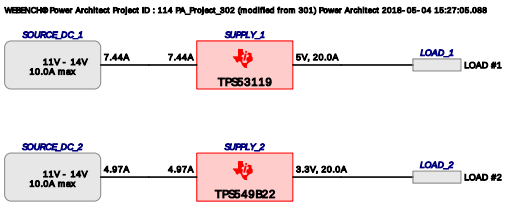
WEBENCH® Power Architect



Project Report

Project : 916945/114 : PA_Project_302 (modified from 301)
Created : 2018-05-04 15:27:05.088
Optimize project optFactor=3

Project Summary

1.	Total System Efficiency	95.446 %
2.	Total System BOM Count	56.0
3.	Total System Footprint	810.0 mm2
4.	Total System BOM Cost	$12.45
5.	Total System Power Dissipation	7.711 W

--> Launch WEBENCH Power Architect.

My Comments

5V 3.3V 20A

Sequencer Flag Table

Supply	Sequencer Flag	Load	Load Name
SUPPLY_1	0	LOAD_1	LOAD #1
SUPPLY_2	0	LOAD_2	LOAD #2

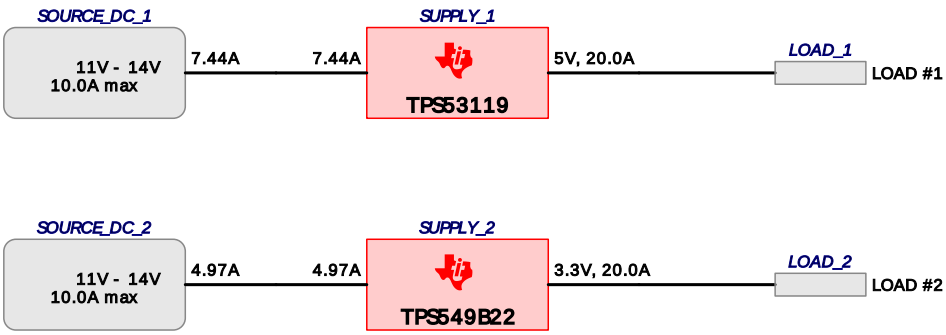
Power Supplies

#	Name	NSID	Description	Vout	Iout	Efficiency	Foot-print	Cost	Design	Page
1.	SUPPLY_1	TPS53119	Switcher : Wide Input Synchronous Buck Controller with Power Block	5 V	20.0 A	96%	490	$5.88	932	4
2.	SUPPLY_2	TPS549B22	Switcher : High-Performance 25-A Synchronous Buck Converter	3.3 V	20.0 A	94.9%	320	$6.57	933	10

Power Loads

#	Name	VLoad	ILoad	Description
1.	LOAD #1	5 V	20 A	VoutRipple=10%
2.	LOAD #2	3.3 V	20 A	VoutRipple=10%

Project Diagram



Electrical Procurement BOM

Manufacturer	Part Number	Description	Quantity	Budgetary Price	Footprint (mm^2)
Kemet	C0805C102K5RACTU	0805	1	$0.01	7
Kemet	C0805C473K5RACTU	0805	1	$0.01	7
TDK	C1005X5R1H104K050BB	0402	1	$0.02	3
Vishay-Dale	CRCW0402165KFKED	0402	1	$0.01	3
Vishay-Dale	CRCW04021K78FKED	0402	1	$0.01	3
Vishay-Dale	CRCW0402309KFKED	0402	1	$0.01	3
Vishay-Dale	CRCW040239K2FKED	0402	1	$0.01	3
Vishay-Dale	CRCW04024R99FKED	0402	1	$0.01	3
Vishay-Dale	CRCW04025K76FKED	0402	1	$0.01	3
Vishay-Dale	CRCW040273K2FKED	0402	1	$0.01	3
Vishay-Dale	CRCW0402866KFKED	0402	1	$0.01	3
Vishay-Dale	CRCW0805100KFKEA	0805	4	$0.01	27
Vishay-Dale	CRCW080534K8FKEA	0805	1	$0.01	7
Vishay-Dale	CRCW080542K2FKEA	0805	1	$0.01	7
Vishay-Dale	CRCW080571K5FKEA	0805	1	$0.01	7
Texas Instruments	CSD86360Q5D	DQY0008A	1	$0.99	56
Taiyo Yuden	EMK107B7104KA-T	0603	1	$0.01	5
Panasonic	ERJ-6ENF1001V	0805	1	$0.01	7
MuRata	GRM155R71E222KA01D	0402	1	$0.01	3
MuRata	GRM216R71E102KA01D	0805	2	$0.01	14
MuRata	GRM21BC81E475KA12L	0805	1	$0.03	7
MuRata	GRM31CR60J107ME39L	1206_190	2	$0.17	22
MuRata	GRM32ER61E226KE15L	1210	24	$0.20	59
Yageo America	RC0201FR-07105KL	0201	2	$0.01	4
Yageo America	RC0201FR-0710KL	0201	3	$0.01	6
Yageo America	RC0805FR-071RL	0805	1	$0.01	7
Taiyo Yuden	TMK212B7105KG-T	0805	3	$0.03	20
Texas Instruments	TPS53119RGTR	RGT0016A	1	$0.75	16
Texas Instruments	TPS549B22RVFR	RVF0040A	1	$3.68	63
Vishay-Bccomponents	VJ0805Y472KXACW1BC	0805	1	$0.01	7
Coilcraft	XAL1010-102MEB	XAL1010	1	$1.71	160
Coilcraft	XAL8080-681MEB	XAL8080	1	$1.55	107
Total			65	$14.25	648.88

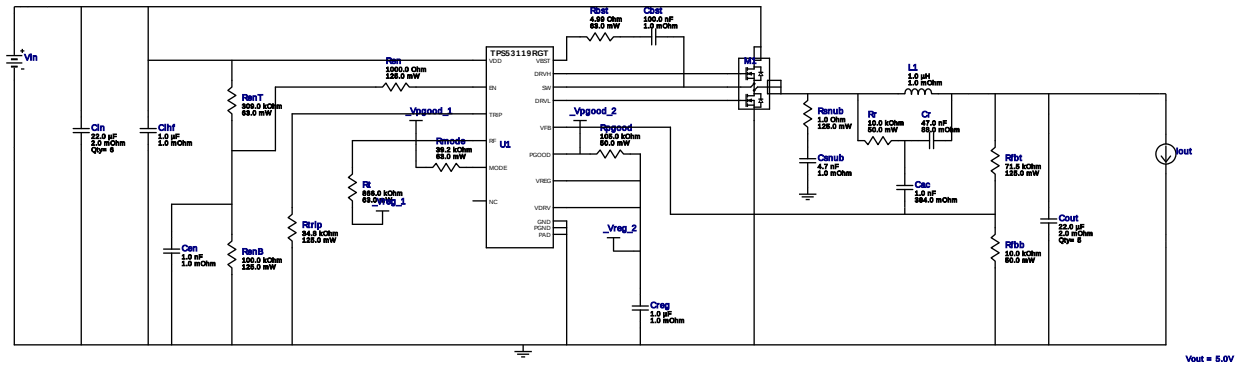
TEXAS INSTRUMENTS

WEBENCH® Design Report

Vout = 5.0V
Iout = 20.0A

Device = TPS53119RGTR
Topology = Buck
Created = 2018-05-04 15:27:02.462
BOM Cost = $5.88
BOM Count = 33
Total Pd = 4.14W

