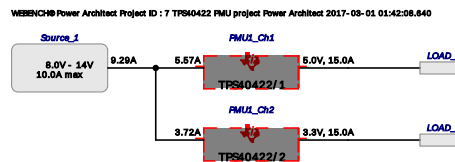


WEBENCH® Power Architect



Project Report

Project : 28154/7 : TPS40422 PMU project
Created : 2017-03-01 01:42:08.640

Project Summary

1. Total System Efficiency	95.729 %
2. Total System BOM Count	59.0
3. Total System Footprint	1.506 kmm2
4. Total System BOM Cost	\$12.08
5. Total System Power Dissipation	5.554 W

--> Launch WEBENCH Power Architect.

My Comments

No comments

Sequencer Flag Table

Supply	Sequencer Flag	Load	Load Name
PMU1_Ch1	0	LOAD_1	
PMU1_Ch2	0	LOAD_2	
PMU1	NA		

Power Supplies

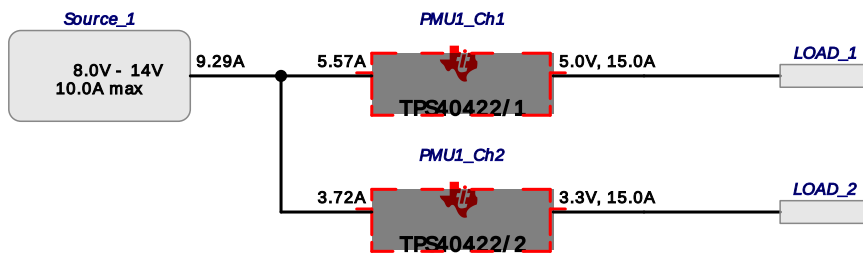
#	Name	NSID	Description	Vout	Iout	Efficiency	Foot-print	Cost	Design	Page
1.	PMU1_Ch1	TPS40422/1	Buck : Stackable 2 Channel Output Controller	5.0 V	15.0 A	96.2%	811	\$8.95	270	10
2.	PMU1_Ch2	TPS40422/2	Buck : Stackable 2 Channel Output Controller	3.3 V	15.0 A	95%	867	\$9.48	271	16
3.	PMU1	TPS40422	PMU : 4.5V to 20V Input Voltage High Current Dual Output Buck Controller	V	NaN A	95.7%	1506	\$12.08	269	4

Power Loads

#	Name	VLoad	ILoad	Description
1.	LOAD_1	5.0 V	15.0 A	VoutRipple=10%
2.	LOAD_2	3.3 V	15.0 A	VoutRipple=10%

Project Diagram

WEBENCH® Power Architect Project ID : 7 TPS40422 PMU project Power Architect 2017-03-01 01:42:08.640



Electrical Procurement BOM

Manufacturer	Part Number	Description	Quantity	Budgetary Price	Footprint (mm ²)
AVX	06033A220JAT2A	0603	2	\$0.01	9
AVX	06035A470KAT2A	0603	2	\$0.01	9
AVX	08053C104KAT2A	0805	4	\$0.01	27
Panasonic	20SVPF560M	CAPSMT_62_F12	8	\$0.70	605
Panasonic	6SVPE220MW	CAPSMT_62_E61	2	\$0.20	107
Chemi-Con	APXE4R0ARA681MH80G	CAPSMT_62_H80	2	\$0.69	212
Kemet	C0603C332K5RACTU	0603	4	\$0.01	19
Kemet	C0805C102K5RACTU	0805	12	\$0.01	81
TDK	C1005X5R1V105K050BC	0402	1	\$0.03	3
TDK	C1608X5R1H474K080AB	0603	4	\$0.03	19
Yageo America	CC0805KRX7R9BB222	0805	4	\$0.01	27
Vishay-Dale	CRCW040210K0FKED	0402	9	\$0.01	27
Vishay-Dale	CRCW040210R0FKED	0402	8	\$0.01	24
Vishay-Dale	CRCW04021K33FKED	0402	2	\$0.01	6
Vishay-Dale	CRCW04021K37FKED	0402	2	\$0.01	6
Vishay-Dale	CRCW04021K78FKED	0402	2	\$0.01	6
Vishay-Dale	CRCW04021K91FKED	0402	2	\$0.01	6
Vishay-Dale	CRCW040236K5FKED	0402	2	\$0.01	6
Vishay-Dale	CRCW04025R11FKED	0402	4	\$0.01	12
Vishay-Dale	CRCW0402665RFKED	0402	2	\$0.01	6
Vishay-Dale	CRCW04026K98FKED	0402	2	\$0.01	6
Vishay-Dale	CRCW040273K2FKED	0402	1	\$0.01	3
Vishay-Dale	CRCW04027K68FKED	0402	2	\$0.01	6
Vishay-Dale	CRCW08053R32FKEA	0805	4	\$0.01	27
Texas Instruments	CSD86360Q5D	DQY0008A	4	\$0.99	224
MuRata	GRM155R60J104KA01D	0402	1	\$0.01	3
MuRata	GRM188R60J105KA01D	0603	1	\$0.01	5
MuRata	GRM188R61A105KA61D	0603	1	\$0.01	5
MuRata	GRM31CC80J476KE18L	1206_190	2	\$0.10	22
MuRata	GRM31CE70G476ME15L	1206_190	2	\$0.10	22
Fairchild Semiconductor	MMBT3904	SOT-23	4	\$0.05	56
Yageo America	RT0805BRD072K23L	0805	2	\$0.05	14
Texas Instruments	TPS40422RHAR	RHA0040B	5	\$2.15	332
Coilcraft	XAL1010-222MEB	XAL1010	2	\$1.71	319
Coilcraft	XAL1010-332MEB	XAL1010	2	\$1.71	319
Total			113	\$3252.13	24999999997

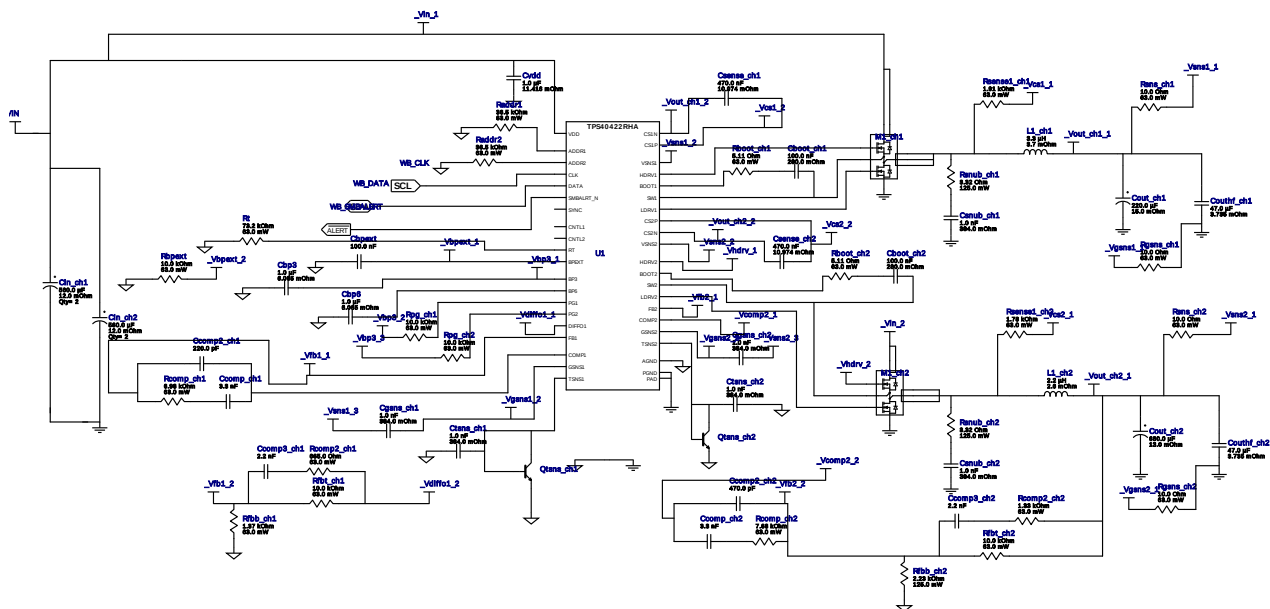


WEBENCH® Design Report

Design : 28154/269 TPS40422RHAR
Design 269 - TPS40422RHAR

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Iout = 15.0A

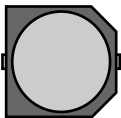
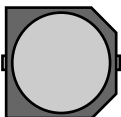
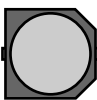
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Topology = PMU
Created = 3/1/17 1:42:05 AM
BOM Cost = \$12.08
BOM Count = 59
Total Pd = 5.55W



1. This schematic shows all the components for this Power Management Unit. The block diagram on the left shows how the channels are connected. Use the drop down PMU Options selector below the optimization dial on the summary page to get the details for each channel. Or click on the block diagram on the left to select a specific channel.

