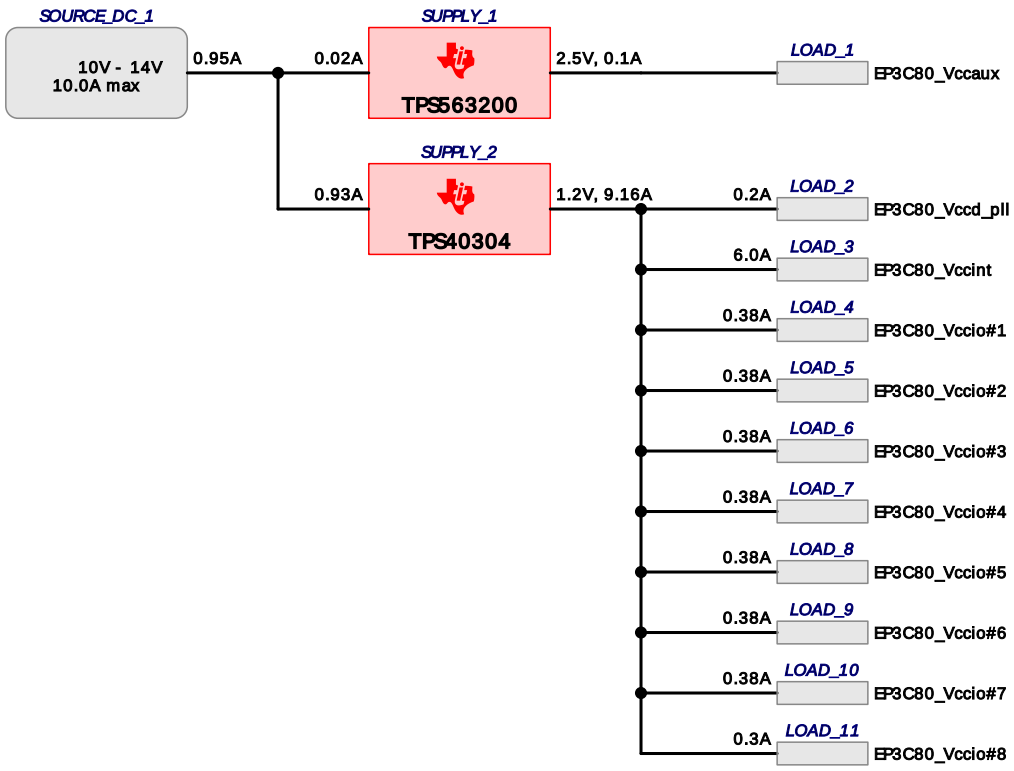
#	Name	VLoad	ILoad	Description
1.	EP3C80_Vccaux	2.5 V	0.1 A	VoutRipple=10%, SoftStart delay=1.0 mSec
2.	EP3C80_Vccd_pll	1.2 V	0.2 A	VoutRipple=10%, SoftStart delay=1.0 mSec
3.	EP3C80_Vccint	1.2 V	6 A	VoutRipple=10%, SoftStart delay=1.0 mSec
4.	EP3C80_Vccio#1	1.2 V	0.38 A	VoutRipple=10%, SoftStart delay=1.0 mSec
5.	EP3C80_Vccio#2	1.2 V	0.38 A	VoutRipple=10%, SoftStart delay=1.0 mSec
6.	EP3C80_Vccio#3	1.2 V	0.38 A	VoutRipple=10%, SoftStart delay=1.0 mSec
7.	EP3C80_Vccio#4	1.2 V	0.38 A	VoutRipple=10%, SoftStart delay=1.0 mSec
8.	EP3C80_Vccio#5	1.2 V	0.38 A	VoutRipple=10%, SoftStart delay=1.0 mSec
9.	EP3C80_Vccio#6	1.2 V	0.38 A	VoutRipple=10%, SoftStart delay=1.0 mSec
10.	EP3C80_Vccio#7	1.2 V	0.38 A	VoutRipple=10%, SoftStart delay=1.0 mSec
11.	EP3C80_Vccio#8	1.2 V	0.3 A	VoutRipple=10%, SoftStart delay=1.0 mSec

FPGAs, Processors

#	Manufacturer	Part Number	Name	Series	Description
1.	Altera	EP3C80	FPGA_1	Cyclone III	FPGA Altera Cyclone III EP3C80
	http://www.altera.com/literature/hb/cyc3/cyc3_ciii52001.pdf				

Project Diagram

WEBENCH® Power Architect Project ID : 2 PA_Project_303 (modified from 301) FPGA Architect 2015-07-14 04:13:08.395



Electrical Procurement BOM

Manufacturer	Part Number	Description	Quantity	Budgetary Price	Footprint (mm^2)
AVX	08053C104KAT2A	0805	2	$0.01	14
Infineon Technologies	BSZ035N03MS G	PG-TSDSON-8	1	$0.37	19
Kemet	C0805C181K5GACTU	0805	1	$0.01	7
Kemet	C0805C475K8PACTU	0805	1	$0.03	7
Yageo America	CC0805KRX7R9BB562	0805	1	$0.01	7
Vishay-Dale	CRCW0402100KFKED	0402	1	$0.01	3
Vishay-Dale	CRCW040210K0FKED	0402	3	$0.01	9
Vishay-Dale	CRCW040222K6FKED	0402	1	$0.01	3
Vishay-Dale	CRCW0402324RFKED	0402	1	$0.01	3
Vishay-Dale	CRCW04023K48FKED	0402	1	$0.01	3
Vishay-Dale	CRCW04023K65FKED	0402	1	$0.01	3
Texas Instruments	CSD17308Q3	TRANS_NexFET_Q3	1	$0.34	19
MuRata	GRM033R71A182KA01D	0201	1	$0.01	2
MuRata	GRM155R71C183KA01D	0402	1	$0.01	3
MuRata	GRM188R61E105KA12D	0603	1	$0.01	5
MuRata	GRM21BR61E475MA12L	0805	1	$0.06	7
MuRata	GRM31CR60J107ME39L	1206	2	$0.20	11
MuRata	GRM31CR60J476ME19L	1206	1	$0.12	11
MuRata	GRM32ER61E226KE15L	1210	1	$0.16	15
Bourns	SDR0403-2R2ML	SDR0403	1	$0.18	28
Bourns	SRP6540-R68M	SRP6540	1	$0.49	83
Texas Instruments	TPS40304DRCR	S-PVSON-N10	1	$0.95	17
Texas Instruments	TPS563200DDCR	DDC0006A	1	$0.52	10
Total			27	$3.77	289