Design : 916945/932 TPS53119RGTR
TPS53119RGTR 11.0V-14.0V to 5.00V @ 20.0A

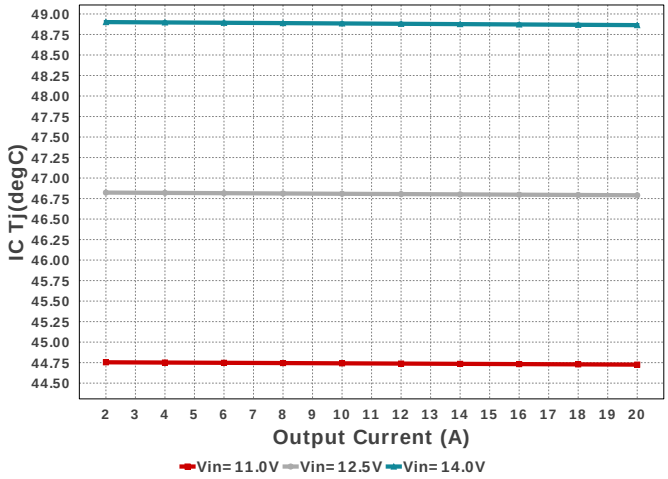


Electrical BOM

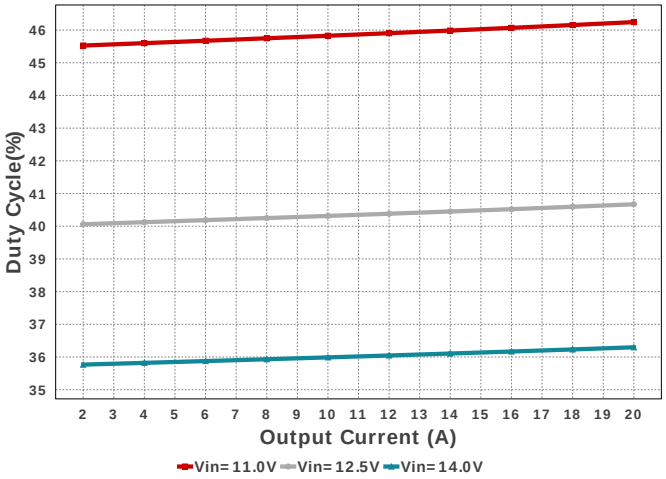
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cac	Kemet	C0805C102K5RACTU Series= X7R	Cap= 1.0 nF ESR= 384.0 mOhm VDC= 50.0 V IRMS= 214.0 mA	1	$0.01	0805 7 mm^2
2.	Cbst	Taiyo Yuden	EMK107B7104KA-T Series= X7R	Cap= 100.0 nF ESR= 1.0 mOhm VDC= 16.0 V IRMS= 0.0 A	1	$0.01	0603 5 mm^2
3.	Cen	MuRata	GRM216R71E102KA01D Series= X7R	Cap= 1.0 nF ESR= 1.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
4.	Cihf	Taiyo Yuden	TMK212B7105KG-T Series= X7R	Cap= 1.0 uF ESR= 1.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.03	0805 7 mm^2
5.	Cin	MuRata	GRM32ER61E226KE15L Series= X5R	Cap= 22.0 uF ESR= 2.0 mOhm VDC= 25.0 V IRMS= 3.67 A	6	$0.20	1210 15 mm^2
6.	Cout	MuRata	GRM32ER61E226KE15L Series= X5R	Cap= 22.0 uF ESR= 2.0 mOhm VDC= 25.0 V IRMS= 3.67 A	5	$0.20	1210 15 mm^2
7.	Cr	Kemet	C0805C473K5RACTU Series= X7R	Cap= 47.0 nF ESR= 88.0 mOhm VDC= 50.0 V IRMS= 1.04 A	1	$0.01	0805 7 mm^2
8.	Creg	Taiyo Yuden	TMK212B7105KG-T Series= X7R	Cap= 1.0 uF ESR= 1.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.03	0805 7 mm^2
9.	Csnub	Vishay-Bccomponents	VJ0805Y472KXACW1BC Series= X7R	Cap= 4.7 nF ESR= 1.0 mOhm VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	L1	Coilcraft	XAL1010-102MEB	L= 1.0 µH DCR= 1.0 mOhm	1	$1.71	 XAL1010 160 mm^2
11.	M1	Texas Instruments	CSD86360Q5D	PowerBlock	1	$0.99	 DQY0008A 56 mm^2
12.	Rbst	Vishay-Dale	CRCW04024R99FKED Series= CRCW..e3	Res= 4.99 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
13.	Ren	Panasonic	ERJ-6ENF1001V Series= ERJ-6E	Res= 1000.0 Ohm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	 0805 7 mm^2
14.	RenB	Vishay-Dale	CRCW0805100KFKEA Series= CRCW..e3	Res= 100.0 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	 0805 7 mm^2
15.	RenT	Vishay-Dale	CRCW0402309KFKED Series= CRCW..e3	Res= 309.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
16.	Rfbb	Yageo America	RC0201FR-0710KL Series= ?	Res= 10.0 kOhm Power= 50.0 mW Tolerance= 1.0%	1	$0.01	 0201 2 mm^2
17.	Rfbt	Vishay-Dale	CRCW080571K5FKEA Series= CRCW..e3	Res= 71.5 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	 0805 7 mm^2
18.	Rmode	Vishay-Dale	CRCW040239K2FKED Series= CRCW..e3	Res= 39.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
19.	Rpgood	Yageo America	RC0201FR-07105KL Series= ?	Res= 105.0 kOhm Power= 50.0 mW Tolerance= 1.0%	1	$0.01	 0201 2 mm^2
20.	Rr	Yageo America	RC0201FR-0710KL Series= ?	Res= 10.0 kOhm Power= 50.0 mW Tolerance= 1.0%	1	$0.01	 0201 2 mm^2
21.	Rsnub	Yageo America	RC0805FR-071RL Series= ?	Res= 1.0 Ohm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	 0805 7 mm^2
22.	Rt	Vishay-Dale	CRCW0402866KFKED Series= CRCW..e3	Res= 866.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
23.	Rtrip	Vishay-Dale	CRCW080534K8FKEA Series= CRCW..e3	Res= 34.8 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	 0805 7 mm^2
24.	U1	Texas Instruments	TPS53119RGTR	Switcher	1	$0.75	 RGT0016A 16 mm^2