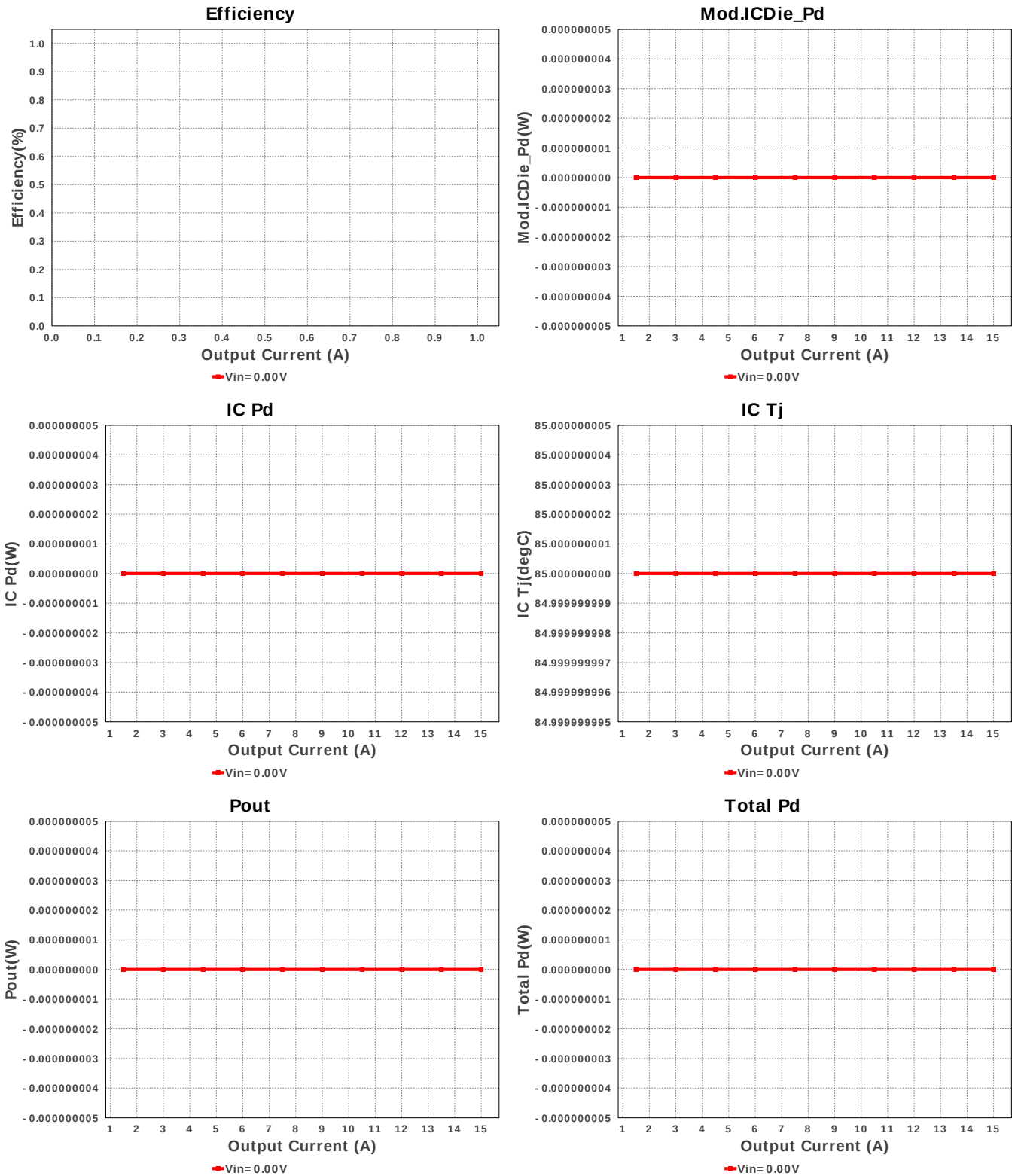
Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot_ch1 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.	Cboot_ch2 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
3.	Cbp3	MuRata	GRM188R60J105KA01D Series= X5R	Cap= 1.0 uF ESR= 6.065 mOhm VDC= 6.3 V IRMS= 1.36934 A	1	\$0.01	0603 5 mm ²
4.	Cbp6	MuRata	GRM188R61A105KA61D Series= X5R	Cap= 1.0 uF ESR= 6.065 mOhm VDC= 10.0 V IRMS= 1.30675 A	1	\$0.01	0603 5 mm ²
5.	Cbext	MuRata	GRM155R60J104KA01D Series= X5R	Cap= 100.0 nF VDC= 6.3 V IRMS= 0.0 A	1	\$0.01	0402 3 mm ²
6.	Ccomp2_ch1 AVX		06033A220JAT2A Series= C0G/NP0	Cap= 220.0 pF VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	0603 5 mm ²
7.	Ccomp2_ch2 AVX		06035A470KAT2A Series= C0G/NP0	Cap= 470.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0603 5 mm ²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
8.	Ccomp3_ch1	Yageo America	CC0805KRX7R9BB222 Series= X7R	Cap= 2.2 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm ²
9.	Ccomp3_ch2	Yageo America	CC0805KRX7R9BB222 Series= X7R	Cap= 2.2 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm ²
10.	Ccomp_ch1	Kemet	C0603C332K5RACTU Series= X7R	Cap= 3.3 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	 0603 5 mm ²
11.	Ccomp_ch2	Kemet	C0603C332K5RACTU Series= X7R	Cap= 3.3 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	 0603 5 mm ²
12.	Cgsns_ch1	Kemet	C0805C102K5RACTU Series= X7R	Cap= 1.0 nF ESR= 384.0 mOhm VDC= 50.0 V IRMS= 214.0 mA	1	\$0.01	 0805 7 mm ²
13.	Cgsns_ch2	Kemet	C0805C102K5RACTU Series= X7R	Cap= 1.0 nF ESR= 384.0 mOhm VDC= 50.0 V IRMS= 214.0 mA	1	\$0.01	 0805 7 mm ²
14.	Cin_ch1	Panasonic	20SVPF560M Series= ?	Cap= 560.0 uF ESR= 12.0 mOhm VDC= 20.0 V IRMS= 5.4 A	2	\$0.70	 CAPSMT_62_F12 151 mm ²
15.	Cin_ch2	Panasonic	20SVPF560M Series= ?	Cap= 560.0 uF ESR= 12.0 mOhm VDC= 20.0 V IRMS= 5.4 A	2	\$0.70	 CAPSMT_62_F12 151 mm ²
16.	Cout_ch1	Panasonic	6SVPE220MW Series= SVPE	Cap= 220.0 uF ESR= 15.0 mOhm VDC= 6.3 V IRMS= 3.15 A	1	\$0.20	 CAPSMT_62_E61 53 mm ²
17.	Cout_ch2	Chemi-Con	APXE4R0ARA681MH80G Series= PXE	Cap= 680.0 uF ESR= 13.0 mOhm VDC= 4.0 V IRMS= 3.95 A	1	\$0.69	 CAPSMT_62_H80 106 mm ²
18.	Couthf_ch1	MuRata	GRM31CC80J476KE18L Series= X6S	Cap= 47.0 uF ESR= 3.735 mOhm VDC= 6.3 V IRMS= 4.0522 A	1	\$0.10	 1206_190 11 mm ²
19.	Couthf_ch2	MuRata	GRM31CE70G476ME15L Series= X7U	Cap= 47.0 uF ESR= 3.735 mOhm VDC= 4.0 V IRMS= 4.1841 A	1	\$0.10	 1206_190 11 mm ²
20.	Csense_ch1	ITDK	C1608X5R1H474K080AB Series= X5R	Cap= 470.0 nF ESR= 10.974 mOhm VDC= 50.0 V IRMS= 1.57483 A	1	\$0.03	 0603 5 mm ²
21.	Csense_ch2	ITDK	C1608X5R1H474K080AB Series= X5R	Cap= 470.0 nF ESR= 10.974 mOhm VDC= 50.0 V IRMS= 1.57483 A	1	\$0.03	 0603 5 mm ²
22.	Csub_ch1	Kemet	C0805C102K5RACTU Series= X7R	Cap= 1.0 nF ESR= 384.0 mOhm VDC= 50.0 V IRMS= 214.0 mA	1	\$0.01	 0805 7 mm ²
23.	Csub_ch2	Kemet	C0805C102K5RACTU Series= X7R	Cap= 1.0 nF ESR= 384.0 mOhm VDC= 50.0 V IRMS= 214.0 mA	1	\$0.01	 0805 7 mm ²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
24.	Ctsns_ch1	Kemet	C0805C102K5RACTU Series= X7R	Cap= 1.0 nF ESR= 384.0 mOhm VDC= 50.0 V IRMS= 214.0 mA	1	\$0.01	 0805 7 mm ²
25.	Ctsns_ch2	Kemet	C0805C102K5RACTU Series= X7R	Cap= 1.0 nF ESR= 384.0 mOhm VDC= 50.0 V IRMS= 214.0 mA	1	\$0.01	 0805 7 mm ²
26.	Cvdd	TDK	C1005X5R1V105K050BC Series= X5R	Cap= 1.0 uF ESR= 11.416 mOhm VDC= 35.0 V IRMS= 1.483 A	1	\$0.03	 0402 3 mm ²
27.	L1_ch1	Coilcraft	XAL1010-332MEB	L= 3.3 µH DCR= 3.7 mOhm	1	\$1.71	 XAL1010 160 mm ²
28.	L1_ch2	Coilcraft	XAL1010-222MEB	L= 2.2 µH DCR= 2.6 mOhm	1	\$1.71	 XAL1010 160 mm ²
29.	M1_ch1	Texas Instruments	CSD86360Q5D	PowerBlock	1	\$0.99	 DQY0008A 56 mm ²
30.	M1_ch2	Texas Instruments	CSD86360Q5D	PowerBlock	1	\$0.99	 DQY0008A 56 mm ²
31.	Qtsns_ch1	Fairchild Semiconductor	MMBT3904	Bipolar Transistor	1	\$0.05	 SOT-23 14 mm ²
32.	Qtsns_ch2	Fairchild Semiconductor	MMBT3904	Bipolar Transistor	1	\$0.05	 SOT-23 14 mm ²
33.	Raddr1	Vishay-Dale	CRCW040236K5FKED Series= CRCW..e3	Res= 36.5 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
34.	Raddr2	Vishay-Dale	CRCW040236K5FKED Series= CRCW..e3	Res= 36.5 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
35.	Rboot_ch1	Vishay-Dale	CRCW04025R11FKED Series= CRCW..e3	Res= 5.11 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
36.	Rboot_ch2	Vishay-Dale	CRCW04025R11FKED Series= CRCW..e3	Res= 5.11 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
37.	Rbpxt	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
38.	Rcomp2_ch1	Vishay-Dale	CRCW0402665RFKED Series= CRCW..e3	Res= 665.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
39.	Rcomp2_ch2	Vishay-Dale	CRCW04021K33FKED Series= CRCW..e3	Res= 1.33 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
40.	Rcomp_ch1	Vishay-Dale	CRCW04026K98FKED Series= CRCW..e3	Res= 6.98 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
41.	Rcomp_ch2	Vishay-Dale	CRCW04027K68FKED Series= CRCW..e3	Res= 7.68 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
42.	Rfbb_ch1	Vishay-Dale	CRCW04021K37FKED Series= CRCW..e3	Res= 1.37 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
43.	Rfbb_ch2	Yageo America	RT0805BRD072K23L Series= RT0805	Res= 2.23 kOhm Power= 125.0 mW Tolerance= 0.1%	1	\$0.05	 0805 7 mm ²
44.	Rfbb_ch1	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
45.	Rfbb_ch2	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
46.	Rgsns_ch1	Vishay-Dale	CRCW040210R0FKED Series= CRCW..e3	Res= 10.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
47.	Rgsns_ch2	Vishay-Dale	CRCW040210R0FKED Series= CRCW..e3	Res= 10.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
48.	Rpg_ch1	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
49.	Rpg_ch2	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
50.	Rsense1_ch1	Vishay-Dale	CRCW04021K91FKED Series= CRCW..e3	Res= 1.91 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
51.	Rsense1_ch2	Vishay-Dale	CRCW04021K78FKED Series= CRCW..e3	Res= 1.78 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
52.	Rsns_ch1	Vishay-Dale	CRCW040210R0FKED Series= CRCW..e3	Res= 10.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
53.	Rsns_ch2	Vishay-Dale	CRCW040210R0FKED Series= CRCW..e3	Res= 10.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
54.	Rsnsb_ch1	Vishay-Dale	CRCW08053R32FKEA Series= CRCW..e3	Res= 3.32 Ohm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	 0805 7 mm ²
55.	Rsnsb_ch2	Vishay-Dale	CRCW08053R32FKEA Series= CRCW..e3	Res= 3.32 Ohm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	 0805 7 mm ²
56.	Rt	Vishay-Dale	CRCW040273K2FKED Series= CRCW..e3	Res= 73.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
57.	U1	Texas Instruments	TPS40422RHAR	Switcher	1	\$2.15	 RHA0040B 66 mm ²



