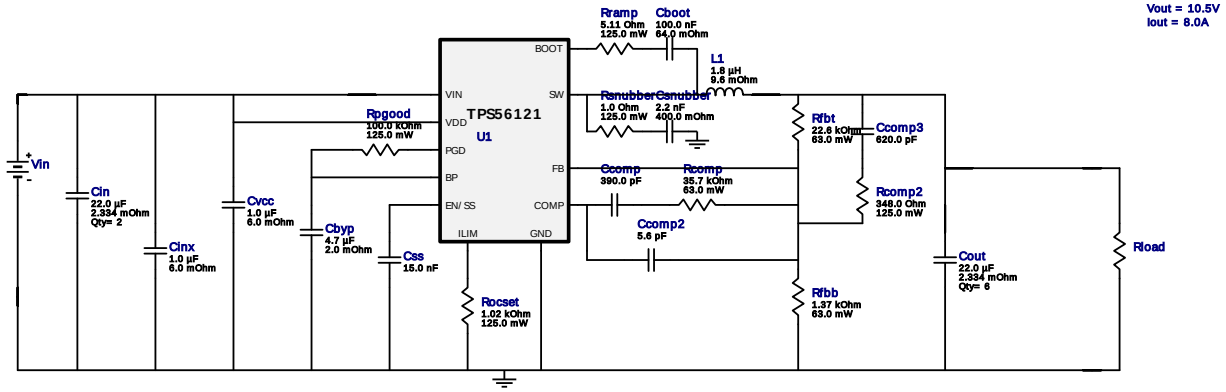
WEBENCH® Design Report

VinMin = 13.0V
VinMax = 13.0V
Vout = 10.5V
Iout = 8.0A

Device = TPS56121DQPR
Topology = Buck
Created = 2017-08-04 08:10:29.174
BOM Cost = $6.24
BOM Count = 27
Total Pd = 2.41W