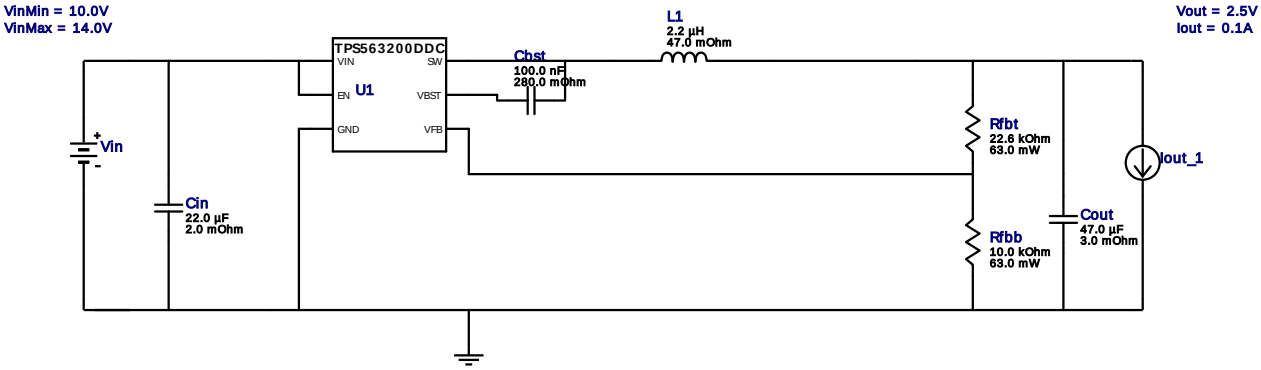
TEXAS INSTRUMENTS

WEBENCH® Design Report

VinMin = 10.0V
VinMax = 14.0V
Vout = 2.5V
Iout = 0.1A

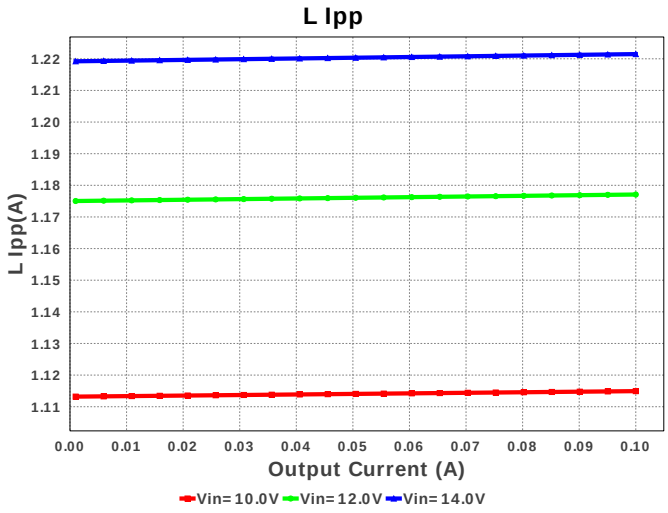
Device = TPS563200DDCR
Topology = Buck
Created = 7/14/15 4:13:06 AM
BOM Cost = $1.01
Footprint = 76.0 mm^2
BOM Count = 7
Total Pd = 0.04W

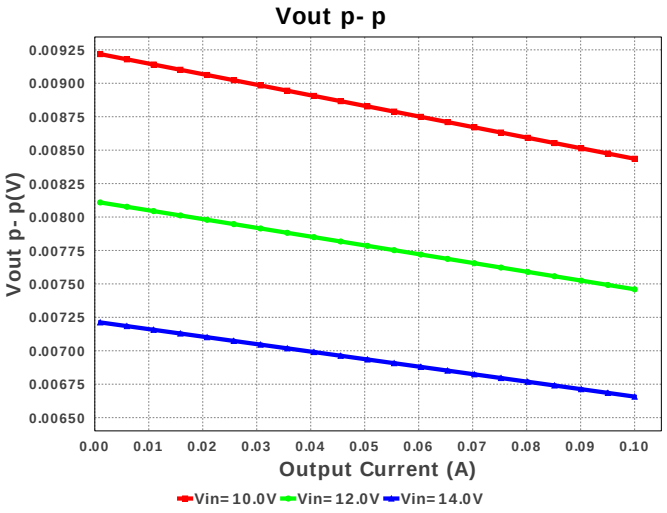
Design : 4166583/27 TPS563200DDCR
TPS563200DDCR 10.0V-14.0V to 2.50V @ 0.1A

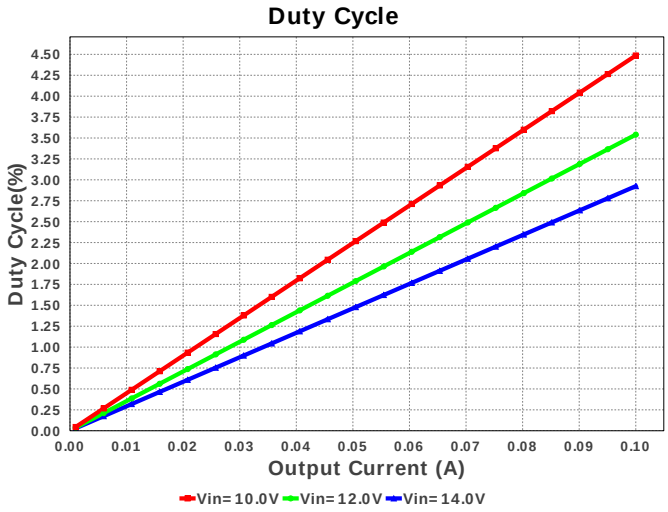


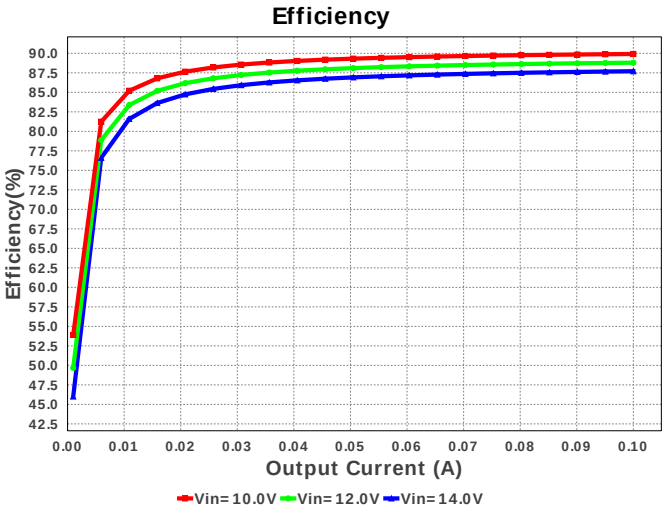
Electrical BOM

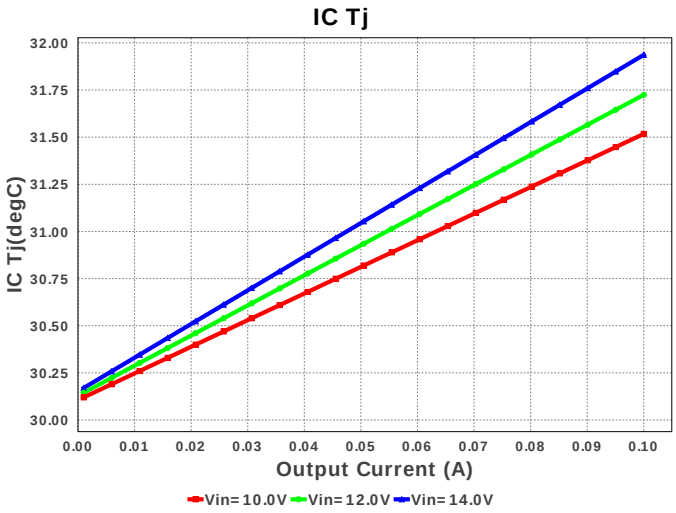
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbst	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
2.	Cin	MuRata	GRM32ER61E226KE15L Series= X5R	Cap= 22.0 uF ESR= 2.0 mOhm VDC= 25.0 V IRMS= 3.67 A	1	$0.16	1210 15 mm^2
3.	Cout	MuRata	GRM31CR60J476ME19L Series= X5R	Cap= 47.0 uF ESR= 3.0 mOhm VDC= 6.3 V IRMS= 0.0 A	1	$0.12	1206 11 mm^2
4.	L1	Bourns	SDR0403-2R2ML	L= 2.2 µH DCR= 47.0 mOhm	1	$0.18	SDR0403 28 mm^2
5.	Rfbb	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
6.	Rfbt	Vishay-Dale	CRCW040222K6FKED Series= CRCW..e3	Res= 22.6 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
7.	U1	Texas Instruments	TPS563200DDCR	Switcher	1	$0.52	DDC0006A 10 mm^2