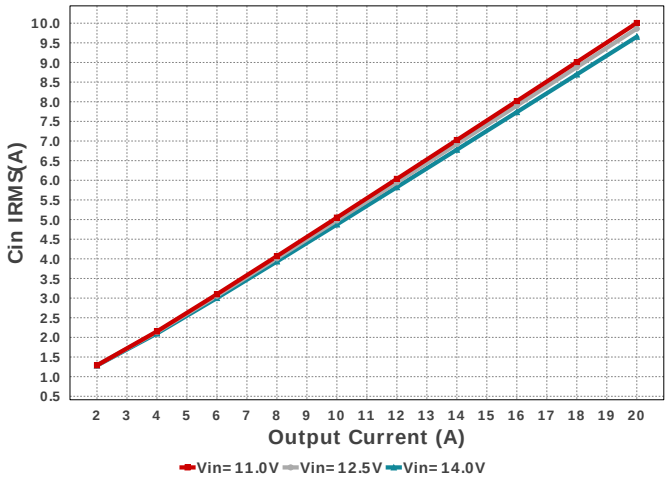
IC Tj



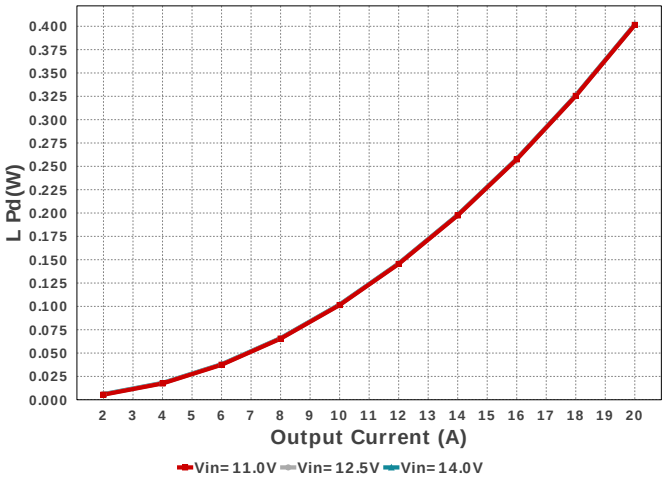
Duty Cycle



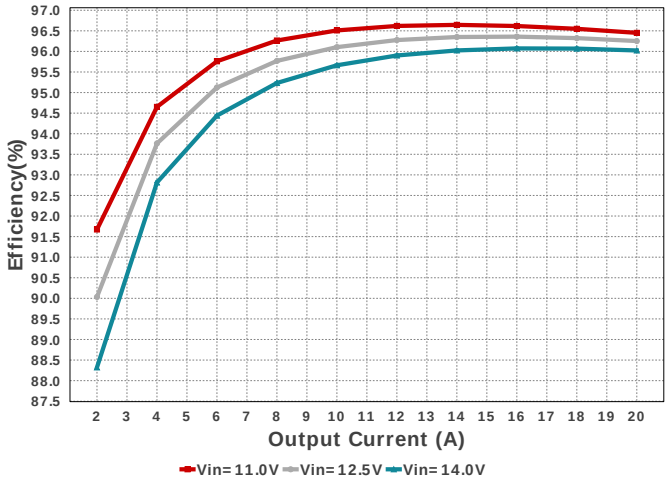
Cin IRMS



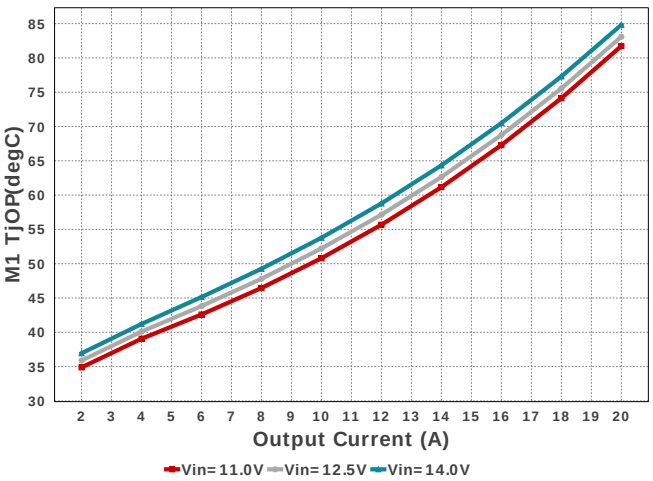
L Pd

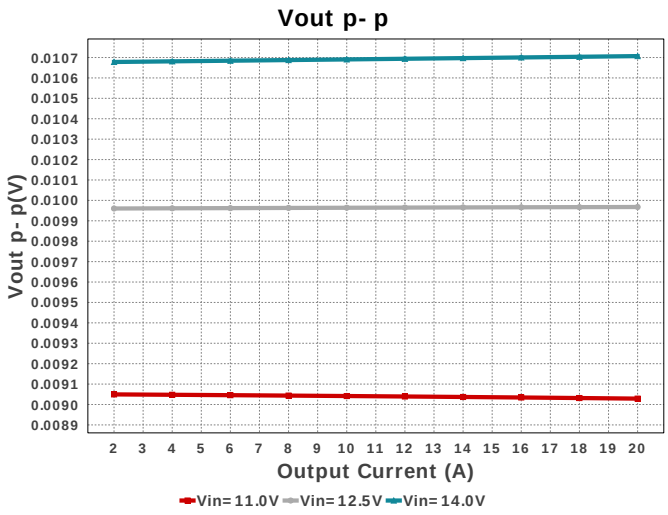


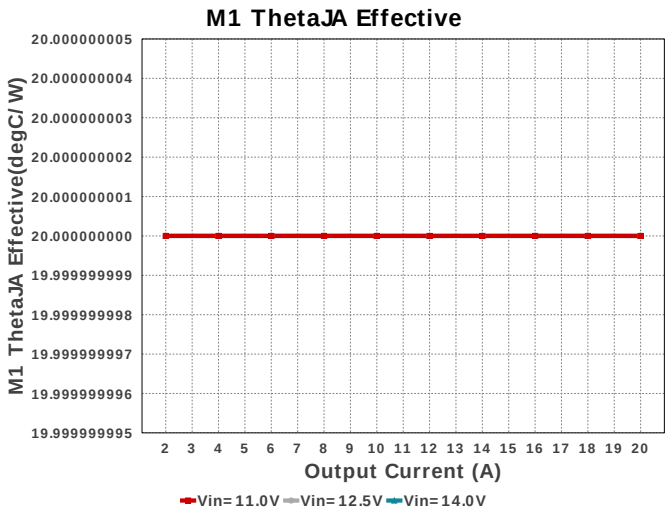
Efficiency

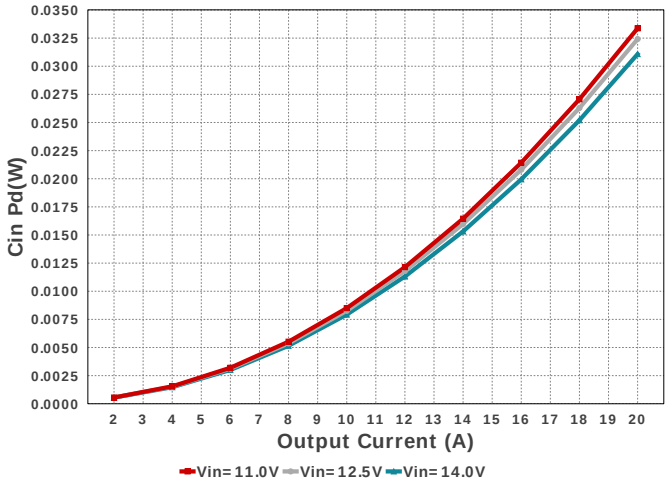


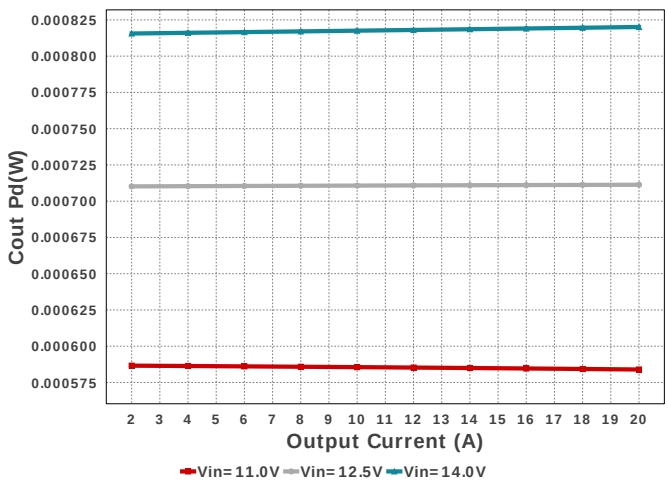
M1 TjOP

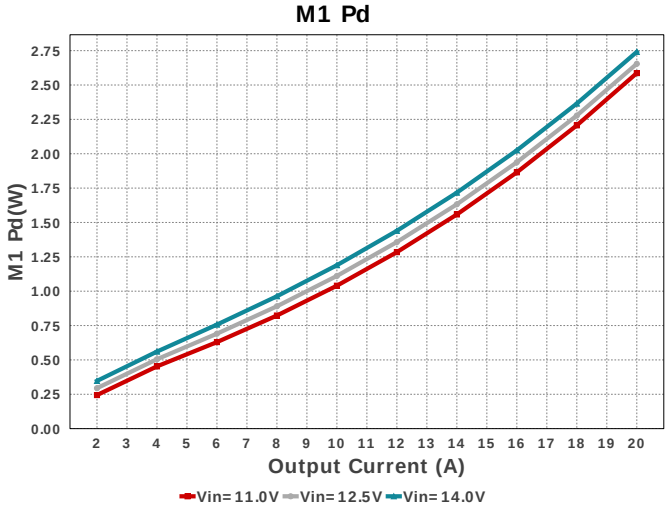


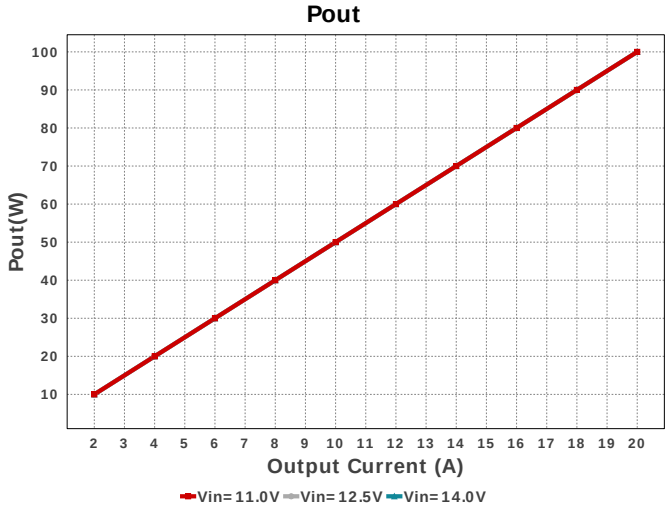


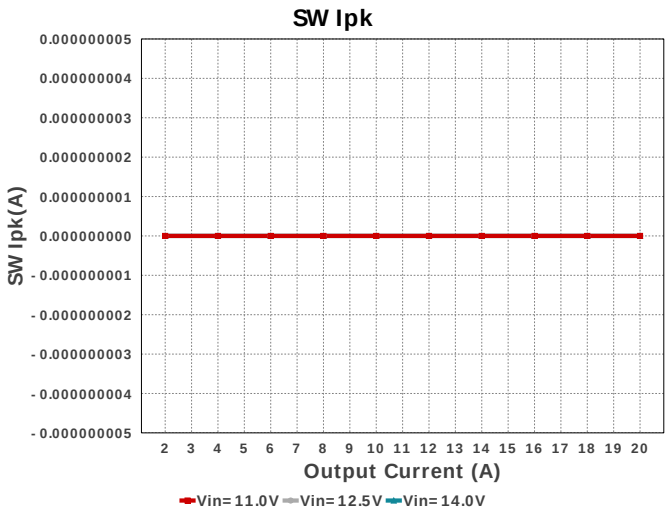


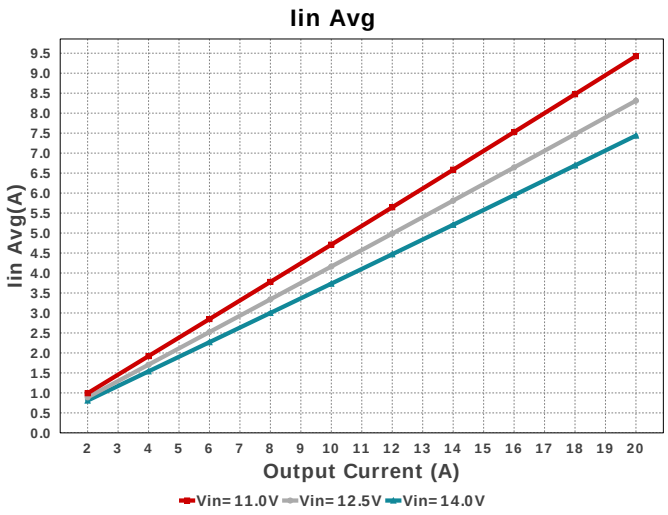


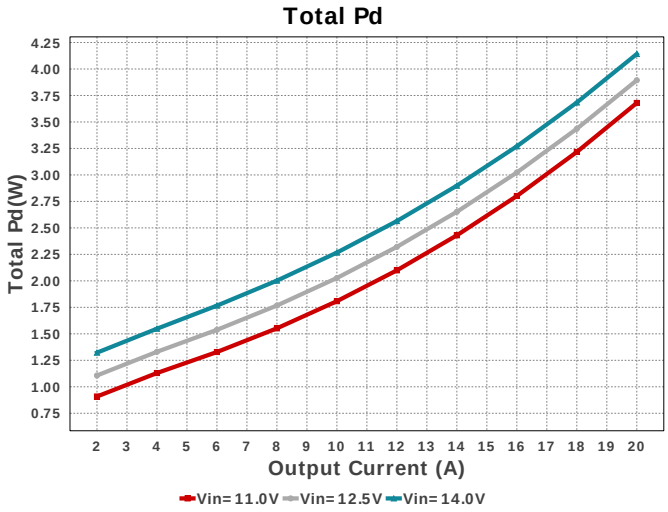


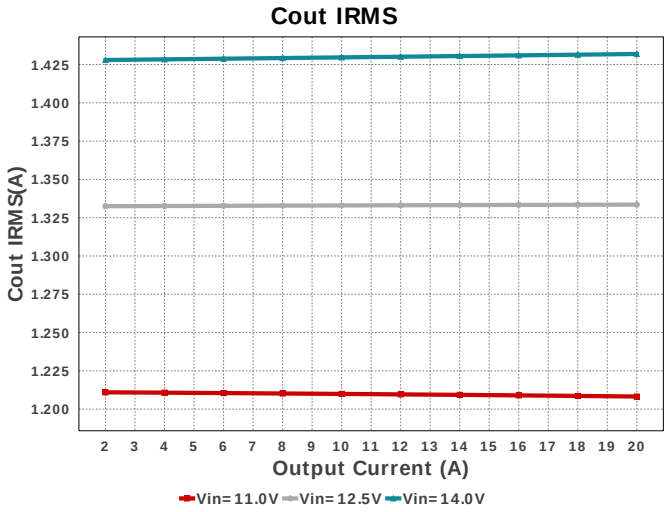


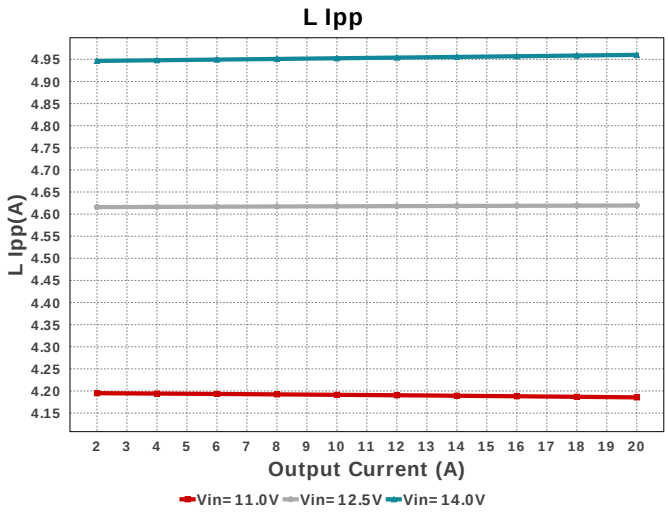


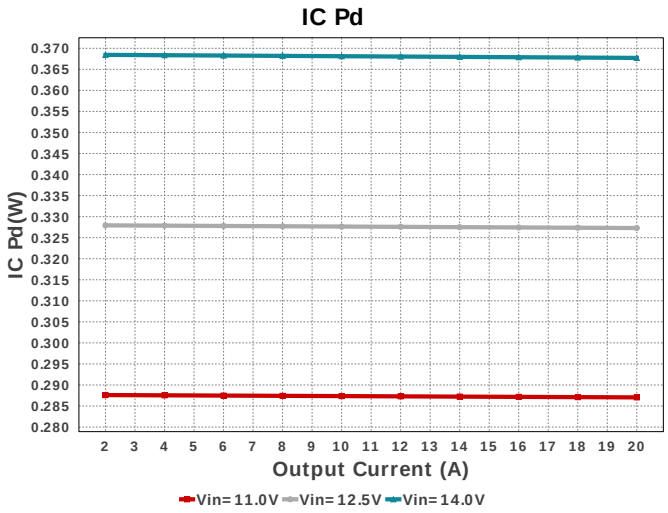












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	9.656 A	Current	Input capacitor RMS ripple current
2.	Cout IRMS	1.432 A	Current	Output capacitor RMS ripple current
3.	Iin Avg	7.439 A	Current	Average input current
4.	L Ipp	4.96 A	Current	Peak-to-peak inductor ripple current