Design : 4055510/480 TPS56121DQPR
TPS56121DQPR 13.0V-13.0V to 10.50V @ 8.0A



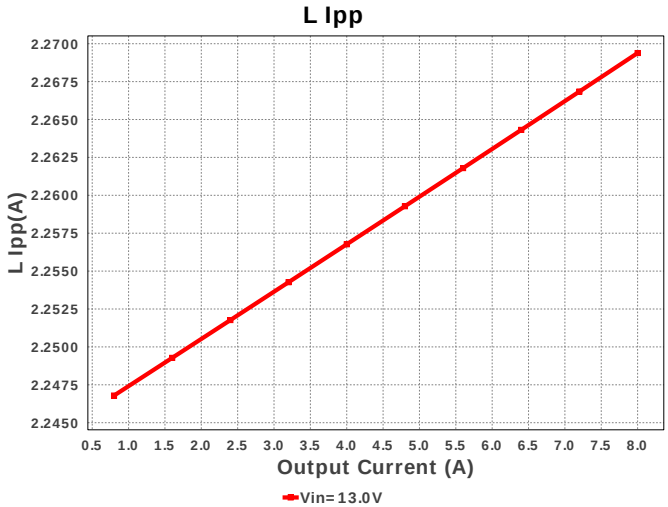
My Comments

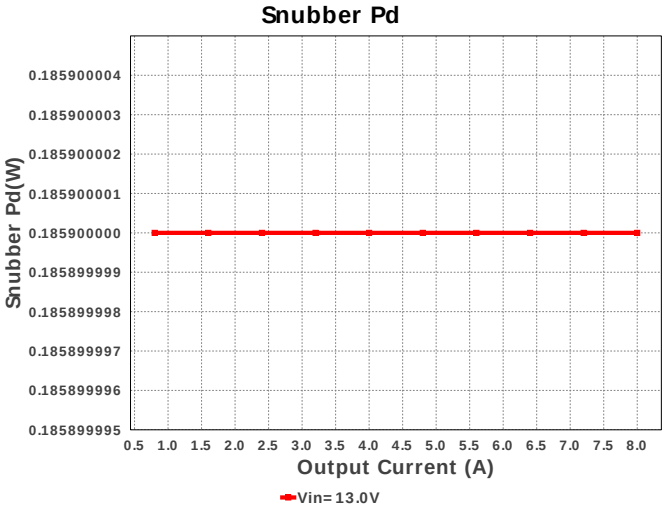
No comments

Electrical BOM

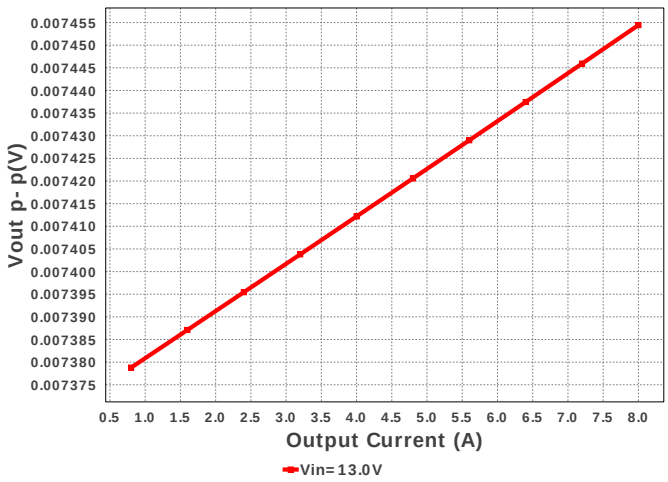
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot	Kemet	C0805C104K5RACTU Series= X7R	Cap= 100.0 nF ESR= 64.0 mOhm VDC= 50.0 V IRMS= 1.64 A	1	$0.01	0805 7 mm²
2.	Cbyp	MuRata	GRM21BR61E475MA12L Series= X5R	Cap= 4.7 uF ESR= 2.0 mOhm VDC= 25.0 V IRMS= 7.29 A	1	$0.03	0805 7 mm²
3.	Ccomp	Yageo America	CC0805KRX7R9BB391 Series= X7R	Cap= 390.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
4.	Ccomp2	MuRata	GRM1555C1H5R6CA01D Series= C0G/NP0	Cap= 5.6 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
5.	Ccomp3	Samsung Electro-Mechanics	CL21C621JBCNNNC Series= C0G/NP0	Cap= 620.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
6.	Cin	MuRata	GRM32ER71E226KE15L Series= X7R	Cap= 22.0 uF ESR= 2.334 mOhm VDC= 25.0 V IRMS= 3.833 A	2	$0.26	1210_280 15 mm²
7.	Cinx	MuRata	GRM219R71E105KA88D Series= X7R	Cap= 1.0 uF ESR= 6.0 mOhm VDC= 25.0 V IRMS= 3.87 A	1	$0.02	0805 7 mm²
8.	Cout	MuRata	GRM32ER71E226KE15L Series= X7R	Cap= 22.0 uF ESR= 2.334 mOhm VDC= 25.0 V IRMS= 3.833 A	6	$0.26	1210_280 15 mm²
9.	Csnubber	Kemet	C0805C222K5RACTU Series= X7R	Cap= 2.2 nF ESR= 400.0 mOhm VDC= 50.0 V IRMS= 251.0 mA	1	$0.01	0805 7 mm²