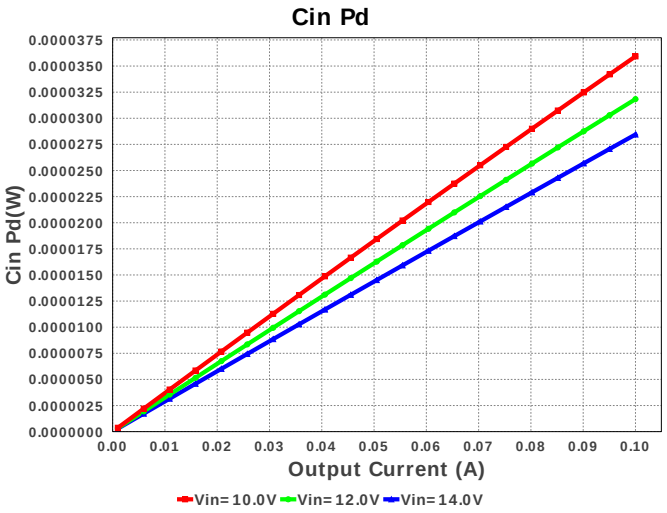


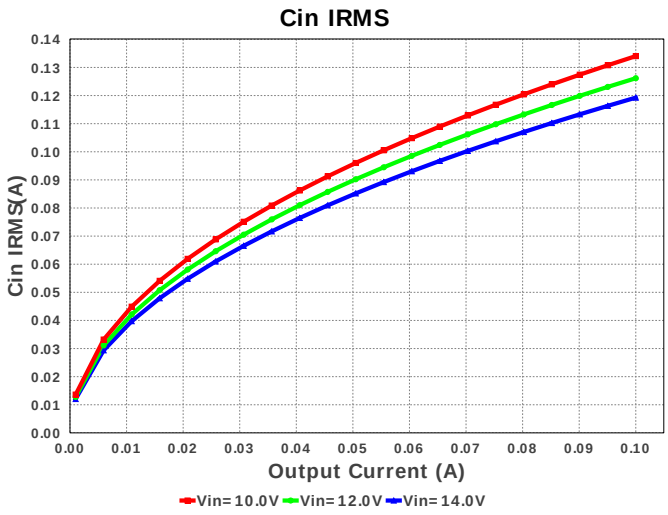


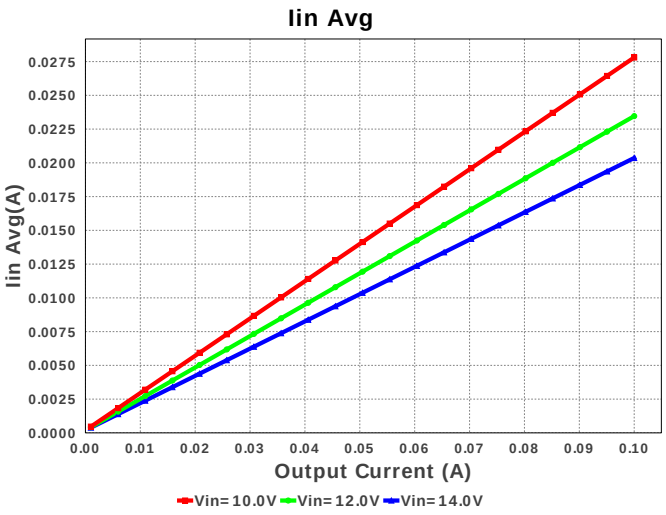


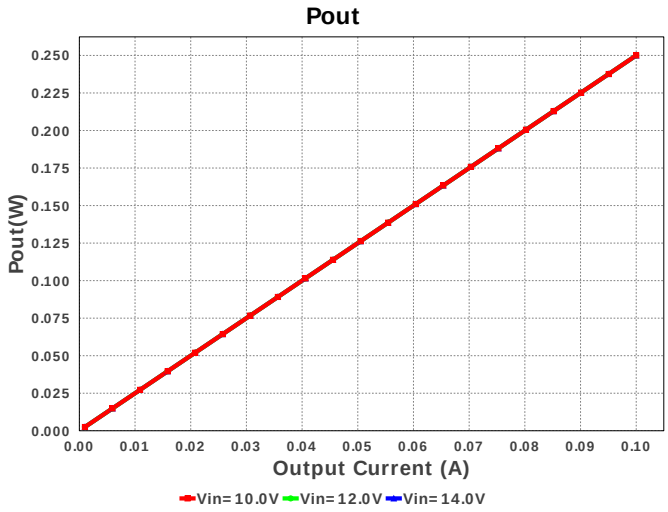


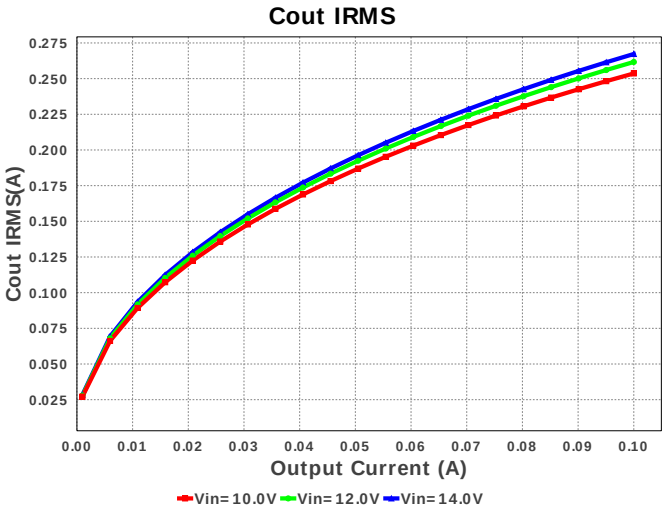


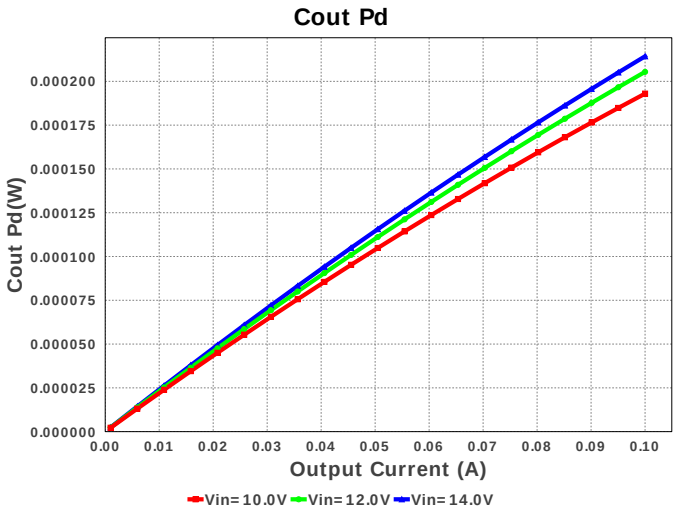


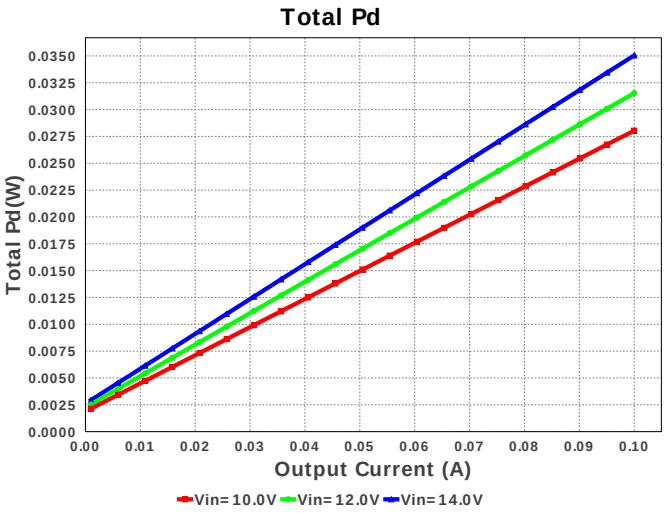


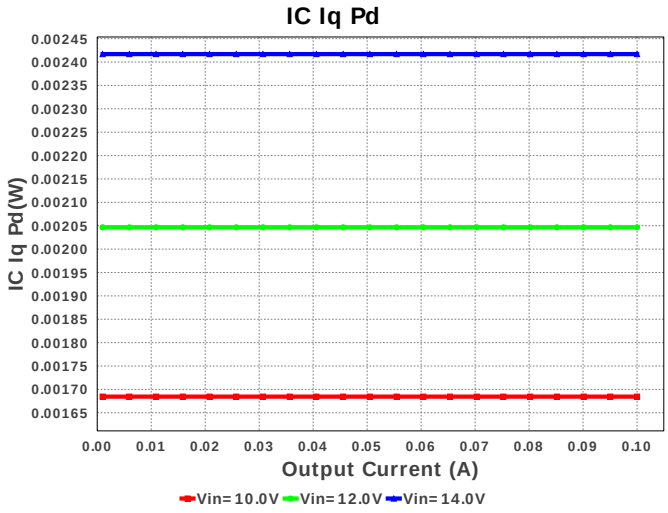


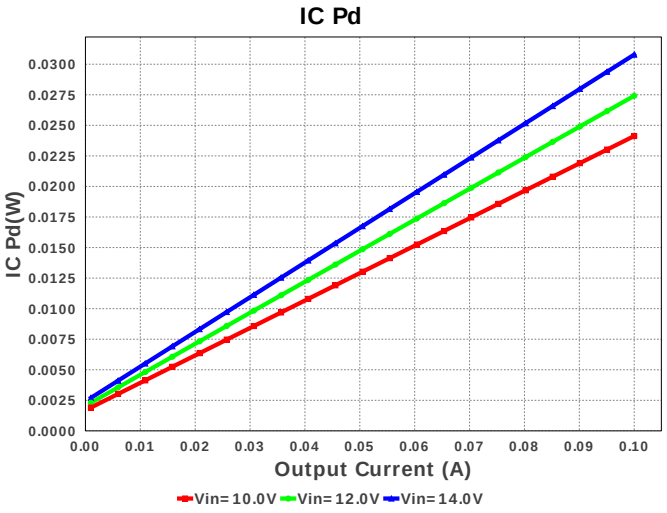


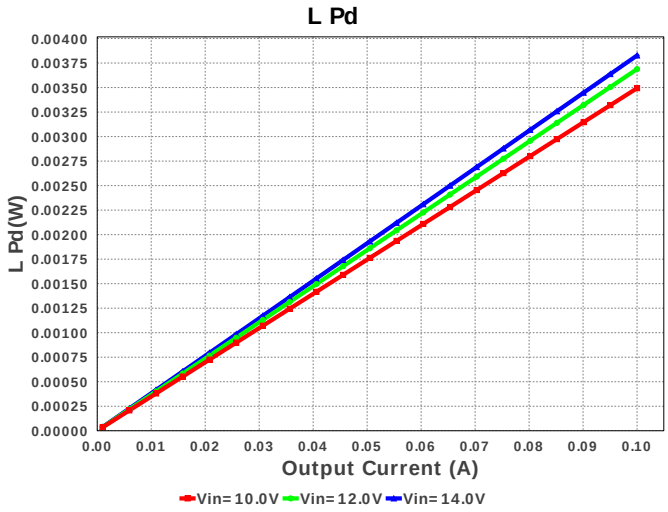


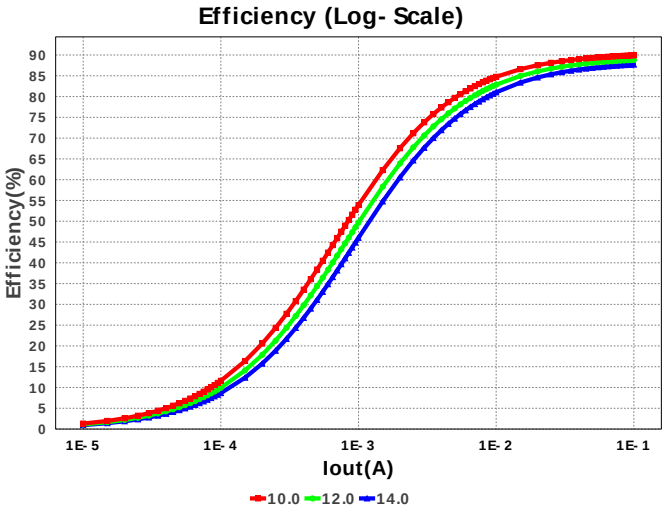












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	119.264 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	267.268 mA	Current	Output capacitor RMS ripple current
3.	Iin Avg	20.361 mA	Current	Average input current
4.	L Ipp	1.222 A	Current	Peak-to-peak inductor ripple current
5.	BOM Count	7	General	Total Design BOM count
6.	FootPrint	76.0 mm^2	General	Total Foot Print Area of BOM components
7.	Frequency	125.033 kHz	General	Switching frequency
8.	Pout	250.0 mW	General	Total output power
9.	Total BOM	$1.01	General	Total BOM Cost
10.	Vout OP	2.5 V	Op_Point	Operational Output Voltage
11.	Duty Cycle	2.924 %	Op_point	Duty cycle
12.	Efficiency	87.705 %	Op_point	Steady state efficiency
13.	IC Tj	31.936 degC	Op_point	IC junction temperature
14.	ICThetaJA	62.9 degC/W	Op_point	IC junction-to-ambient thermal resistance
15.	IOUT_OP	100.0 mA	Op_point	Iout operating point