5.	SW Ipk	0.0 A	Current	Peak switch current
6.	BOM Count	33	General	Total Design BOM count
7.	FootPrint	490.0 mm^2	General	Total Foot Print Area of BOM components
8.	Frequency	650.0 kHz	General	Switching frequency
9.	IC Tolerance	6.0 mV	General	IC Feedback Tolerance
10.	Mode	CCM	General	Conduction Mode
11.	Pout	100.0 W	General	Total output power

#	Name	Value	Category	Description
12.	Total BOM	$5.88	General	Total BOM Cost
13.	Duty Cycle	36.297 %	Op Point	Duty cycle
14.	Efficiency	96.023 %	Op Point	Steady state efficiency
15.	IC Tj	48.864 degC	Op Point	IC junction temperature
16.	ICThetaJA	51.3 degC/W	Op Point	IC junction-to-ambient thermal resistance
17.	IOUT_OP	20.0 A	Op Point	Iout operating point
18.	M1 ThetaJA Effective	20.0 degC/W	Op Point	Effective Power Block Junction-to-Ambient Thermal Resistance
19.	M1 TjOP	84.818 degC	Op Point	Power Block junction temperature
20.	VIN_OP	14.0 V	Op Point	Vin operating point
21.	Vout Actual	4.984 V	Op Point	Vout Actual calculated based on selected voltage divider resistors