10.	Css	MuRata	GRM155R71C153KA01D Series= X7R	Cap= 15.0 nF VDC= 16.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
11.	Cvcc	MuRata	GRM219R71E105KA88D Series= X7R	Cap= 1.0 uF ESR= 6.0 mOhm VDC= 25.0 V IRMS= 3.87 A	1	$0.02	0805 7 mm²
12.	L1	Coilcraft	XAL6030-182MEB	L= 1.8 µH DCR= 9.6 mOhm	1	$0.65	XAL6030 72 mm²
13.	Rcomp	Vishay-Dale	CRCW040235K7FKED Series= CRCW..e3	Res= 35.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
14.	Rcomp2	Vishay-Dale	CRCW0805348RFKEA Series= CRCW..e3	Res= 348.0 Ohm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm²
15.	Rfbb	Vishay-Dale	CRCW04021K37FKED Series= CRCW..e3	Res= 1.37 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
16.	Rfbt	Vishay-Dale	CRCW040222K6FKED Series= CRCW..e3	Res= 22.6 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
17.	Rocset	Panasonic	ERJ-6ENF1021V Series= ERJ-6E	Res= 1.02 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm²
18.	Rpgood	Panasonic	ERJ-6ENF1003V Series= ERJ-6E	Res= 100.0 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm²
19.	Rramp	Vishay-Dale	CRCW08055R11FKEA Series= CRCW..e3	Res= 5.11 Ohm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm²
20.	Rsnubber	Vishay-Dale	CRCW08051R00FKEA Series= CRCW..e3	Res= 1.0 Ohm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm²
21.	U1	Texas Instruments	TPS56121DQPR	Switcher	1	$3.30	R-PSON-N22 58 mm²