16.	VIN_OP	14.0 V	Op_point	Vin operating point
17.	Vout p-p	7.251 mV	Op_point	Peak-to-peak output ripple voltage
18.	Cin Pd	28.448 µW	Power	Input capacitor power dissipation
19.	Cout Pd	214.297 µW	Power	Output capacitor power dissipation
20.	IC Iq Pd	2.417 mW	Power	IC Iq Pd
21.	IC Pd	30.786 mW	Power	IC power dissipation
22.	L Pd	3.827 mW	Power	Inductor power dissipation
23.	Total Pd	35.047 mW	Power	Total Power Dissipation

Design Inputs

#	Name	Value	Description
1.	Iout	100.0 m	Maximum Output Current
2.	Iout1	100.0 m	Output Current #1
3.	SoftStart	1.0 ms	Soft Start Time (ms)
4.	VinMax	14.0	Maximum input voltage

#	Name	Value	Description
5.	VinMin	10.0	Minimum input voltage
6.	Vout	2.5	Output Voltage
7.	Vout1	2.5	Output Voltage #1
8.	base_pn	TPS563200	Texas Instruments Base Part Number
9.	source	DC	Input Source Type
10.	ta	30.0	Ambient temperature

Design Assistance

1. TPS563200 Product Folder : http://www.ti.com/product/TPS563200 : contains the data sheet and other resources.

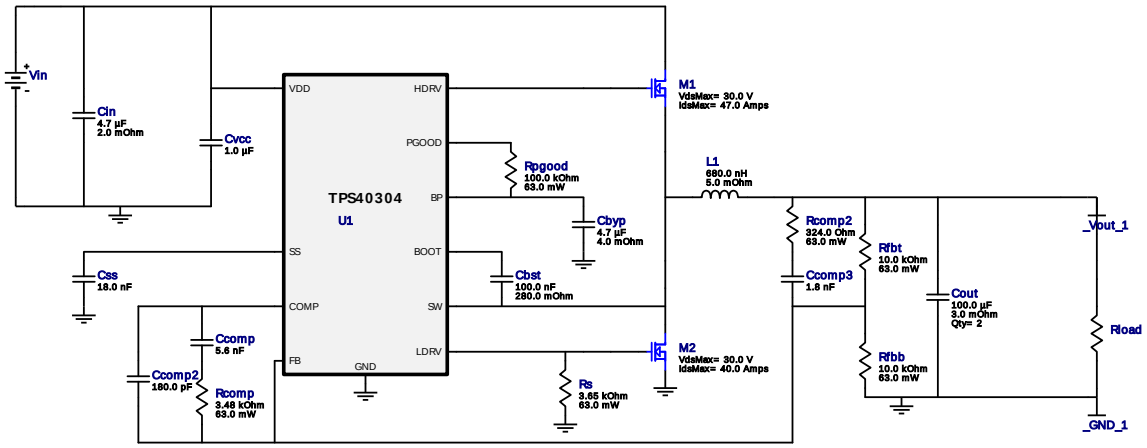
TEXAS INSTRUMENTS

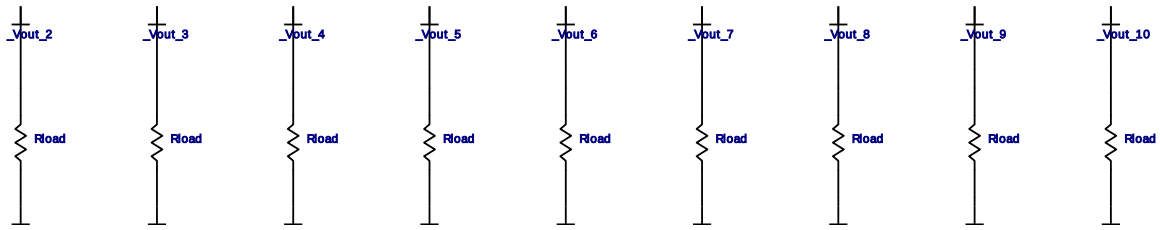
WEBENCH® Design Report

VinMin = 10.0V
VinMax = 14.0V
Vout = 1.2V
Iout = 9.16A

Device = TPS40304DRCR
Topology = Buck
Created = 7/14/15 4:13:07 AM
BOM Cost = $2.76
Footprint = 222.0 mm^2
BOM Count = 20
Total Pd = 2.09W