22.	Vout OP	5.0 V	Op Point	Operational Output Voltage
23.	Vout Tolerance	981.1 m%	Op Point	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
24.	Vout p-p	10.707 mV	Op Point	Peak-to-peak output ripple voltage
25.	Cin Pd	31.078 mW	Power	Input capacitor power dissipation
26.	Cout Pd	820.109 µW	Power	Output capacitor power dissipation
27.	IC Pd	367.718 mW	Power	IC power dissipation
28.	L Pd	402.05 mW	Power	Inductor power dissipation
29.	M1 Pd	2.741 W	Power	Power Block power dissipation
30.	Total Pd	4.142 W	Power	Total Power Dissipation

Design Inputs

#	Name	Value	Description
1.	Iout	20.0	Maximum Output Current
2.	VinMax	14.0	Maximum input voltage
3.	VinMin	11.0	Minimum input voltage
4.	Vout	5.0	Output Voltage
5.	base_pn	TPS53119	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	30.0	Ambient temperature

Design Assistance

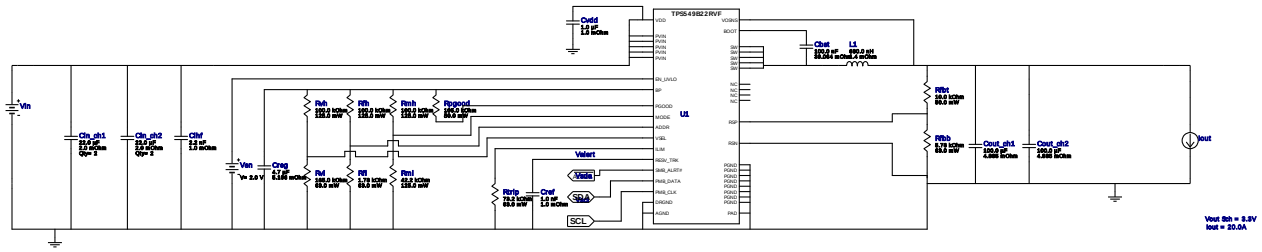
1. **TPS53119** Product Folder : http://www.ti.com/product/TPS53119 : contains the data sheet and other resources.