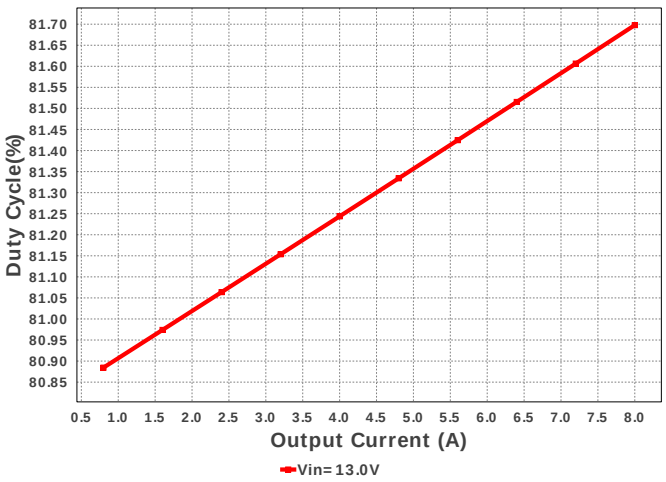




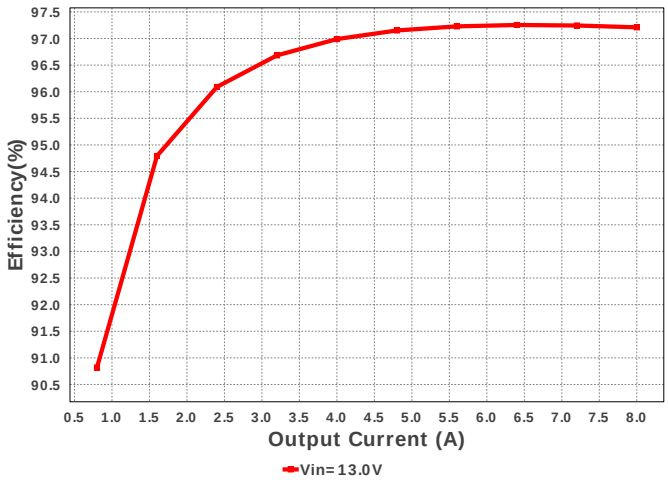
Vout p- p



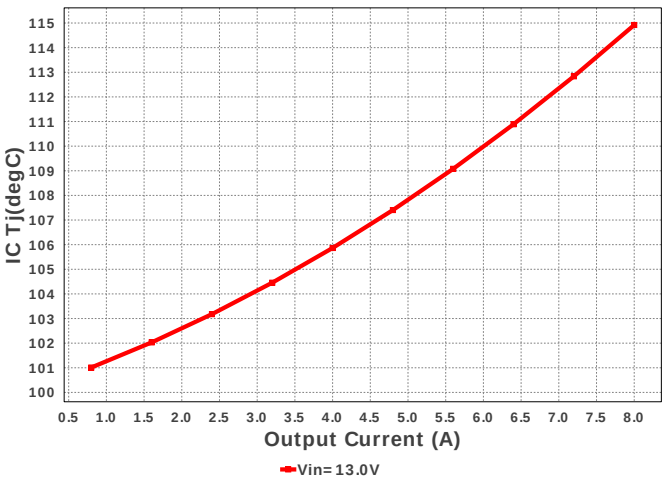
Duty Cycle



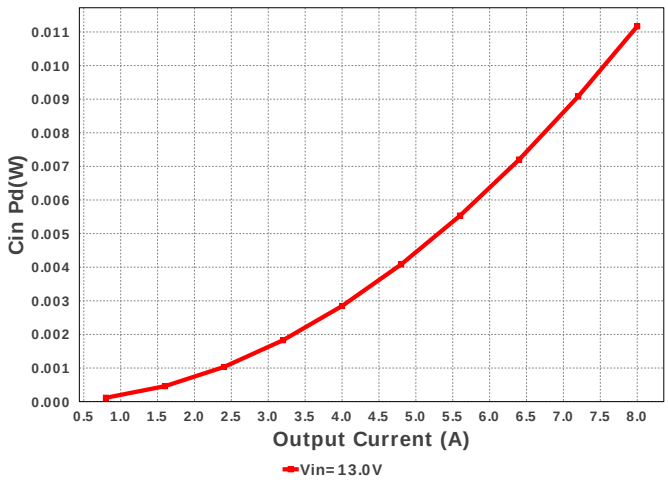
Efficiency



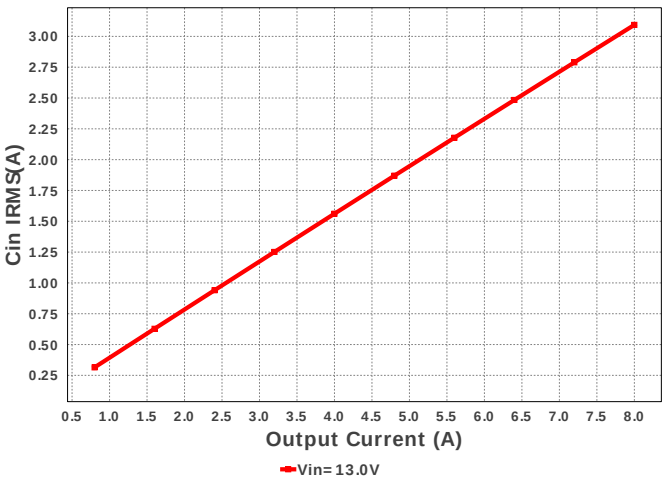
IC Tj

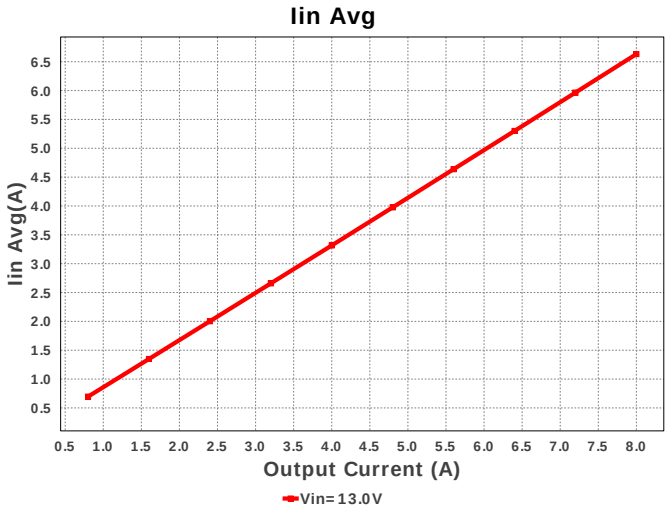


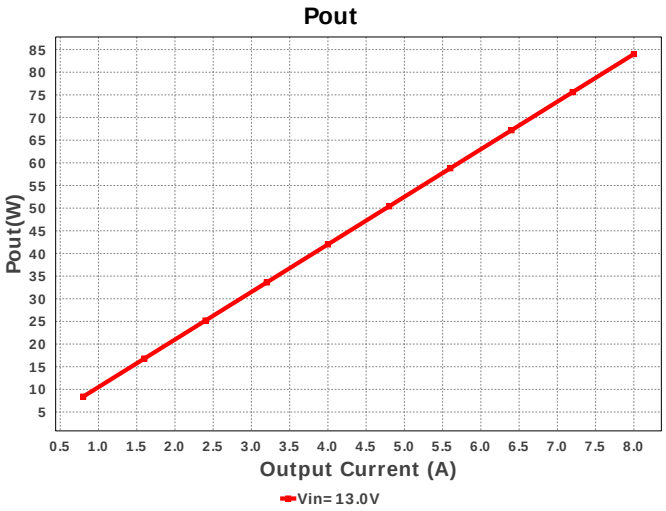
Cin Pd

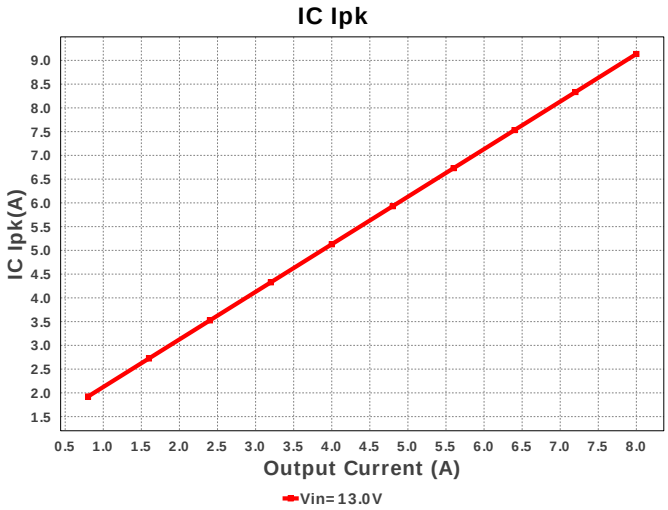


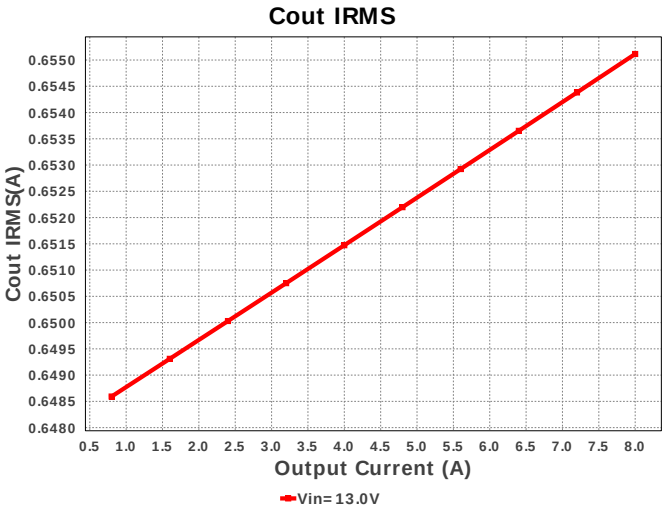
Cin IRMS

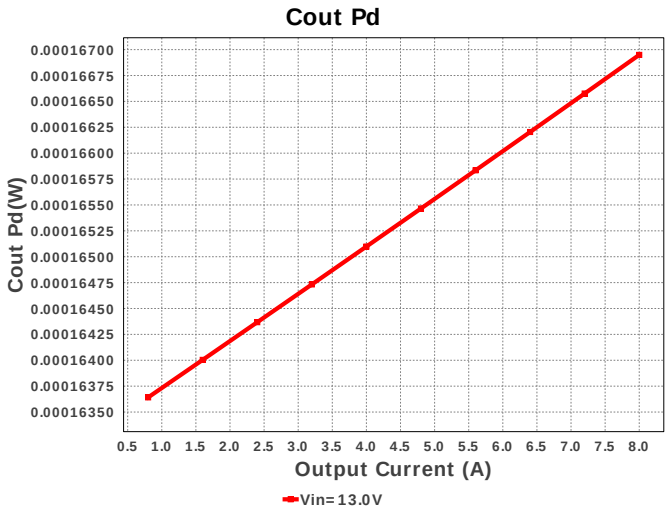


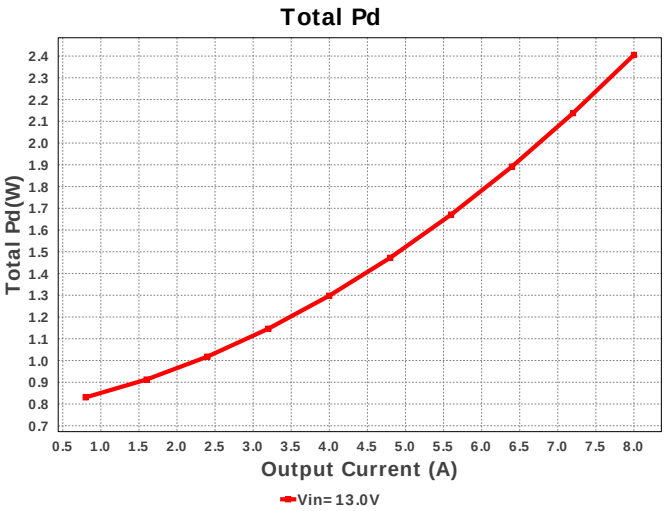


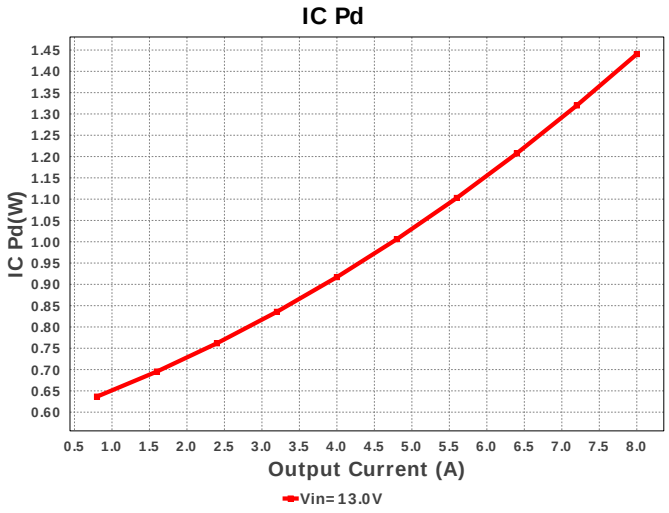


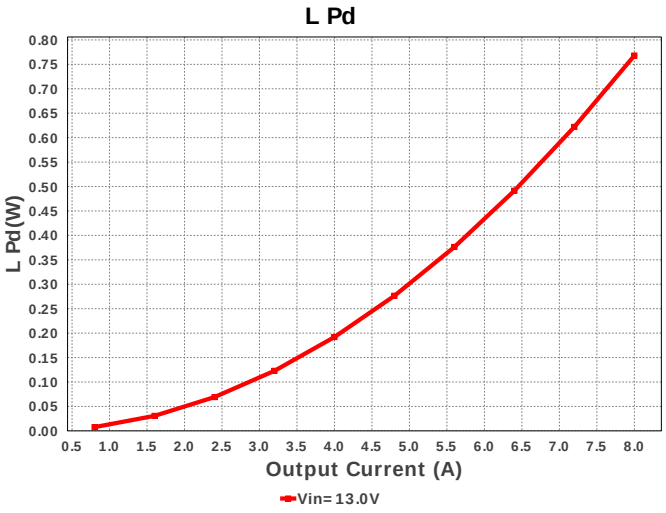


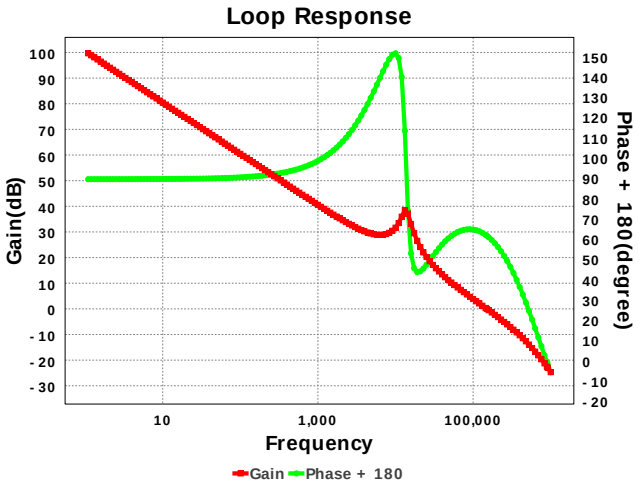












Operating Values

#	Name	Value	Category	Description
1.	BOM Count	27		Total Design BOM count