Design : 4166583/28 TPS40304DRCR
TPS40304DRCR 10.0V-14.0V to 1.20V @ 9.16A

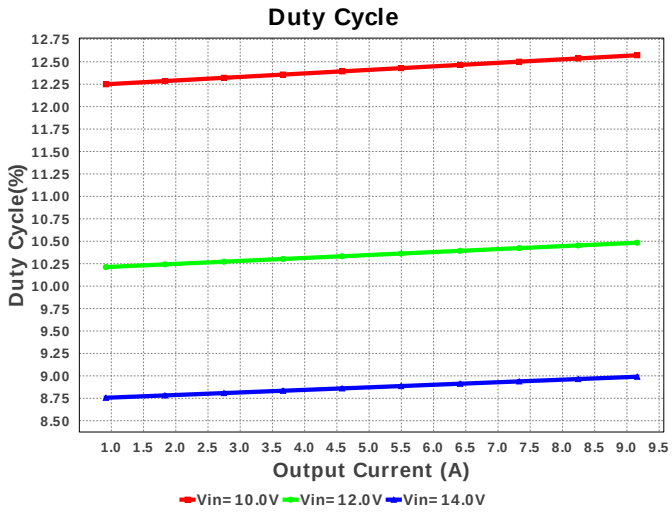


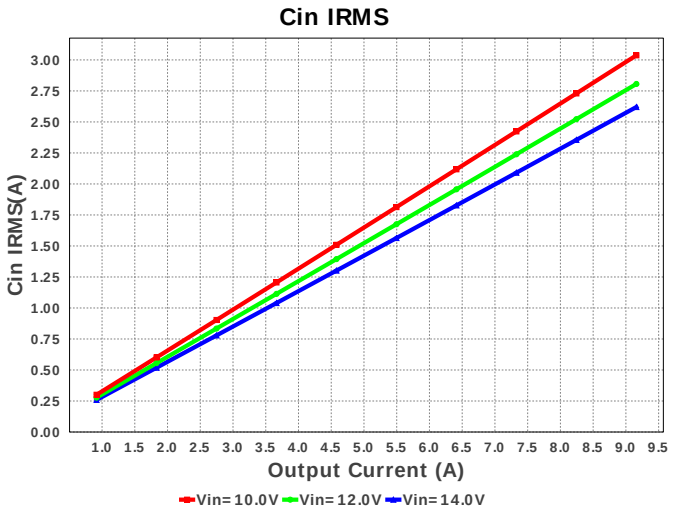


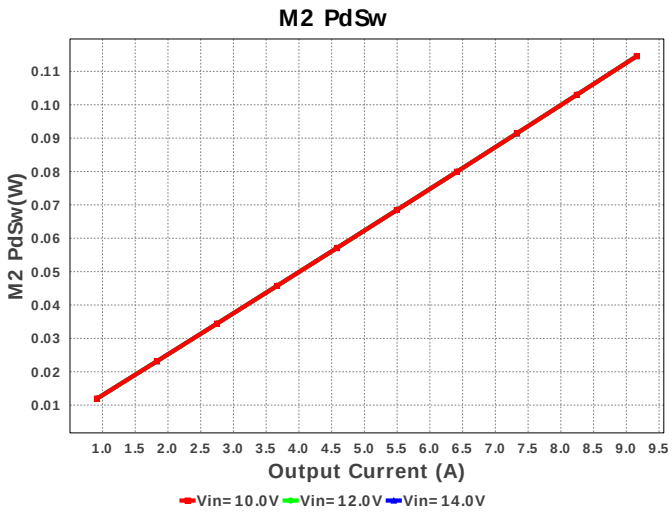
Electrical BOM

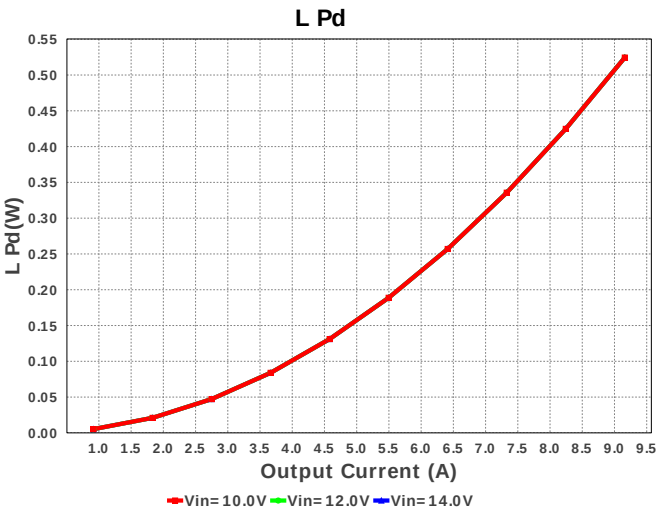
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbst	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
2.	Cbyp	Kemet	C0805C475K8PACTU Series= X5R	Cap= 4.7 uF ESR= 4.0 mOhm VDC= 10.0 V IRMS= 9.89 A	1	$0.03	0805 7 mm^2
3.	Ccomp	Yageo America	CC0805KRX7R9BB562 Series= X7R	Cap= 5.6 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
4.	Ccomp2	Kemet	C0805C181K5GACTU Series= C0G/NP0	Cap= 180.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
5.	Ccomp3	MuRata	GRM033R71A182KA01D Series= X7R	Cap= 1.8 nF VDC= 10.0 V IRMS= 0.0 A	1	$0.01	0201 2 mm^2
6.	Cin	MuRata	GRM21BR61E475MA12L Series= X5R	Cap= 4.7 uF ESR= 2.0 mOhm VDC= 25.0 V IRMS= 7.29 A	1	$0.06	0805 7 mm^2

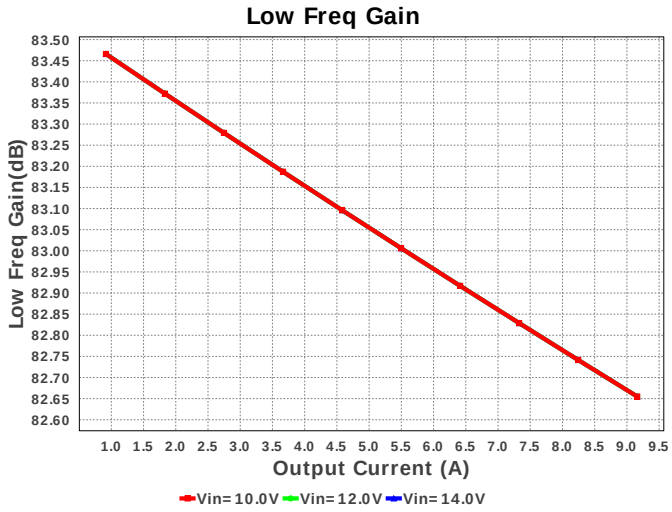
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
7.	Cout	MuRata	GRM31CR60J107ME39L Series= X5R	Cap= 100.0 uF ESR= 3.0 mOhm VDC= 6.3 V IRMS= 0.0 A	2	$0.20	1206 11 mm²
8.	Css	MuRata	GRM155R71C183KA01D Series= X7R	Cap= 18.0 nF VDC= 16.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
9.	Cvcc	MuRata	GRM188R61E105KA12D Series= X5R	Cap= 1.0 uF VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0603 5 mm²
10.	L1	Bourns	SRP6540-R68M	L= 680.0 nH DCR= 5.0 mOhm	1	$0.49	SRP6540 83 mm²
11.	M1	Texas Instruments	CSD17308Q3	VdsMax= 30.0 V IdsMax= 47.0 Amps	1	$0.34	TRANS_NexFET_Q3 19 mm²
12.	M2	Infineon Technologies	BSZ035N03MS G	VdsMax= 30.0 V IdsMax= 40.0 Amps	1	$0.37	PG-TSDSON-8 19 mm²
13.	Rcomp	Vishay-Dale	CRCW04023K48FKED Series= CRCW..e3	Res= 3.48 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
14.	Rcomp2	Vishay-Dale	CRCW0402324RFKED Series= CRCW..e3	Res= 324.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
15.	Rfbb	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
16.	Rfbt	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
17.	Rpgood	Vishay-Dale	CRCW0402100KFKED Series= CRCW..e3	Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
18.	Rs	Vishay-Dale	CRCW04023K65FKED Series= CRCW..e3	Res= 3.65 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
19.	U1	Texas Instruments	TPS40304DRCR	Switcher	1	$0.95	S-PVSON-N10 17 mm²