Operating Values

#	Name	Value	Category	Description
1.	BOM Count	59	General	Total Design BOM count
2.	FootPrint	1.506 k mm ²	General	Total PMU footprint area of BOM components
3.	Pout	124.5 W	General	Total PMU output power
4.	Total BOM	\$12.08	General	Total BOM Cost
5.	Efficiency	95.729 %	Op_point	PMU steady state efficiency
6.	IC Tj	108.689 degC	Op_point	PMU IC junction temperature
7.	ICThetaJA	31.1 degC/W	Op_point	IC junction-to-ambient thermal resistance
8.	M1_ch1 TjOP	112.413 degC	Op_point	Power Block junction temperature
9.	M1_ch2 TjOP	110.718 degC	Op_point	Power Block junction temperature
10.	Cin_ch1 Pd	315.095 mW	Power	Input capacitor power dissipation
11.	Cin_ch2 Pd	249.54 mW	Power	Input capacitor power dissipation

#	Name	Value	Category	Description
12.	Cout_ch1 Pd	16.072 mW	Power	Output capacitor power dissipation
13.	Cout_ch2 Pd	19.604 mW	Power	Output capacitor power dissipation
14.	IC Pd	761.714 mW	Power	IC Pd
15.	L1_ch1 Pd	836.464 mW	Power	Inductor power dissipation
16.	L1_ch2 Pd	588.921 mW	Power	Inductor power dissipation
17.	M1_ch1 Pd	1.371 W	Power	Power Block power dissipation
18.	M1_ch2 Pd	1.286 W	Power	Power Block power dissipation
19.	Module ICPd	761.714 mW	Power	IC Pd
20.	Total Pd	5.554 W	Power	PMU total power dissipation
21.	Total Pd	5.554 W	Power	PMU total power dissipation

Design Inputs

#	Name	Value	Description
1.	Iout	15.0	Maximum Output Current
2.	Iout1	15.0	Output Current #1
3.	Iout2	15.0	Output Current #2
4.	Vin1Max	14.0	Maximum Input Voltage #1
5.	Vin1Min	8.0	Minimum Input Voltage #1
6.	Vin2Max	14.0	Maximum Input Voltage #2
7.	Vin2Min	8.0	Minimum Input Voltage #2
8.	Vout	5.0	Output Voltage
9.	Vout1	5.0	Output Voltage #1
10.	Vout2	3.3	Output Voltage #2
11.	base_pn	TPS40422	Base Product Number
12.	source	DC	Input Source Type
13.	Ta	85.0	Ambient temperature

Design Assistance

1. **TPS40422** Product Folder : <http://www.ti.com/product/tps40422> : contains the data sheet and other resources.

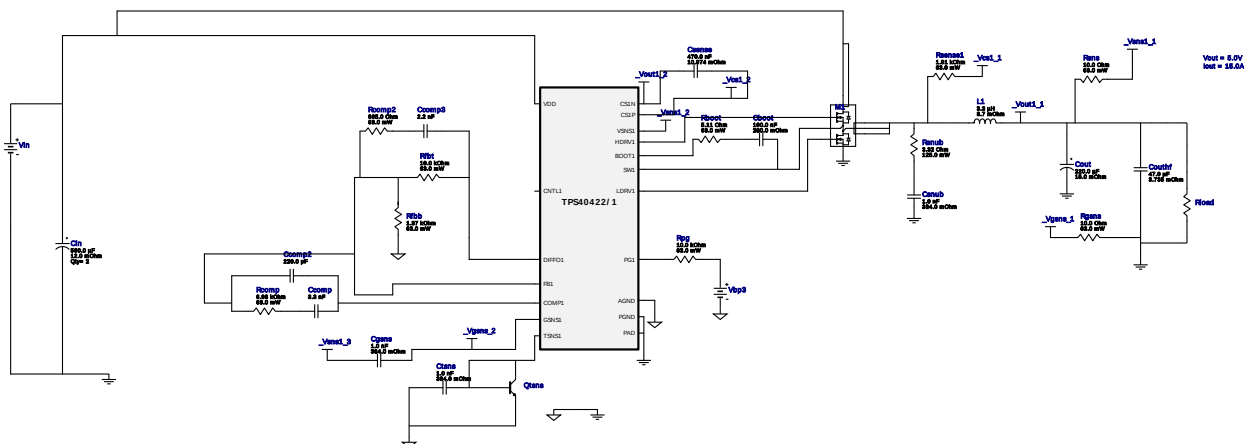


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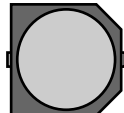
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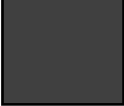
WEBENCH® Design Report

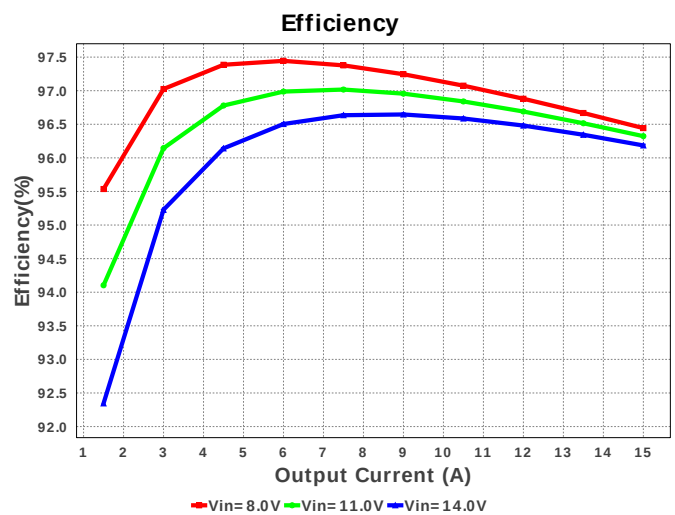
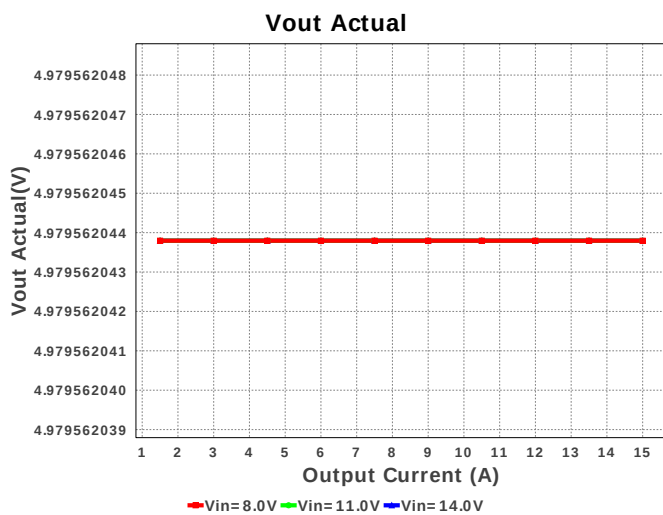
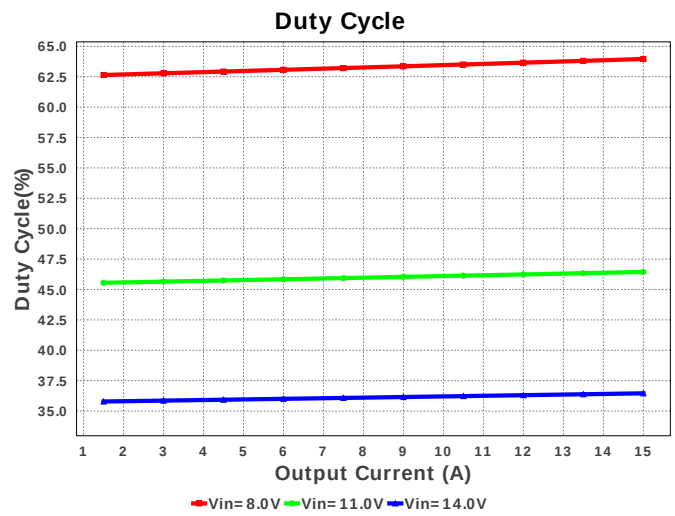
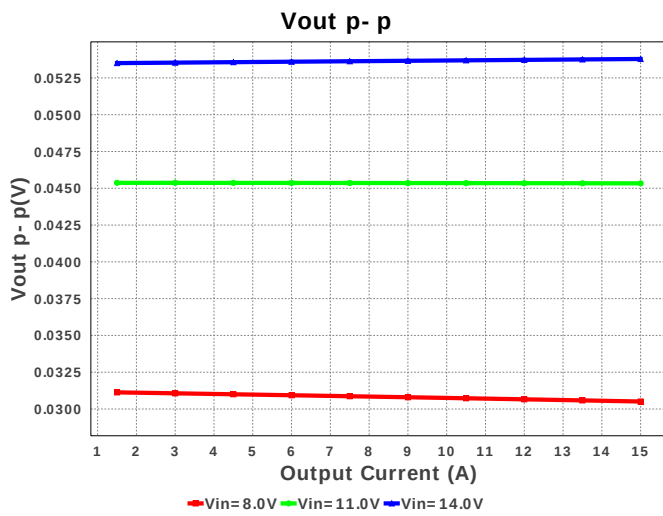
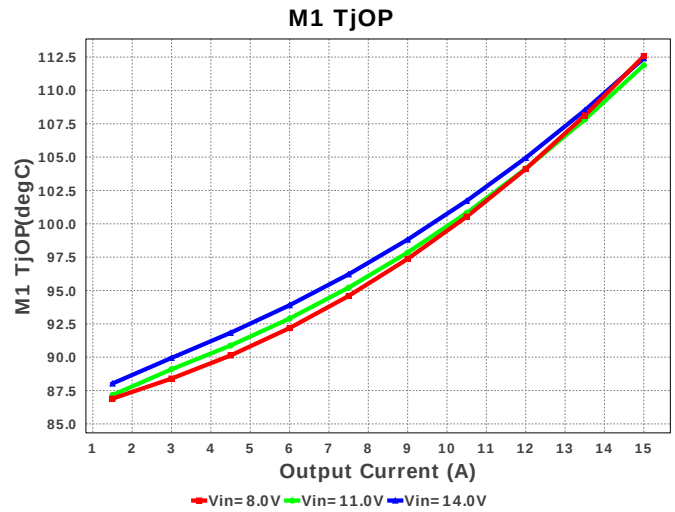
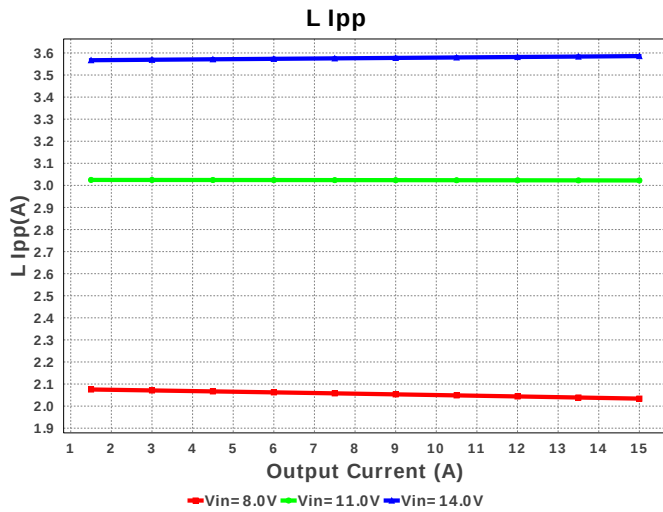
Design : 28154/270 TPS40422RHAR
TPS40422RHAR 8.0V-14.0V to 5.00V @ 15.0A