WEBENCH® Design Report

Vout = 3.3V
Iout = 20.0A

Device = TPS549B22RVFR
Topology = Buck
Created = 2018-05-04 15:27:03.777
BOM Cost = $6.57
BOM Count = 23
Total Pd = 3.57W

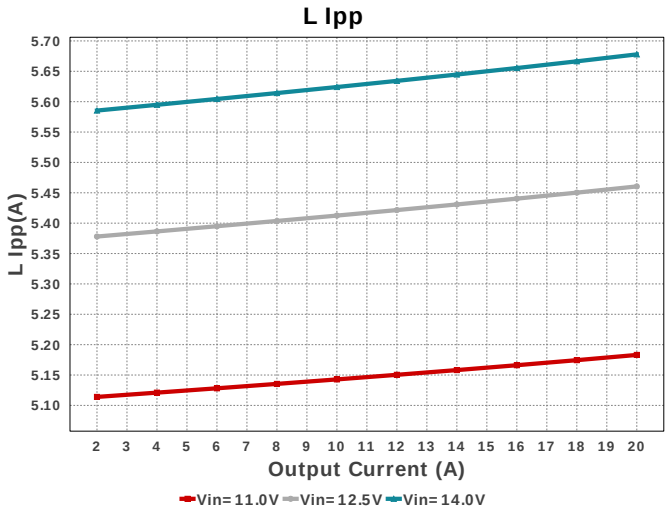
Design : 916945/933 TPS549B22RVFR
TPS549B22RVFR 11.0V-14.0V to 3.30V @ 20.0A

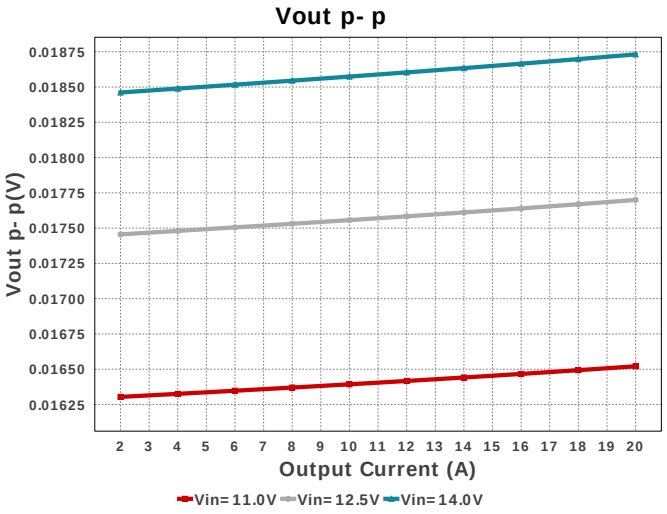


Electrical BOM

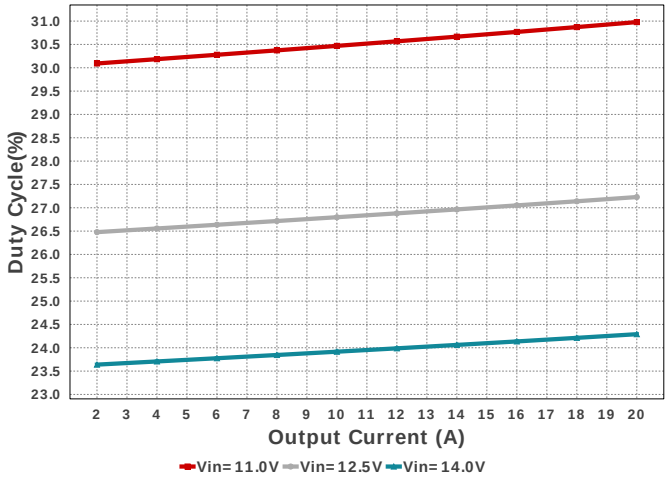
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbst	TDK	C1005X5R1H104K050BB Series= X5R	Cap= 100.0 nF ESR= 39.064 mOhm VDC= 50.0 V IRMS= 814.67 mA	1	$0.02	0402 3 mm²
2.	Cihf	MuRata	GRM155R71E222KA01D Series= X7R	Cap= 2.2 nF ESR= 1.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
3.	Cin_ch1	MuRata	GRM32ER61E226KE15L Series= X5R	Cap= 22.0 uF ESR= 2.0 mOhm VDC= 25.0 V IRMS= 3.67 A	2	$0.20	1210 15 mm²
4.	Cin_ch2	MuRata	GRM32ER61E226KE15L Series= X5R	Cap= 22.0 uF ESR= 2.0 mOhm VDC= 25.0 V IRMS= 3.67 A	2	$0.20	1210 15 mm²
5.	Cout_ch1	MuRata	GRM31CR60J107ME39L Series= X5R	Cap= 100.0 uF ESR= 4.885 mOhm VDC= 6.3 V IRMS= 4.4118 A	1	$0.17	1206_190 11 mm²
6.	Cout_ch2	MuRata	GRM31CR60J107ME39L Series= X5R	Cap= 100.0 uF ESR= 4.885 mOhm VDC= 6.3 V IRMS= 4.4118 A	1	$0.17	1206_190 11 mm²
7.	Cref	MuRata	GRM216R71E102KA01D Series= X7R	Cap= 1.0 nF ESR= 1.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
8.	Creg	MuRata	GRM21BC81E475KA12L Series= X6S	Cap= 4.7 uF ESR= 5.166 mOhm VDC= 25.0 V IRMS= 2.03531 A	1	$0.03	0805 7 mm²
9.	Cvdd	Taiyo Yuden	TMK212B7105KG-T Series= X7R	Cap= 1.0 uF ESR= 1.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.03	0805 7 mm²
10.	L1	Coilcraft	XAL8080-681MEB	L= 680.0 nH DCR= 1.4 mOhm	1	$1.55	XAL8080 107 mm²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
11.	Rfbb	Vishay-Dale	CRCW04025K76FKED Series= CRCW..e3	Res= 5.76 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
12.	Rfbt	Yageo America	RC0201FR-0710KL Series= ?	Res= 10.0 kOhm Power= 50.0 mW Tolerance= 1.0%	1	$0.01	0201 2 mm²
13.	Rfh	Vishay-Dale	CRCW0805100KFKEA Series= CRCW..e3	Res= 100.0 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm²
14.	Rfl	Vishay-Dale	CRCW04021K78FKED Series= CRCW..e3	Res= 1.78 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
15.	Rmh	Vishay-Dale	CRCW0805100KFKEA Series= CRCW..e3	Res= 100.0 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm²
16.	Rml	Vishay-Dale	CRCW080542K2FKEA Series= CRCW..e3	Res= 42.2 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm²
17.	Rpgood	Yageo America	RC0201FR-07105KL Series= ?	Res= 105.0 kOhm Power= 50.0 mW Tolerance= 1.0%	1	$0.01	0201 2 mm²
18.	Rtrip	Vishay-Dale	CRCW040273K2FKED Series= CRCW..e3	Res= 73.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
19.	Rvh	Vishay-Dale	CRCW0805100KFKEA Series= CRCW..e3	Res= 100.0 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm²
20.	Rvl	Vishay-Dale	CRCW0402165KFKED Series= CRCW..e3	Res= 165.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
21.	U1	Texas Instruments	TPS549B22RVFR	Switcher	1	$3.68	RVF0040A 63 mm²