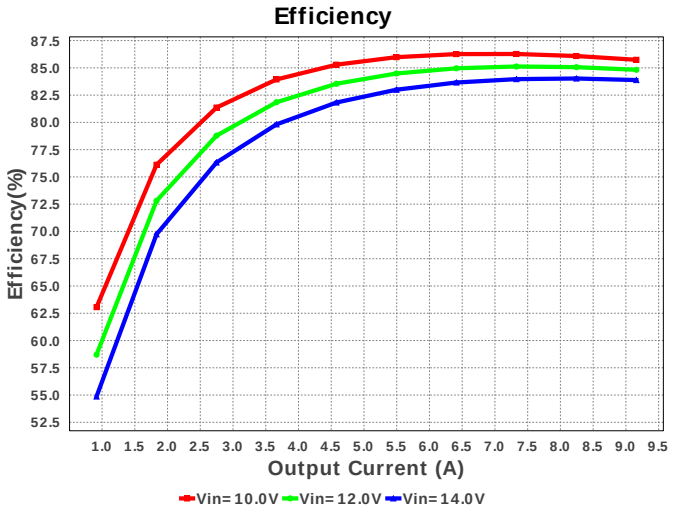


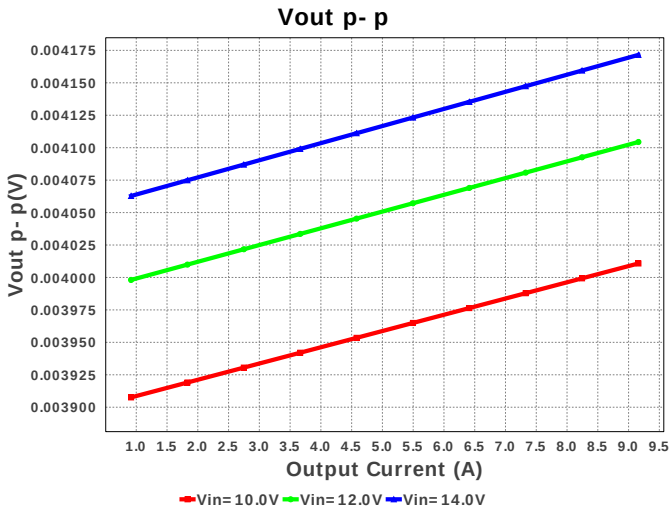


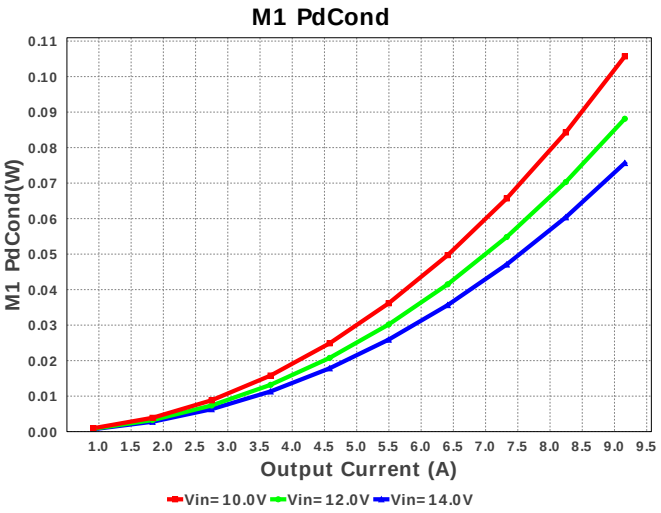


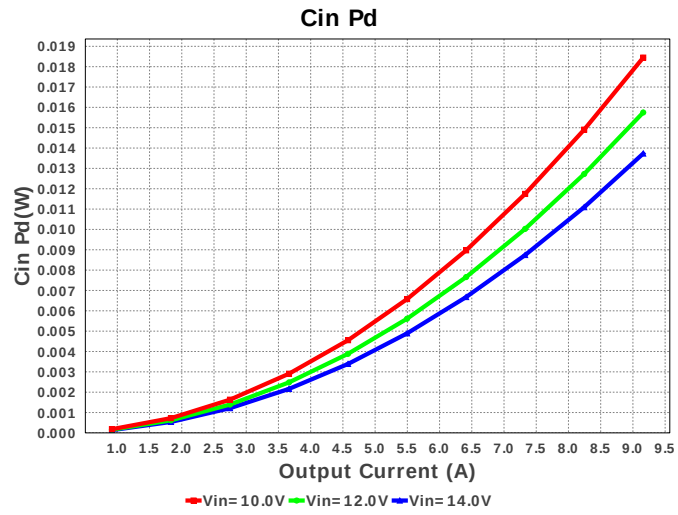


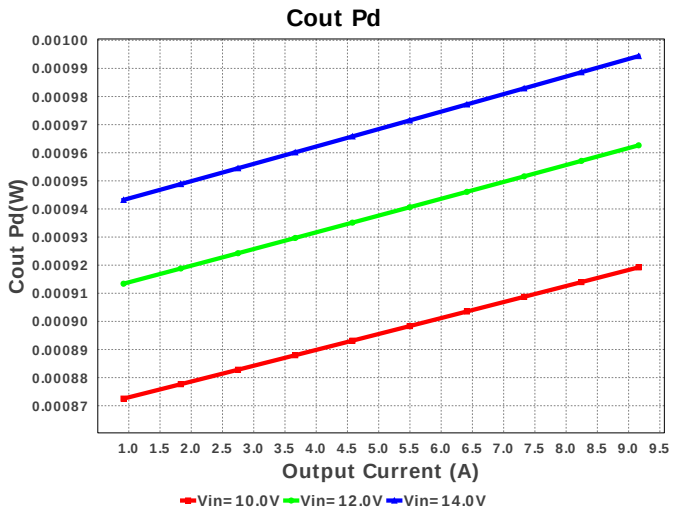


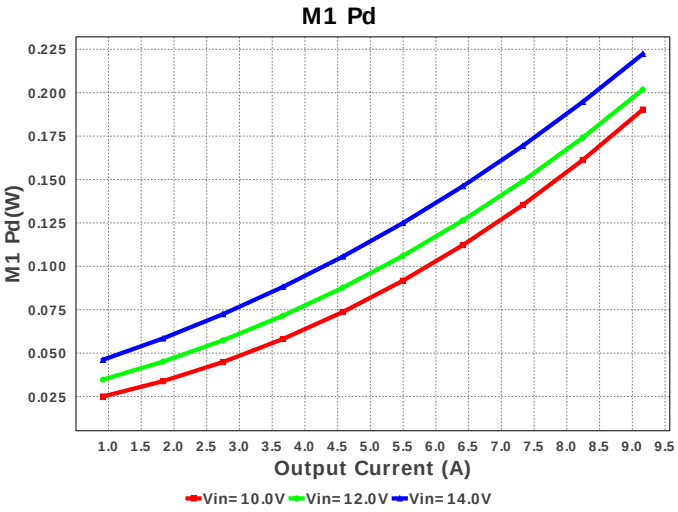


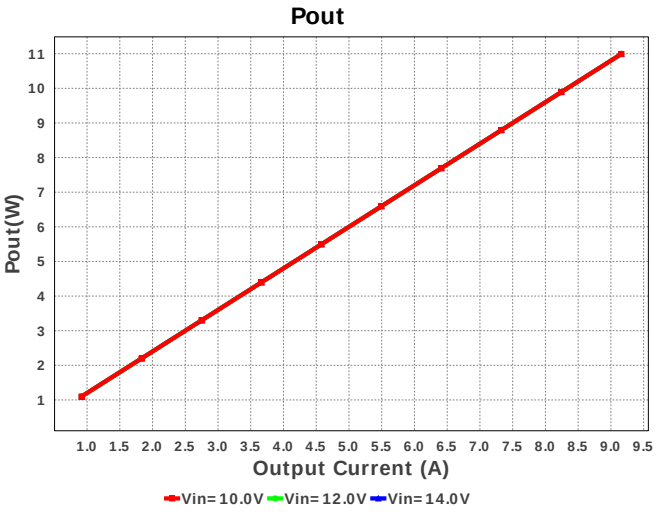


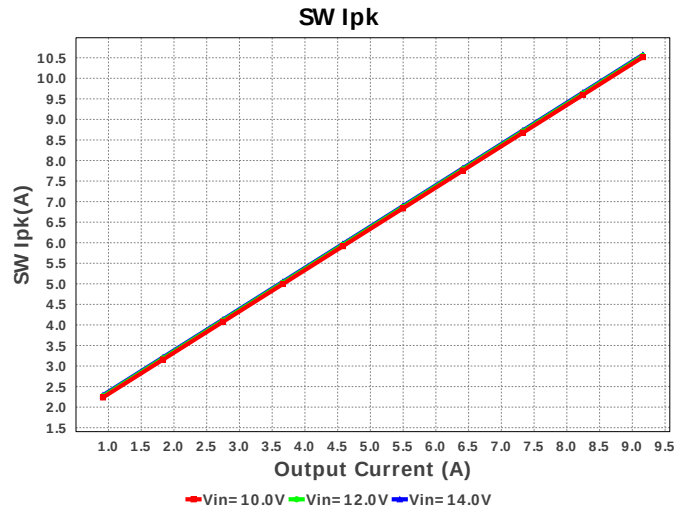


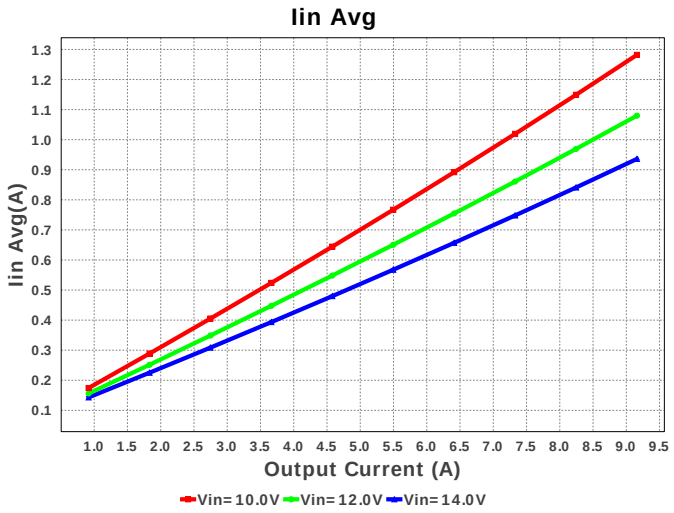


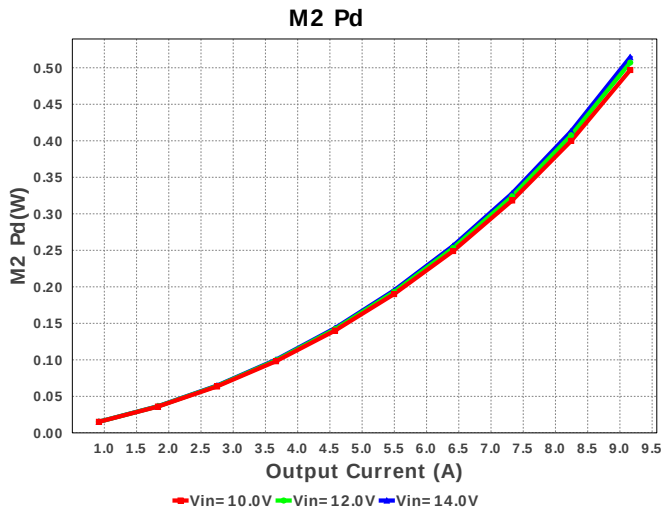


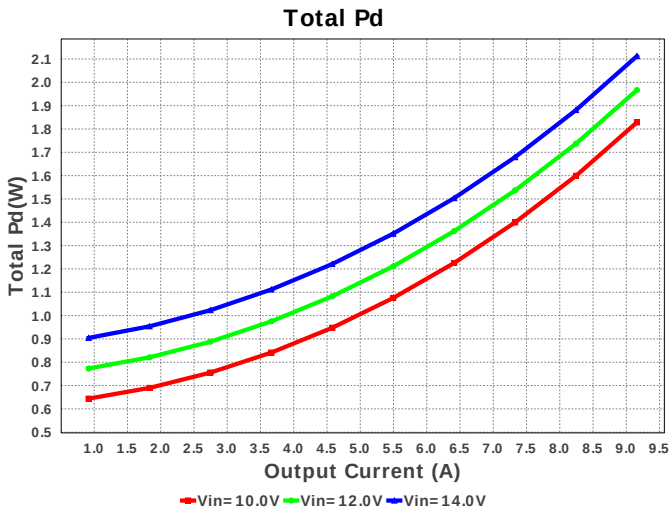


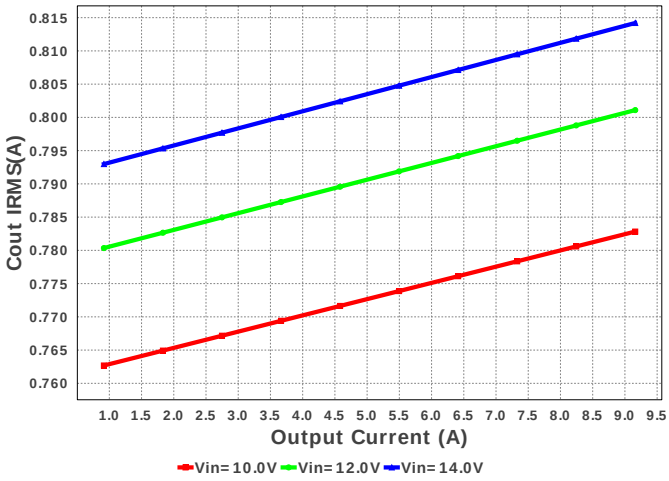


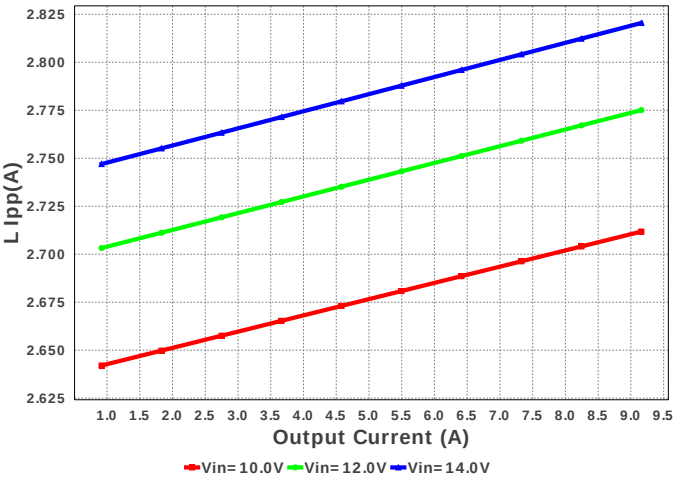


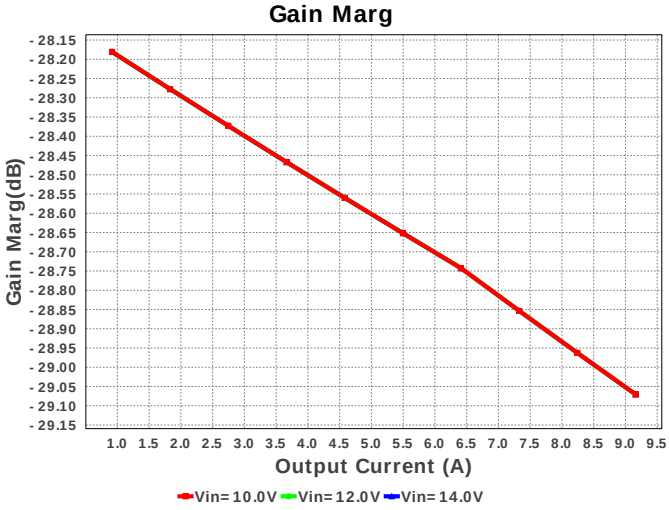


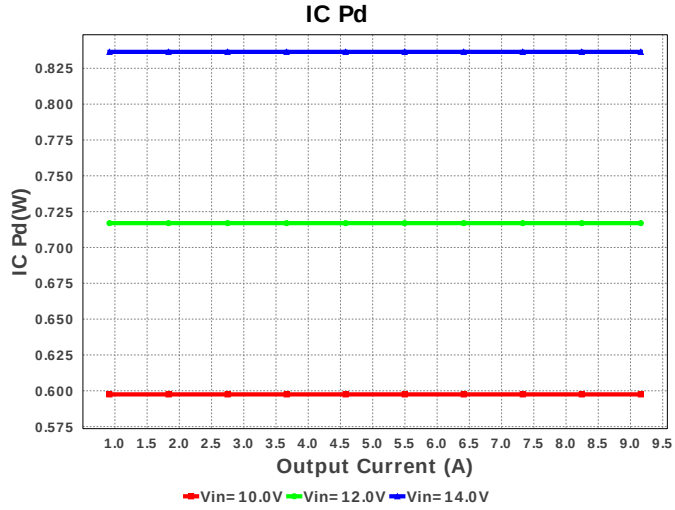


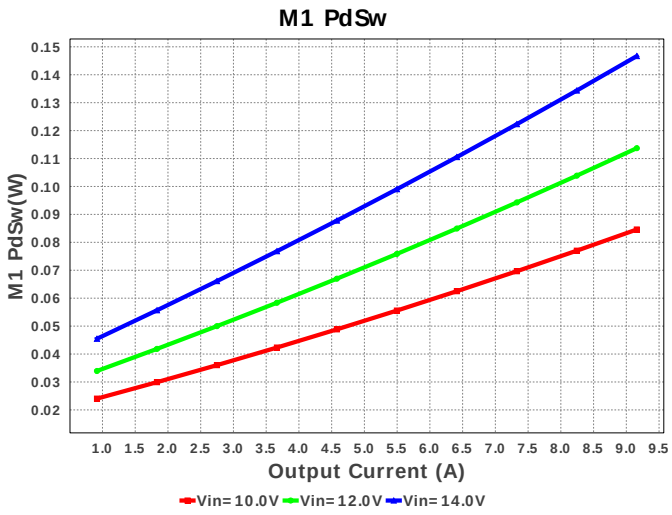


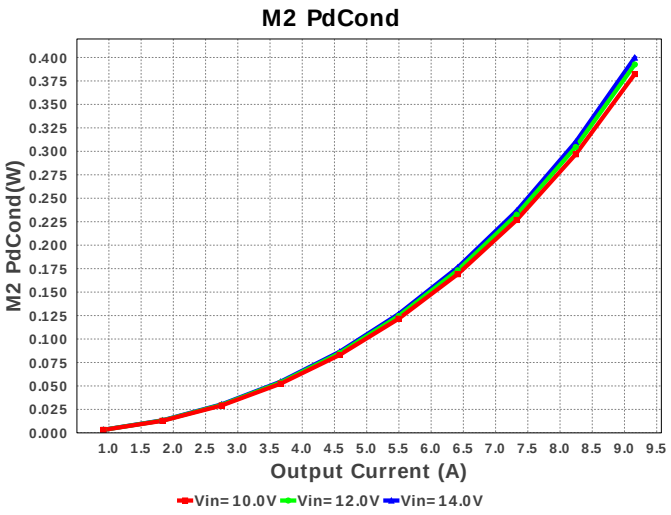


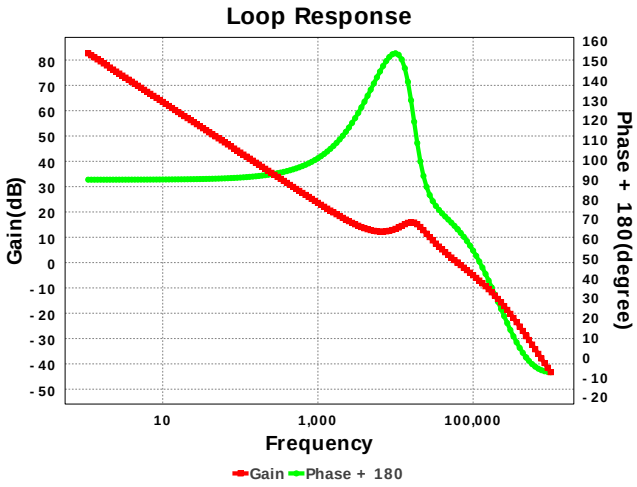












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	2.62 A	Current	Input capacitor RMS ripple current
2.	Cout IRMS	814.199 mA	Current	Output capacitor RMS ripple current
3.	Iin Avg	934.38 mA	Current	Average input current