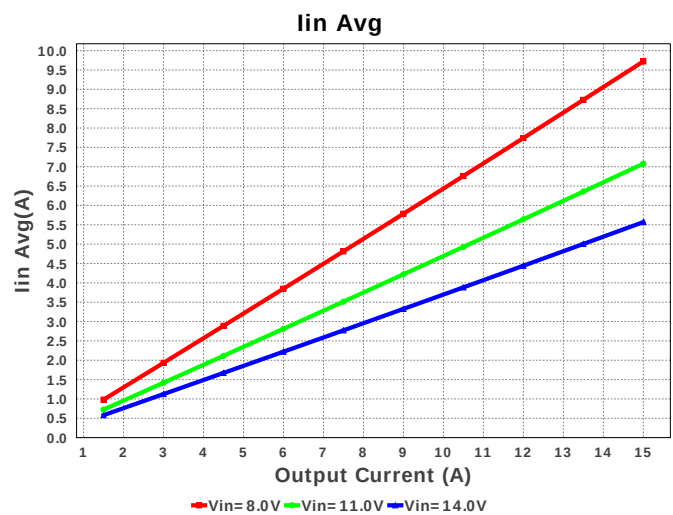
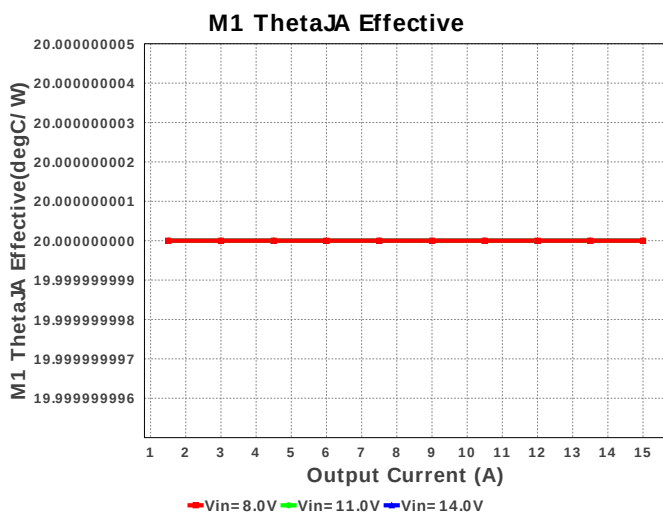
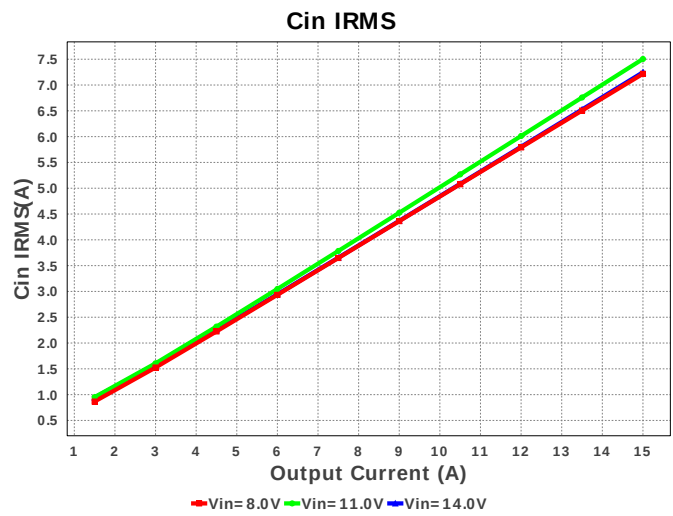
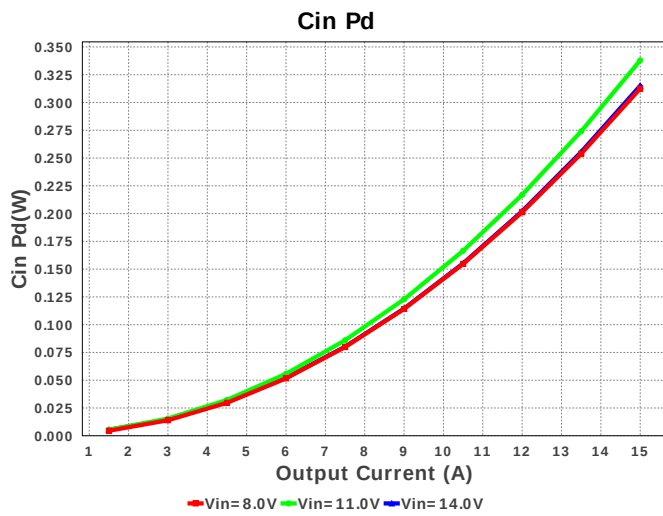
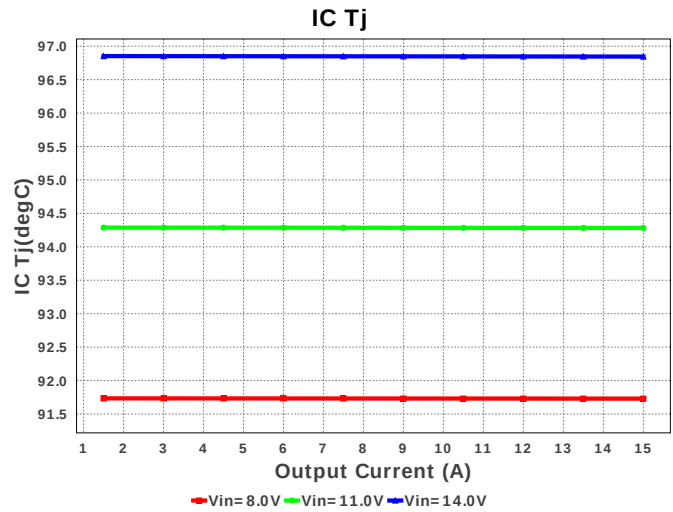
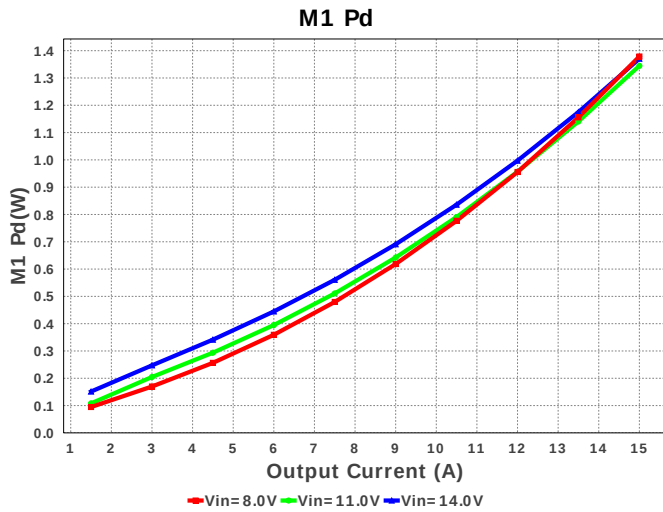