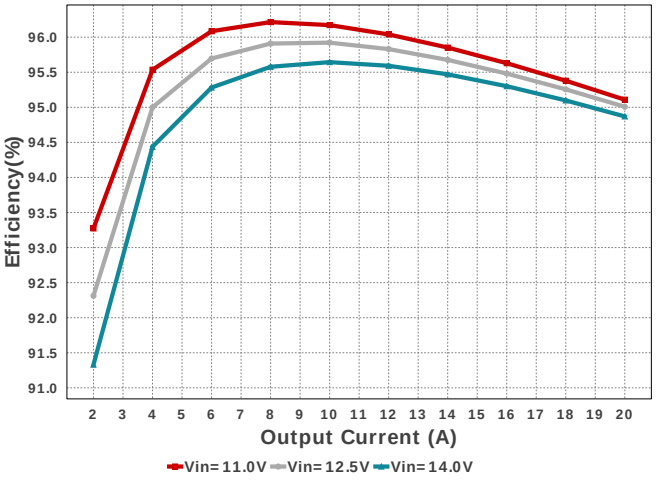




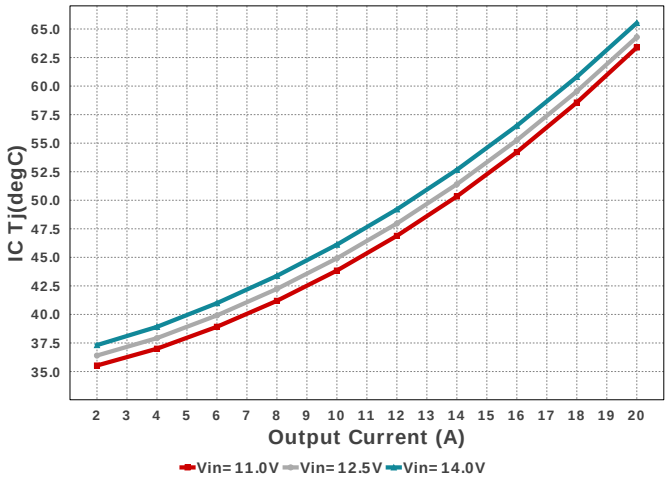
Duty Cycle



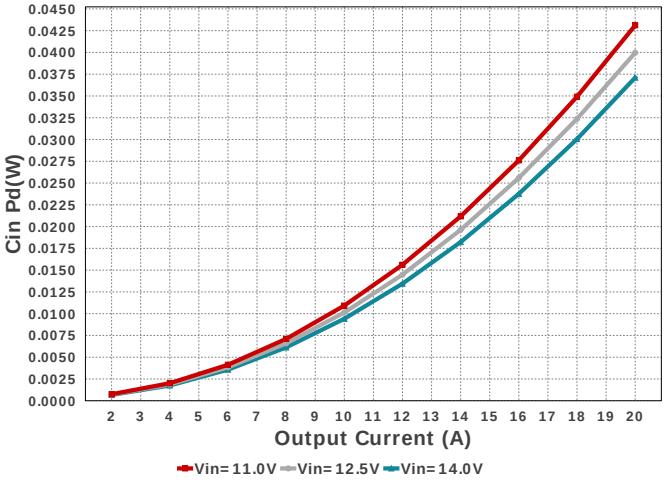
Efficiency



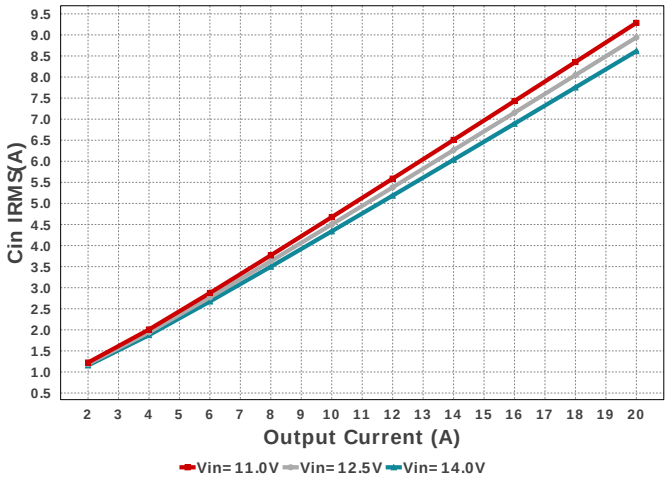
IC Tj



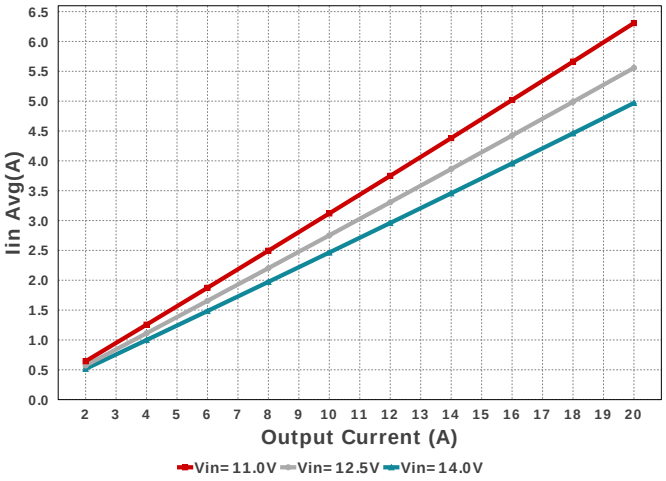
Cin Pd

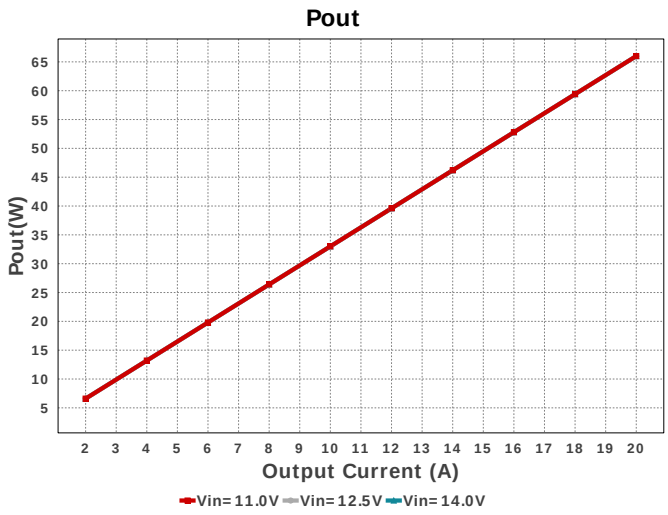


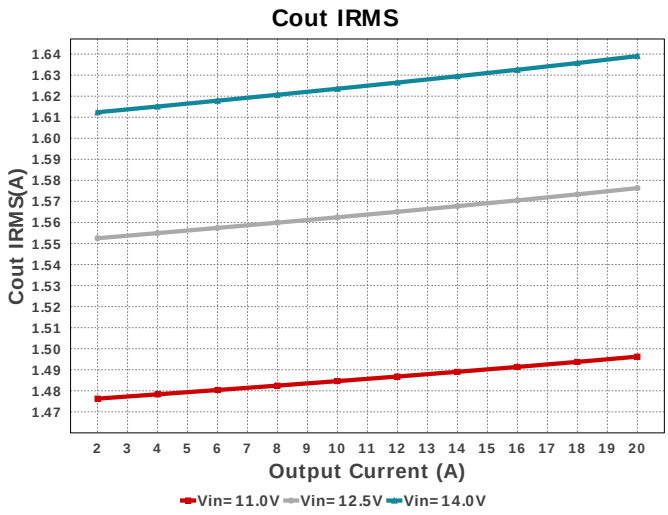
Cin IRMS

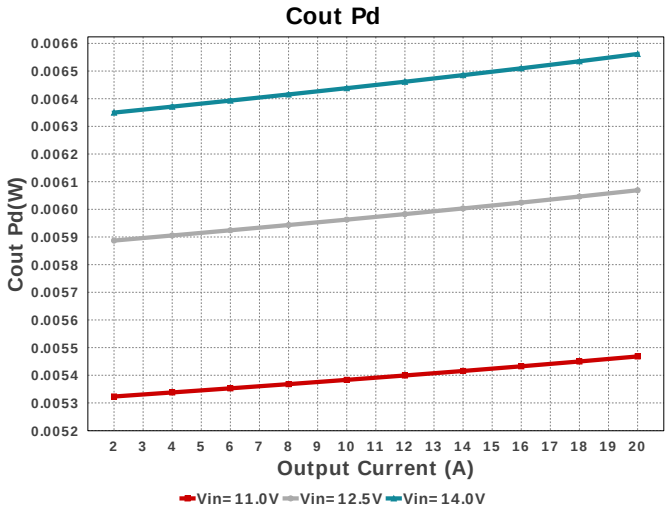


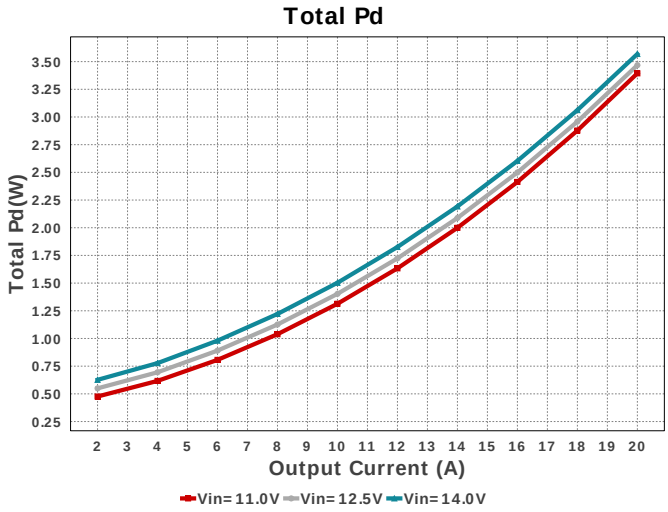
Iin Avg

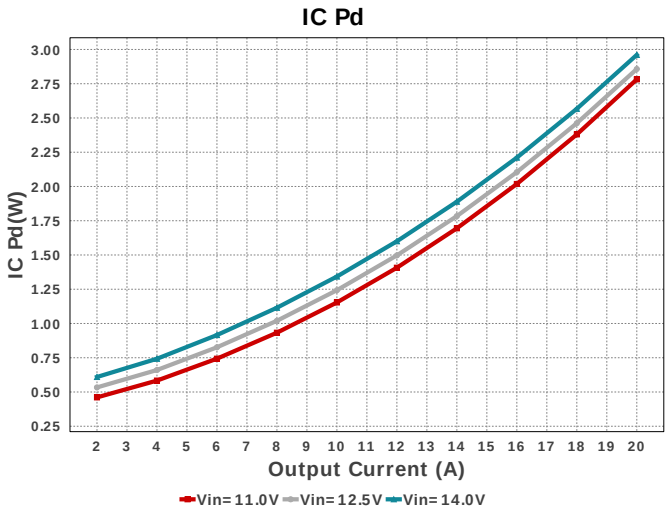


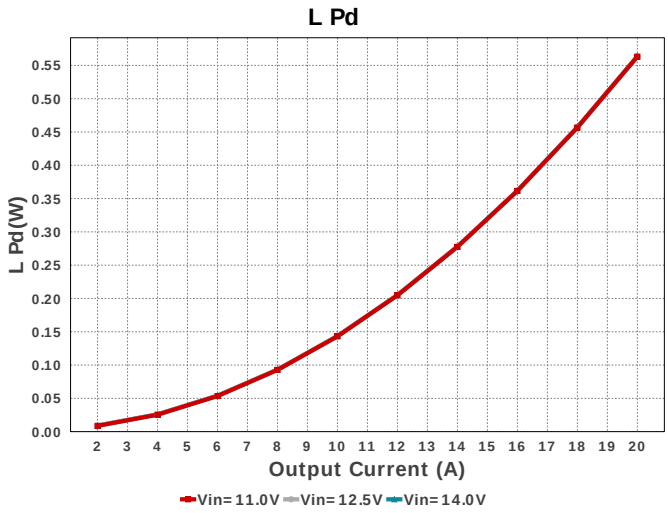












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	8.615 A	Current	Input capacitor RMS ripple current
2.	Cout IRMS	1.639 A	Current	Output capacitor RMS ripple current
3.	Iin Avg	4.969 A	Current	Average input current
4.	L Ipp	5.678 A	Current	Peak-to-peak inductor ripple current
5.	BOM Count	23	General	Total Design BOM count
6.	FootPrint	320.0 mm^2	General	Total Foot Print Area of BOM components
7.	Frequency	661.63 kHz	General	Switching frequency
8.	Mode	CCM	General	Conduction Mode
9.	Pout	66.0 W	General	Total output power
10.	Total BOM	$6.57	General	Total BOM Cost
11.	Duty Cycle	24.291 %	Op Point	Duty cycle

#	Name	Value	Category	Description
12.	Efficiency	94.87 %	Op Point	Steady state efficiency