4.	L Ipp	2.82 A	Current	Peak-to-peak inductor ripple current
5.	SW Ipk	10.57 A	Current	Peak switch current
6.	BOM Count	20	General	Total Design BOM count
7.	FootPrint	222.0 mm^2	General	Total Foot Print Area of BOM components
8.	Frequency	600.0 kHz	General	Switching frequency
9.	IC Tolerance	10.0 mV	General	IC Feedback Tolerance
10.	Pout	10.992 W	General	Total output power
11.	Total BOM	$2.76	General	Total BOM Cost
12.	Low Freq Gain	83.236 dB	Op_Point	Gain at 10Hz
13.	Cross Freq	47.133 kHz	Op_point	Bode plot crossover frequency
14.	Duty Cycle	8.99 %	Op_point	Duty cycle
15.	Efficiency	84.028 %	Op_point	Steady state efficiency
16.	IOUT_OP	9.16 A	Op_point	Iout operating point
17.	Phase Marg	64.867 deg	Op_point	Bode Plot Phase Margin
18.	VIN_OP	14.0 V	Op_point	Vin operating point
19.	Vout p-p	2.938 mV	Op_point	Peak-to-peak output ripple voltage
20.	Cin Pd	13.73 mW	Power	Input capacitor power dissipation
21.	Cout Pd	994.38 µW	Power	Output capacitor power dissipation
22.	IC Pd	836.472 mW	Power	IC power dissipation