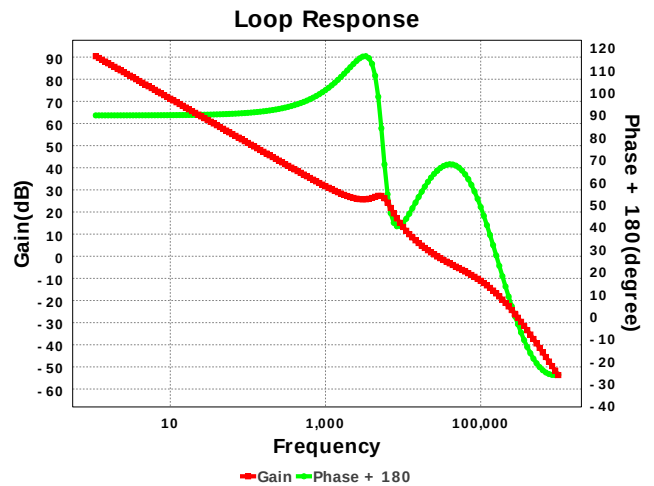
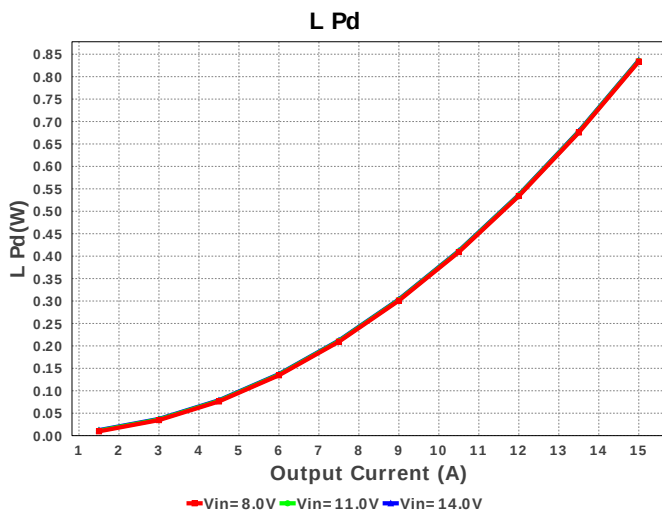
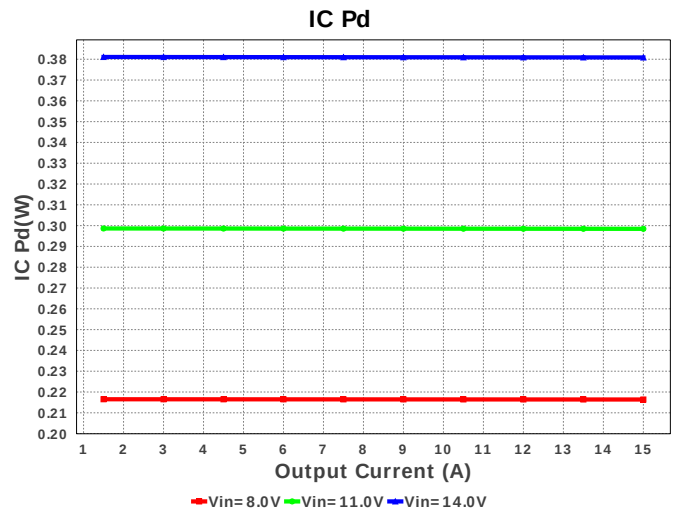
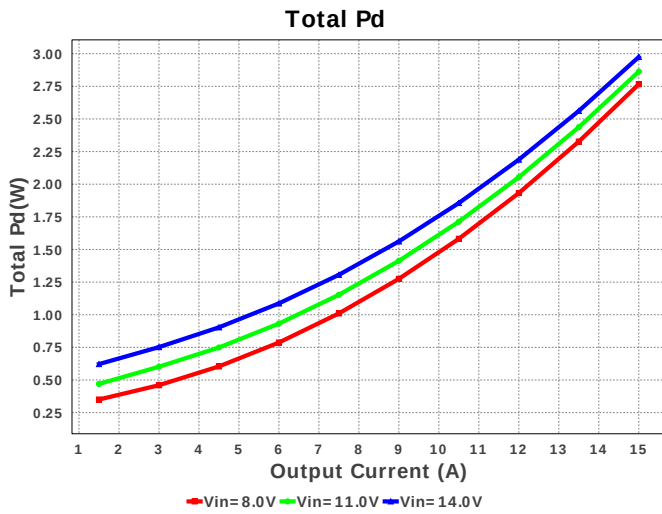
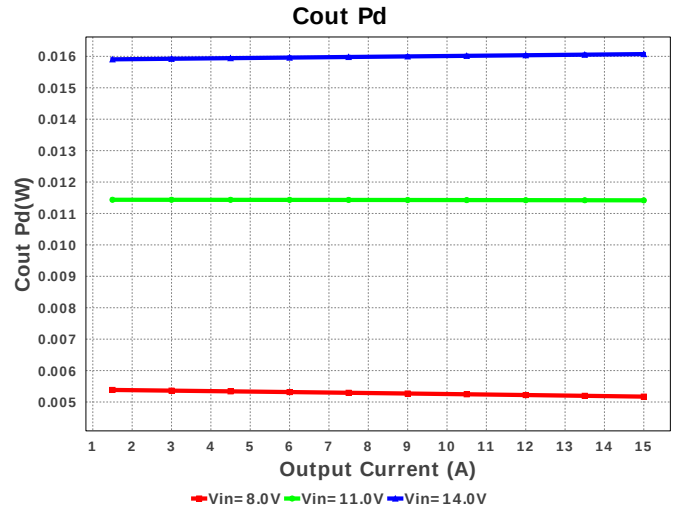
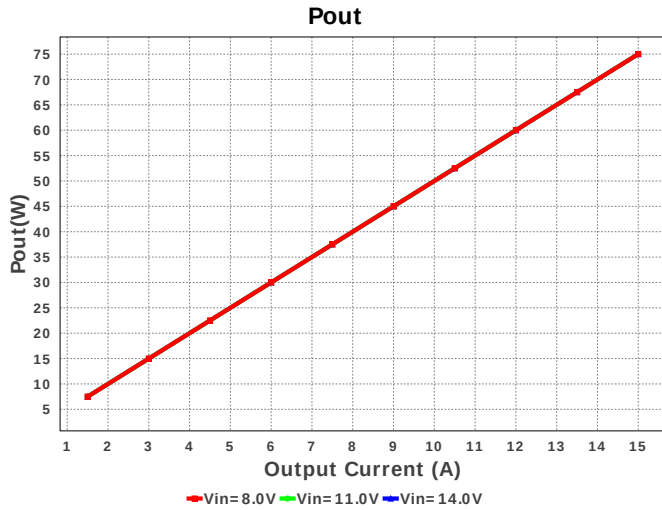
Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot	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.	Ccomp	Kemet	C0603C332K5RACTU Series= X7R	Cap= 3.3 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0603 5 mm ²
3.	Ccomp2	AVX	06033A220JAT2A Series= C0G/NP0	Cap= 220.0 pF VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	0603 5 mm ²
4.	Ccomp3	Yageo America	CC0805KRX7R9BB222 Series= X7R	Cap= 2.2 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
5.	Cgsns	Kemet	C0805C102K5RACTU Series= X7R	Cap= 1.0 nF ESR= 384.0 mOhm VDC= 50.0 V IRMS= 214.0 mA	1	\$0.01	0805 7 mm ²
6.	Cin	Panasonic	20SPVF560M Series= ?	Cap= 560.0 uF ESR= 12.0 mOhm VDC= 20.0 V IRMS= 5.4 A	2	\$0.70	 CAPSMT_62_F12 151 mm ²
7.	Cout	Panasonic	6SVPE220MW Series= SVPE	Cap= 220.0 uF ESR= 15.0 mOhm VDC= 6.3 V IRMS= 3.15 A	1	\$0.20	 CAPSMT_62_E61 53 mm ²
8.	Couthf	MuRata	GRM31CC80J476KE18L Series= X6S	Cap= 47.0 uF ESR= 3.735 mOhm VDC= 6.3 V IRMS= 4.0522 A	1	\$0.10	 1206_190 11 mm ²
9.	Csense	TDK	C1608X5R1H474K080AB Series= X5R	Cap= 470.0 nF ESR= 10.974 mOhm VDC= 50.0 V IRMS= 1.57483 A	1	\$0.03	 0603 5 mm ²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	Csneb	Kemet	C0805C102K5RACTU Series= X7R	Cap= 1.0 nF ESR= 384.0 mOhm VDC= 50.0 V IRMS= 214.0 mA	1	\$0.01	 0805 7 mm ²
11.	Ctsns	Kemet	C0805C102K5RACTU Series= X7R	Cap= 1.0 nF ESR= 384.0 mOhm VDC= 50.0 V IRMS= 214.0 mA	1	\$0.01	 0805 7 mm ²
12.	L1	Coilcraft	XAL1010-332MEB	L= 3.3 µH DCR= 3.7 mOhm	1	\$1.71	 XAL1010 160 mm ²
13.	M1	Texas Instruments	CSD86360Q5D	PowerBlock	1	\$0.99	 DQY0008A 56 mm ²
14.	Qtsns	Fairchild Semiconductor	MMBT3904	Bipolar Transistor	1	\$0.05	 SOT-23 14 mm ²
15.	Rboot	Vishay-Dale	CRCW04025R11FKED Series= CRCW..e3	Res= 5.11 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
16.	Rcomp	Vishay-Dale	CRCW04026K98FKED Series= CRCW..e3	Res= 6.98 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
17.	Rcomp2	Vishay-Dale	CRCW0402665RFKED Series= CRCW..e3	Res= 665.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
18.	Rfbb	Vishay-Dale	CRCW04021K37FKED Series= CRCW..e3	Res= 1.37 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
19.	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
20.	Rgsns	Vishay-Dale	CRCW040210R0FKED Series= CRCW..e3	Res= 10.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
21.	Rpg	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
22.	Rsense1	Vishay-Dale	CRCW04021K91FKED Series= CRCW..e3	Res= 1.91 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
23.	Rsns	Vishay-Dale	CRCW040210R0FKED Series= CRCW..e3	Res= 10.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
24.	Rsnub	Vishay-Dale	CRCW08053R32FKEA Series= CRCW..e3	Res= 3.32 Ohm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	 0805 7 mm ²
25.	U1	Texas Instruments	TPS40422RHAR	Switcher	0	\$2.15	 RHA0040B 66 mm ²
26.	U1	Texas Instruments	TPS40422RHAR	Switcher	0	\$2.15	 RHA0040B 66 mm ²







Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	7.247 A	Current	Input capacitor RMS ripple current
2.	Iin Avg	5.57 A	Current	Average input current
3.	L Ipp	3.586 A	Current	Peak-to-peak inductor ripple current
4.	Frequency	273.224 kHz	General	Switching frequency
5.	IC Tolerance	3.0 mV	General	IC Feedback Tolerance
6.	Mode	CCM	General	Conduction Mode
7.	Pout	75.0 W	General	Total output power
8.	Low Freq Gain	90.408 dB	Op_Point	Gain at 10Hz
9.	M1 ThetaJA Effective	20.0 degC/W	Op_Point	Effective Power Block Junction-to-Ambient Thermal Resistance
10.	Vout Actual	4.98 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
11.	Vout OP	5.0 V	Op_Point	Operational Output Voltage

#	Name	Value	Category	Description
12.	Cross Freq	27.47 kHz	Op_point	Bode plot crossover frequency
13.	Duty Cycle	36.46 %	Op_point	Duty cycle
14.	Efficiency	96.185 %	Op_point	PMU channel steady state efficiency
15.	Gain Marg	-26.296 dB	Op_point	Bode Plot Gain Margin
16.	ICThetaJA	31.1 degC/W	Op_point	IC junction-to-ambient thermal resistance
17.	IOUT_OP	15.0 A	Op_point	Iout operating point
18.	M1 TjOP	112.413 degC	Op_point	Power Block junction temperature
19.	Phase Marg	65.284 deg	Op_point	Bode Plot Phase Margin
20.	VIN_OP	14.0 V	Op_point	Vin operating point
21.	Vout p-p	53.786 mV	Op_point	Peak-to-peak output ripple voltage
22.	Cin Pd	315.095 mW	Power	Input capacitor power dissipation
23.	Cout Pd	16.072 mW	Power	Output capacitor power dissipation
24.	IC Pd	380.857 mW	Power	IC power dissipation
25.	L Pd	836.464 mW	Power	Inductor power dissipation
26.	M1 Pd	1.371 W	Power	Power Block power dissipation
27.	Total Pd	2.975 W	Power	PMU channel power dissipation
28.	Vout Tolerance	2.286 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	15.0	Maximum Output Current
2.	VinMax	14.0	Maximum input voltage
3.	VinMin	8.0	Minimum input voltage
4.	Vout	5.0	Output Voltage
5.	base_pn	TPS40422/1	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	85.0	Ambient temperature

Design Assistance

1. **TPS40422/1** Product Folder : <http://www.ti.com/product/tps40422> : contains the data sheet and other resources.