2.	Total BOM	$6.24		Total BOM Cost
3.	Cin IRMS	3.093 A	Current	Input capacitor RMS ripple current
4.	Cout IRMS	655.115 mA	Current	Output capacitor RMS ripple current
5.	IC Ipk	9.135 A	Current	Peak switch current in IC
6.	Iin Avg	6.632 A	Current	Average input current
7.	L Ipp	2.269 A	Current	Peak-to-peak inductor ripple current
8.	FootPrint	343.0 mm^2	General	Total Foot Print Area of BOM components
9.	Frequency	500.0 kHz	General	Switching frequency
10.	Mode	CCM	General	Conduction Mode
11.	Pout	84.0 W	General	Total output power
12.	ICThetaJA Effective	17.3 degC/W	Op_Point	Effective IC Junction-to-Ambient Thermal Resistance
13.	Low Freq Gain	99.666 dB	Op_Point	Gain at 1Hz
14.	Vout Actual	10.498 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
15.	Vout OP	10.5 V	Op_Point	Operational Output Voltage
16.	Cross Freq	150.13 kHz	Op_point	Bode plot crossover frequency
17.	Duty Cycle	81.698 %	Op_point	Duty cycle
18.	Efficiency	97.21 %	Op_point	Steady state efficiency
19.	Gain Marg	-22.545 dB	Op_point	Bode Plot Gain Margin
20.	IC Tj	114.92 degC	Op_point	IC junction temperature
21.	IOUT_OP	8.0 A	Op_point	Iout operating point
22.	Phase Marg	62.131 deg	Op_point	Bode Plot Phase Margin
23.	VIN_OP	13.0 V	Op_point	Vin operating point
24.	Vout p-p	7.454 mV	Op_point	Peak-to-peak output ripple voltage
25.	Cin Pd	11.168 mW	Power	Input capacitor power dissipation
26.	Cout Pd	166.949 µW	Power	Output capacitor power dissipation
27.	IC Pd	1.44 W	Power	IC power dissipation
28.	L Pd	768.0 mW	Power	Inductor power dissipation
29.	Snubber Pd	185.9 mW	Power	Snubber Power Dissipation
30.	Total Pd	2.406 W	Power	Total Power Dissipation

#	Name	Value	Category	Description
31.	Vout Tolerance	2.924 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	8.0	Maximum Output Current
2.	SoftStart	0.9 ms	Soft Start Time (ms)
3.	VinMax	13.0	Maximum input voltage
4.	VinMin	13.0	Minimum input voltage
5.	Vout	10.5	Output Voltage
6.	base_pn	TPS56121	Base Product Number
7.	source	DC	Input Source Type
8.	Ta	90.0	Ambient temperature

Design Assistance

1. **TPS56121** Product Folder : http://www.ti.com/product/TPS56121 : contains the data sheet and other resources.