13.	IC Tj	65.527 degC	Op Point	IC junction temperature
14.	ICThetaJA Effective	12.0 degC/W	Op Point	Effective IC Junction-to-Ambient Thermal Resistance
15.	IOUT_OP	20.0 A	Op Point	Iout operating point
16.	VIN_OP	14.0 V	Op Point	Vin operating point
17.	Vout Actual	3.281 V	Op Point	Vout Actual calculated based on selected voltage divider resistors
18.	Vout OP	3.3 V	Op Point	Operational Output Voltage
19.	Vout Tolerance	1.662 %	Op Point	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
20.	Vout p-p	18.731 mV	Op Point	Peak-to-peak output ripple voltage
21.	PMBus Vout Command	1.69 k	PMBus	PMBus Vout Command
22.	Cin Pd	37.107 mW	Power	Input capacitor power dissipation
23.	Cout Pd	6.562 mW	Power	Output capacitor power dissipation
24.	IC Pd	2.961 W	Power	IC power dissipation
25.	L Pd	563.761 mW	Power	Inductor power dissipation
26.	Total Pd	3.569 W	Power	Total Power Dissipation

Design Inputs

#	Name	Value	Description
1.	Iout	20.0	Maximum Output Current
2.	VinMax	14.0	Maximum input voltage
3.	VinMin	11.0	Minimum input voltage
4.	Vout	3.3	Output Voltage
5.	base_pn	TPS549B22	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	30.0	Ambient temperature

Design Assistance

1. **TPS549B22** Product Folder : http://www.ti.com/product/TPS549B22 : contains the data sheet and other resources.