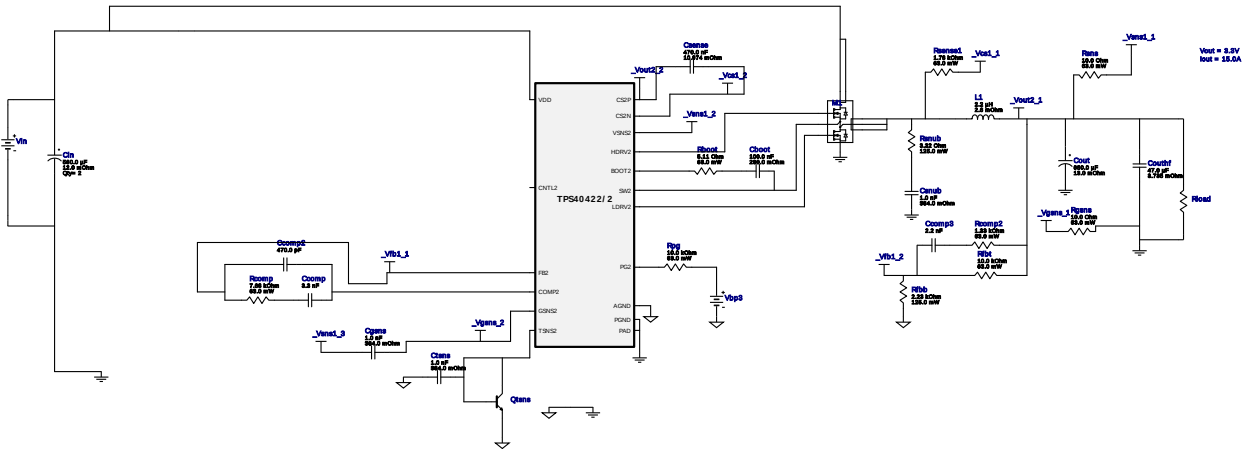


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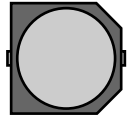
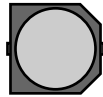
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WEBENCH® Design Report

Design : 28154/271 TPS40422RHAR
TPS40422RHAR 8.0V-14.0V to 3.30V @ 15.0A

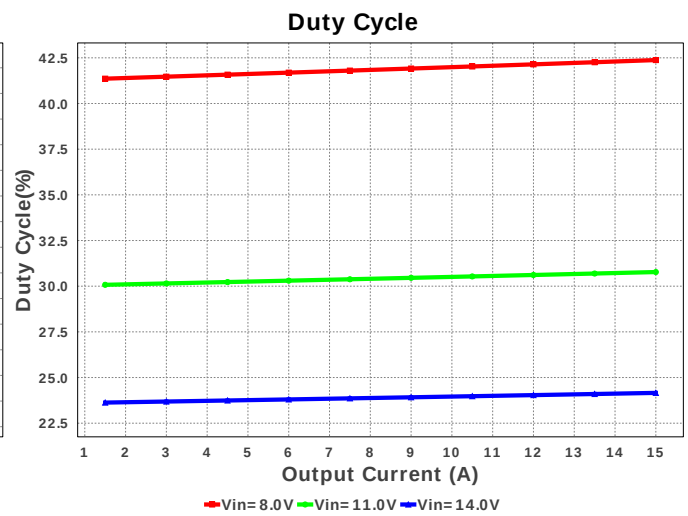
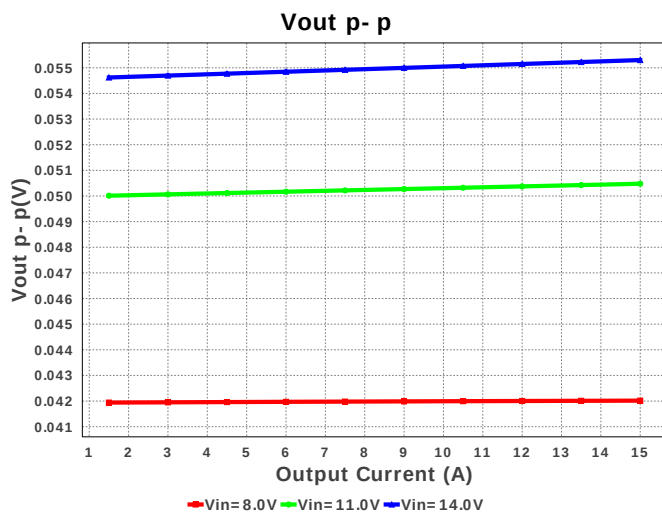
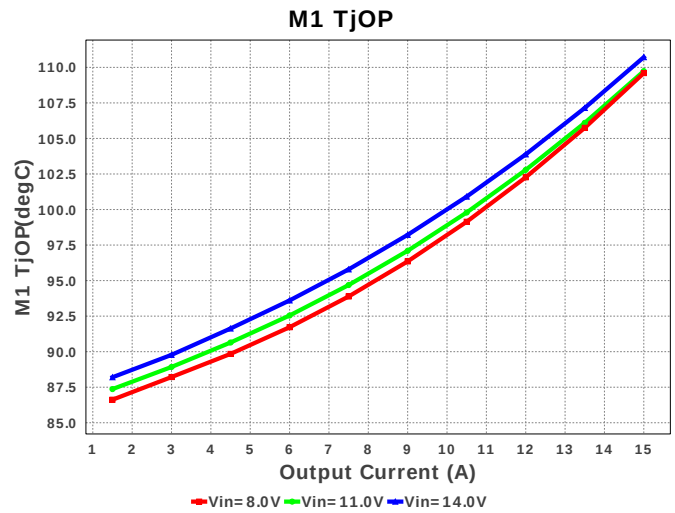
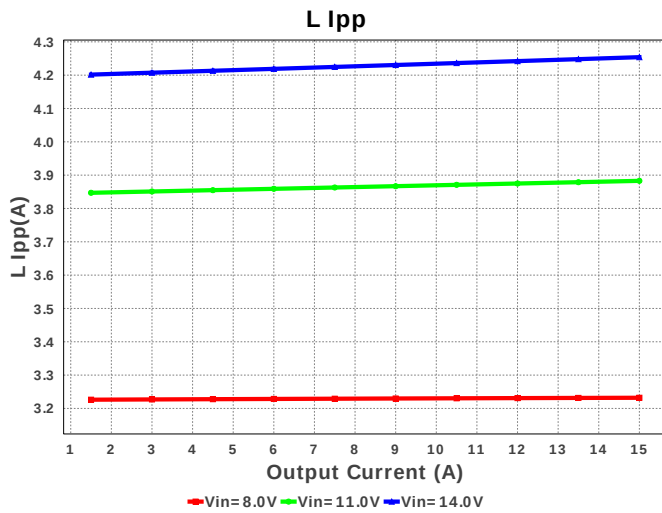