23.	L Pd	524.41 mW	Power	Inductor power dissipation
24.	M1 Pd	221.535 mW	Power	M1 MOSFET total power dissipation
25.	M1 PdCond	74.859 mW	Power	M1 MOSFET conduction losses
26.	M1 PdSw	146.676 mW	Power	M1 MOSFET switching losses
27.	M2 Pd	492.181 mW	Power	M2 MOSFET total power dissipation
28.	M2 PdCond	377.607 mW	Power	M2 MOSFET conduction losses
29.	M2 PdSw	114.574 mW	Power	M2 MOSFET switching losses
30.	Total Pd	2.089 W	Power	Total Power Dissipation

Design Inputs

#	Name	Value	Description
1.	Iout	9.16	Maximum Output Current
2.	Iout1	9.16	Output Current #1
3.	SoftStart	1.0 ms	Soft Start Time (ms)
4.	VinMax	14.0	Maximum input voltage
5.	VinMin	10.0	Minimum input voltage
6.	Vout	1.2	Output Voltage
7.	Vout1	1.2	Output Voltage #1
8.	base_pn	TPS40304	Texas Instruments Base Part Number
9.	source	DC	Input Source Type
10.	ta	30.0	Ambient temperature

Design Assistance

1. TPS40304 Product Folder : http://www.ti.com/product/TPS40304 : contains the data sheet and other resources.