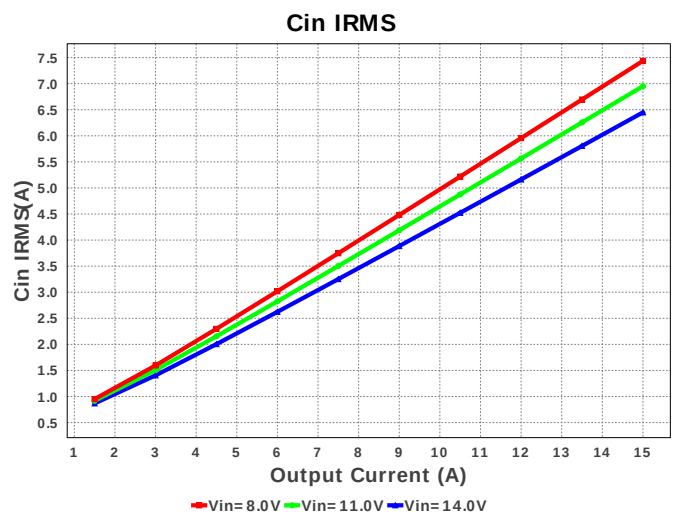
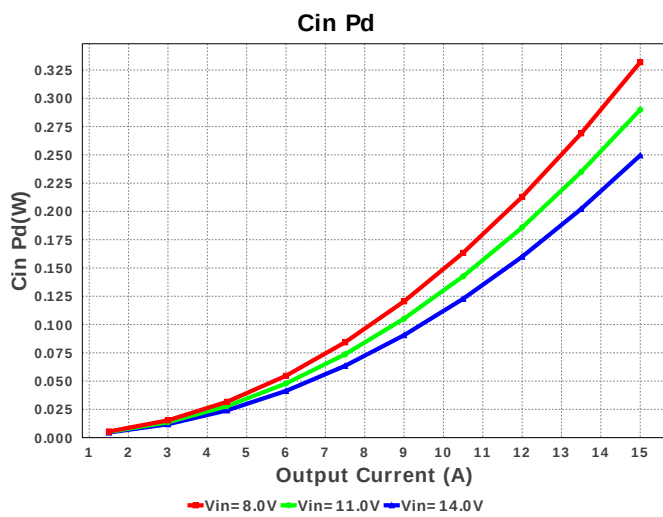
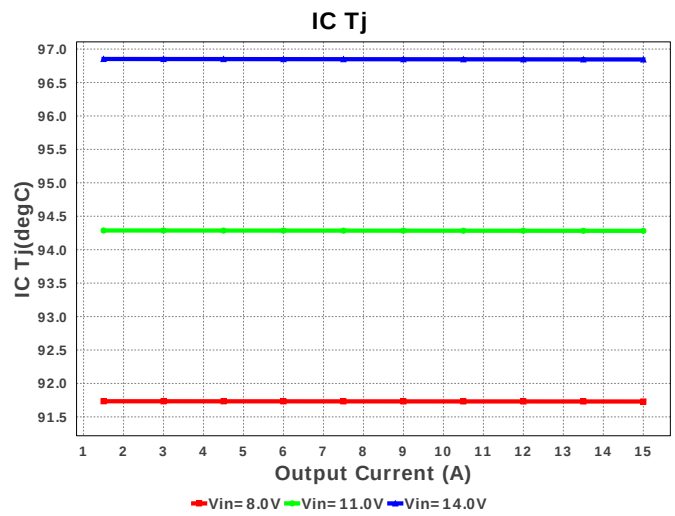
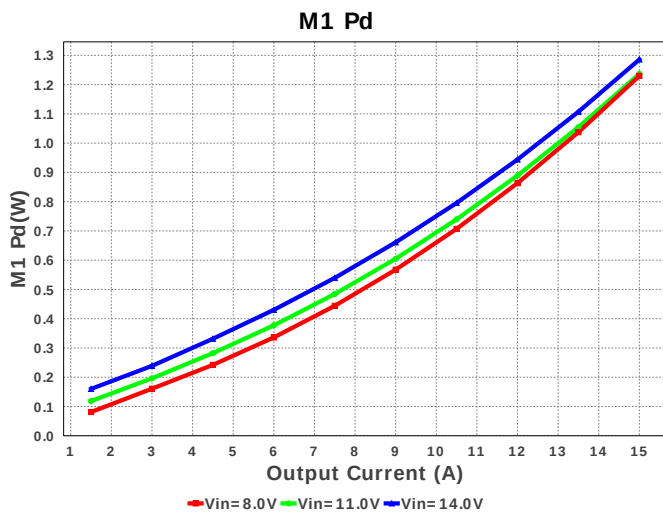
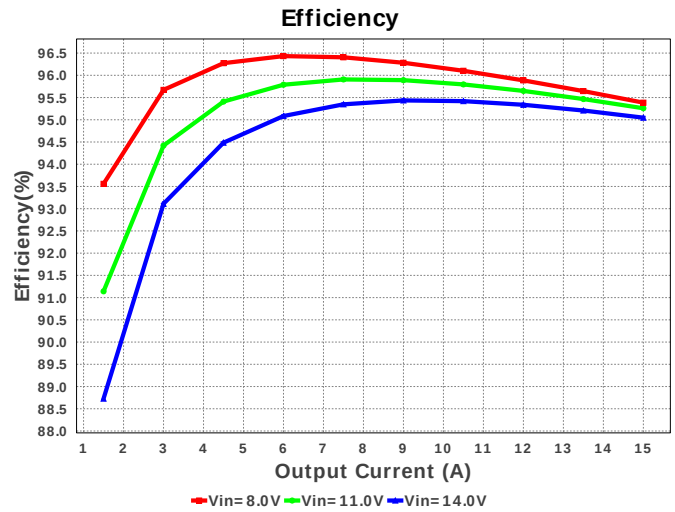
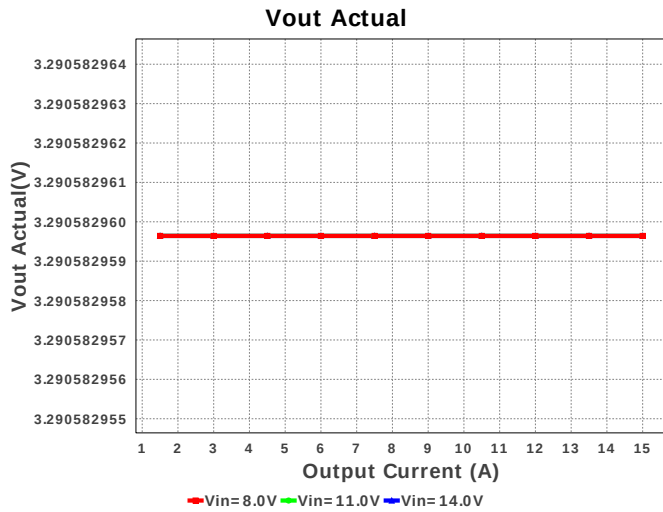
Electrical BOM

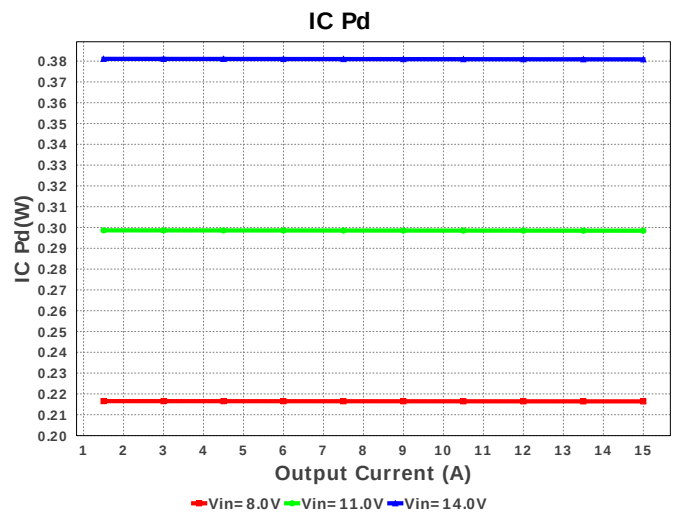
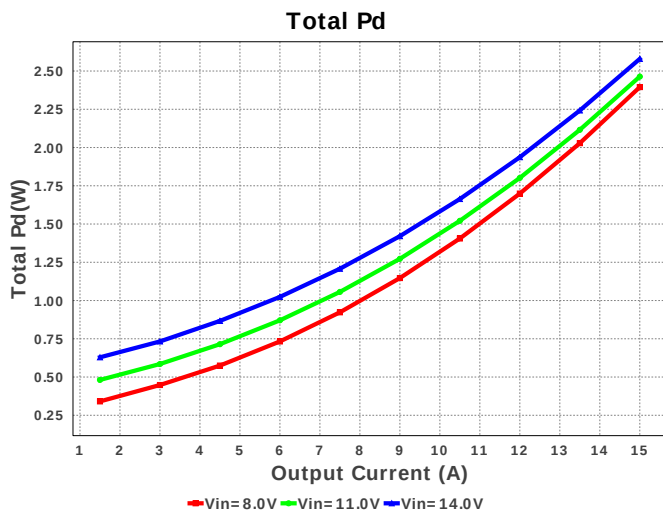
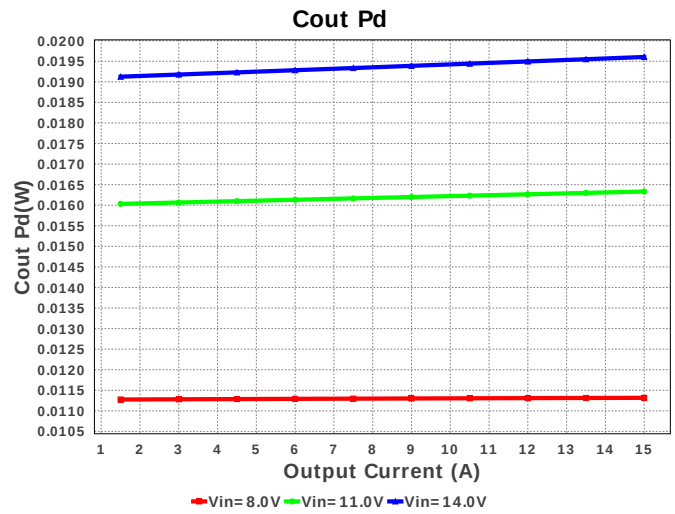
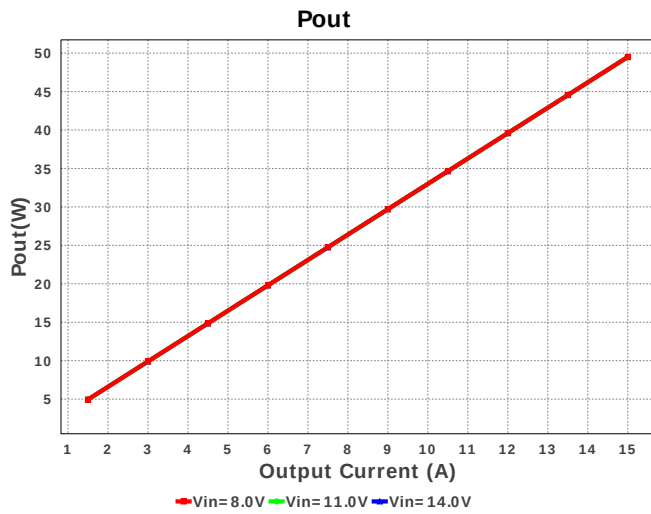
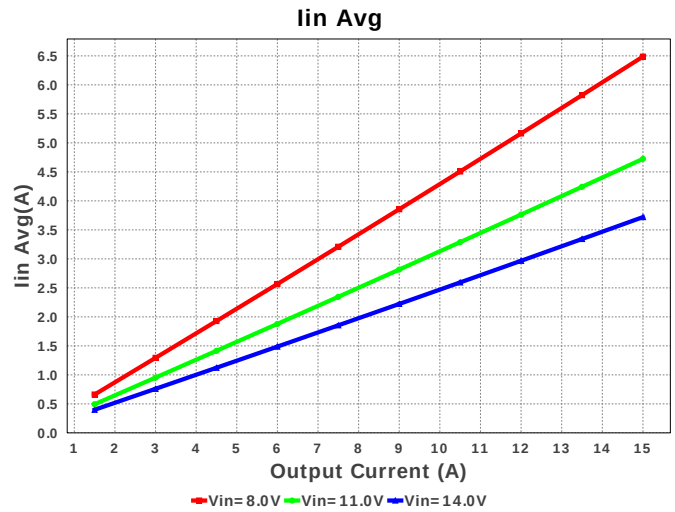
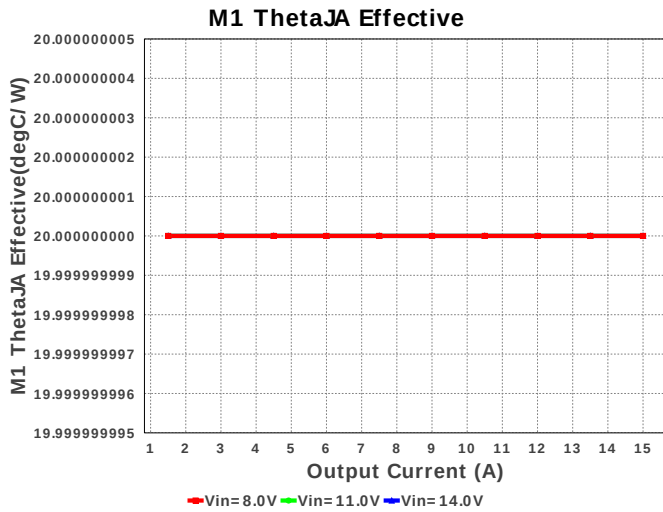
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
2.	Ccomp	Kemet	C0603C332K5RACTU Series= X7R	Cap= 3.3 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0603 5 mm ²
3.	Ccomp2	AVX	06035A470KAT2A Series= C0G/NP0	Cap= 470.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0603 5 mm ²
4.	Ccomp3	Yageo America	CC0805KRX7R9BB222 Series= X7R	Cap= 2.2 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
5.	Cgsns	Kemet	C0805C102K5RACTU Series= X7R	Cap= 1.0 nF ESR= 384.0 mOhm VDC= 50.0 V IRMS= 214.0 mA	1	\$0.01	0805 7 mm ²
6.	Cin	Panasonic	20SVPF560M Series= ?	Cap= 560.0 uF ESR= 12.0 mOhm VDC= 20.0 V IRMS= 5.4 A	2	\$0.70	 CAPSMT_62_F12 151 mm ²
7.	Cout	Chemi-Con	APXE4R0ARA681MH80G Series= PXE	Cap= 680.0 uF ESR= 13.0 mOhm VDC= 4.0 V IRMS= 3.95 A	1	\$0.69	 CAPSMT_62_H80 106 mm ²
8.	Couthf	MuRata	GRM31CE70G476ME15L Series= X7U	Cap= 47.0 uF ESR= 3.735 mOhm VDC= 4.0 V IRMS= 4.1841 A	1	\$0.10	 1206_190 11 mm ²

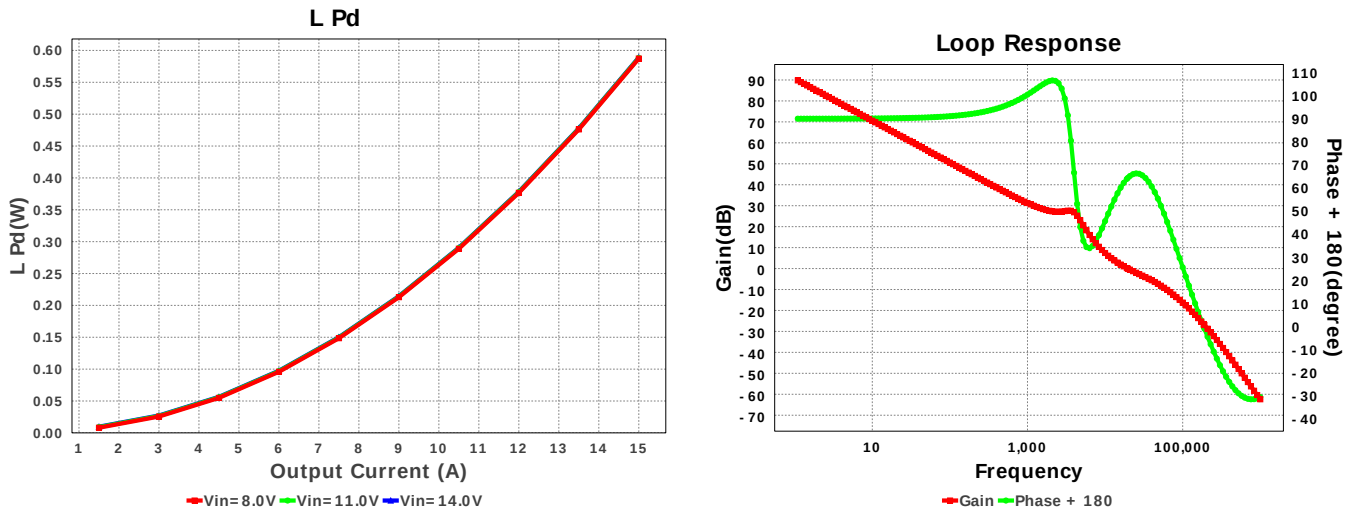
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
9.	Csense	TDK	C1608X5R1H474K080AB Series= X5R	Cap= 470.0 nF ESR= 10.974 mOhm VDC= 50.0 V IRMS= 1.57483 A	1	\$0.03	 0603 5 mm ²
10.	Csnu	Kemet	C0805C102K5RACTU Series= X7R	Cap= 1.0 nF ESR= 384.0 mOhm VDC= 50.0 V IRMS= 214.0 mA	1	\$0.01	 0805 7 mm ²
11.	Ctsns	Kemet	C0805C102K5RACTU Series= X7R	Cap= 1.0 nF ESR= 384.0 mOhm VDC= 50.0 V IRMS= 214.0 mA	1	\$0.01	 0805 7 mm ²
12.	L1	Coilcraft	XAL1010-222MEB	L= 2.2 µH DCR= 2.6 mOhm	1	\$1.71	 XAL1010 160 mm ²
13.	M1	Texas Instruments	CSD86360Q5D	PowerBlock	1	\$0.99	 DQY0008A 56 mm ²
14.	Qtsns	Fairchild Semiconductor	MMBT3904	Bipolar Transistor	1	\$0.05	 SOT-23 14 mm ²
15.	Rboot	Vishay-Dale	CRCW04025R11FKED Series= CRCW..e3	Res= 5.11 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
16.	Rcomp	Vishay-Dale	CRCW04027K68FKED Series= CRCW..e3	Res= 7.68 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
17.	Rcomp2	Vishay-Dale	CRCW04021K33FKED Series= CRCW..e3	Res= 1.33 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
18.	Rfbb	Yageo America	RT0805BRD072K23L Series= RT0805	Res= 2.23 kOhm Power= 125.0 mW Tolerance= 0.1%	1	\$0.05	 0805 7 mm ²
19.	Rfbt	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
20.	Rgsns	Vishay-Dale	CRCW040210R0FKED Series= CRCW..e3	Res= 10.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
21.	Rpg	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
22.	Rsense1	Vishay-Dale	CRCW04021K78FKED Series= CRCW..e3	Res= 1.78 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
23.	Rsns	Vishay-Dale	CRCW040210R0FKED Series= CRCW..e3	Res= 10.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
24.	Rsnu	Vishay-Dale	CRCW08053R32FKEA Series= CRCW..e3	Res= 3.32 Ohm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	 0805 7 mm ²
25.	U1	Texas Instruments	TPS40422RHAR	Switcher	0	\$2.15	 RHA0040B 66 mm ²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
26.	U1	Texas Instruments	TPS40422RHAR	Switcher	0	\$2.15	 RHA0040B 66 mm ²









Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	6.449 A	Current	Input capacitor RMS ripple current
2.	Iin Avg	3.72 A	Current	Average input current
3.	L Ipp	4.254 A	Current	Peak-to-peak inductor ripple current
4.	Frequency	273.224 kHz	General	Switching frequency
5.	IC Tolerance	3.0 mV	General	IC Feedback Tolerance
6.	Mode	CCM	General	Conduction Mode
7.	Pout	49.5 W	General	Total output power
8.	Low Freq Gain	89.779 dB	Op_Point	Gain at 10Hz
9.	M1 ThetaJA Effective	20.0 degC/W	Op_Point	Effective Power Block Junction-to-Ambient Thermal Resistance
10.	Vout Actual	3.291 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
11.	Vout OP	3.3 V	Op_Point	Operational Output Voltage
12.	Cross Freq	19.638 kHz	Op_point	Bode plot crossover frequency
13.	Duty Cycle	24.159 %	Op_point	Duty cycle
14.	Efficiency	95.047 %	Op_point	PMU channel steady state efficiency
15.	Gain Marg	-26.61 dB	Op_point	Bode Plot Gain Margin
16.	ICThetaJA	31.1 degC/W	Op_point	IC junction-to-ambient thermal resistance
17.	IOUT_OP	15.0 A	Op_point	Iout operating point
18.	M1 TjOP	110.718 degC	Op_point	Power Block junction temperature
19.	Phase Marg	64.42 deg	Op_point	Bode Plot Phase Margin
20.	VIN_OP	14.0 V	Op_point	Vin operating point
21.	Vout p-p	55.302 mV	Op_point	Peak-to-peak output ripple voltage
22.	Cin Pd	249.54 mW	Power	Input capacitor power dissipation
23.	Cout Pd	19.604 mW	Power	Output capacitor power dissipation
24.	IC Pd	380.857 mW	Power	IC power dissipation
25.	L Pd	588.921 mW	Power	Inductor power dissipation
26.	M1 Pd	1.286 W	Power	Power Block power dissipation
27.	Total Pd	2.579 W	Power	PMU channel power dissipation
28.	Vout Tolerance	1.405 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	15.0	Maximum Output Current
2.	VinMax	14.0	Maximum input voltage
3.	VinMin	8.0	Minimum input voltage
4.	Vout	3.3	Output Voltage
5.	base_pn	TPS40422/2	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	85.0	Ambient temperature

Design Assistance

1. **TPS40422/2** Product Folder : <http://www.ti.com/product/tps40422> : contains the data sheet and other resources.

Texas Instruments' WEBENCH simulation tools attempt to recreate the performance of a substantially equivalent physical implementation of the design. Simulations are created using Texas Instruments' published specifications as well as the published specifications of other device manufacturers. While Texas Instruments does update this information periodically, this information may not be current at the time the simulation is built. Texas Instruments does not warrant the accuracy or completeness of the specifications or any information contained therein. Texas Instruments does not warrant that any designs or recommended parts will meet the specifications you entered, will be suitable for your application or fit for any particular purpose, or will operate as shown in the simulation in a physical implementation. Texas Instruments does not warrant that the designs are production worthy.

You should completely validate and test your design implementation to confirm the system functionality for your application prior to production.

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