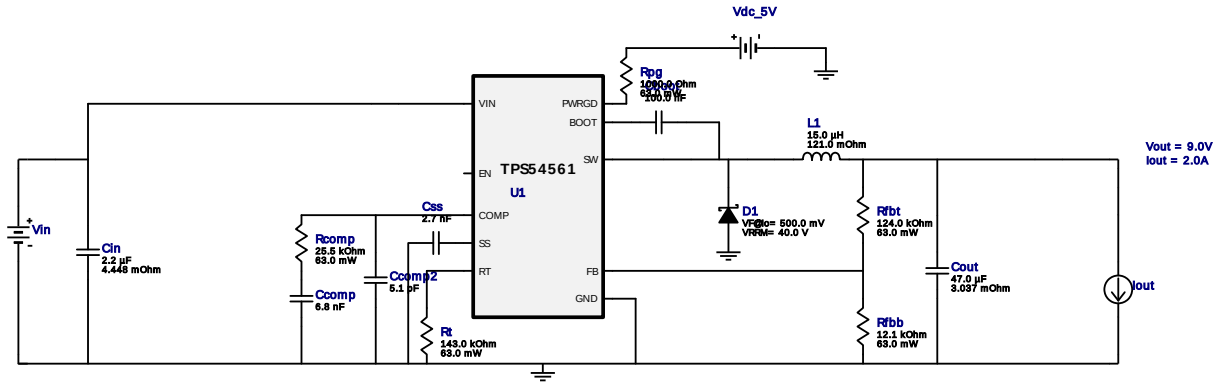
WEBENCH ® Design Report

VinMin = 14.0V
VinMax = 25.0V
Vout = 9.0V
Iout = 2.0A

Device = TPS54561DPRR
Topology = Buck
Created = 7/15/16 6:38:14 PM
BOM Cost = $4.09
BOM Count = 14
Total Pd = 1.49W

Design : 4742013/15 TPS54561DPRR
TPS54561DPRR 14.0V-25.0V to 9.00V @ 2.0A



Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot	MuRata	GRM155R61A104KA01D Series= X5R	Cap= 100.0 nF VDC= 10.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
2.	Ccomp	Yageo America	CC0805KRX7R9BB682 Series= X7R	Cap= 6.8 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
3.	Ccomp2	MuRata	GRM1555C1H5R1CA01D Series= C0G/NP0	Cap= 5.1 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
4.	Cin	MuRata	GRM31CR71H225KA88L Series= X7R	Cap= 2.2 uF ESR= 4.448 mOhm VDC= 50.0 V IRMS= 2.2252 A	1	$0.05	1206_190 11 mm²
5.	Cout	MuRata	GRM32ER61C476ME15L Series= X5R	Cap= 47.0 uF ESR= 3.037 mOhm VDC= 16.0 V IRMS= 4.59346 A	1	$0.24	1210_280 15 mm²
6.	Css	Yageo America	CC0805KRX7R9BB272 Series= X7R	Cap= 2.7 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
7.	D1	Diodes Inc.	B340A-13-F	VF@Io= 500.0 mV VRRM= 40.0 V	1	$0.11	SMA 37 mm²
8.	L1	Bourns	SRP6540-150M	L= 15.0 µH DCR= 121.0 mOhm	1	$0.60	SRP6540 83 mm²
9.	Rcomp	Vishay-Dale	CRCW040225K5FKED Series= CRCW..e3	Res= 25.5 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
10.	Rfbb	Vishay-Dale	CRCW040212K1FKED Series= CRCW..e3	Res= 12.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
11.	Rfbt	Vishay-Dale	CRCW0402124KFKED Series= CRCW..e3	Res= 124.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²

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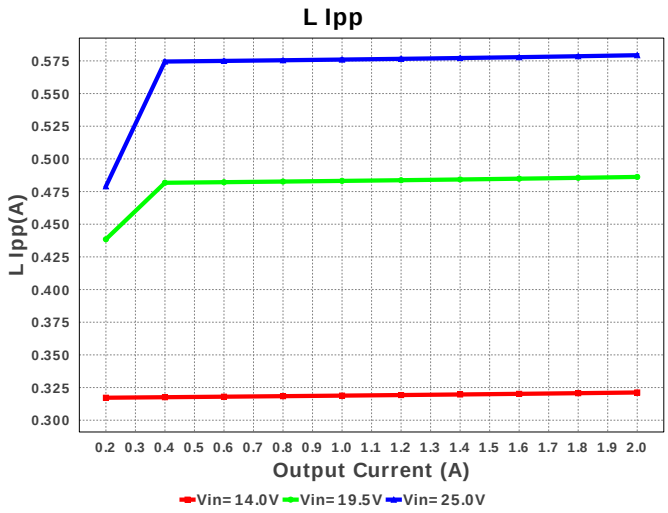
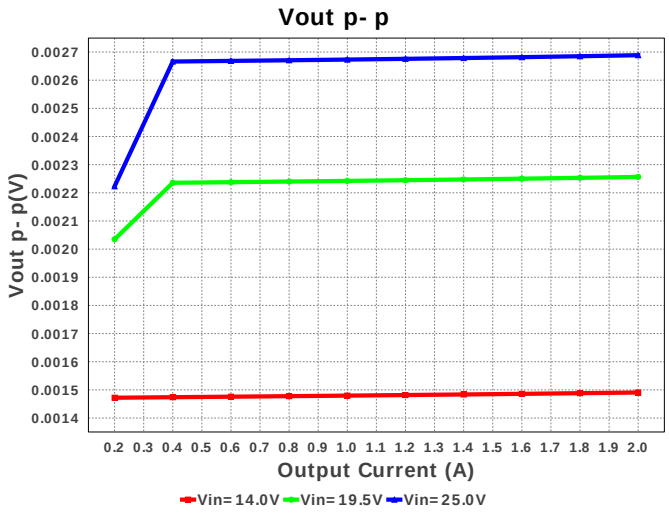
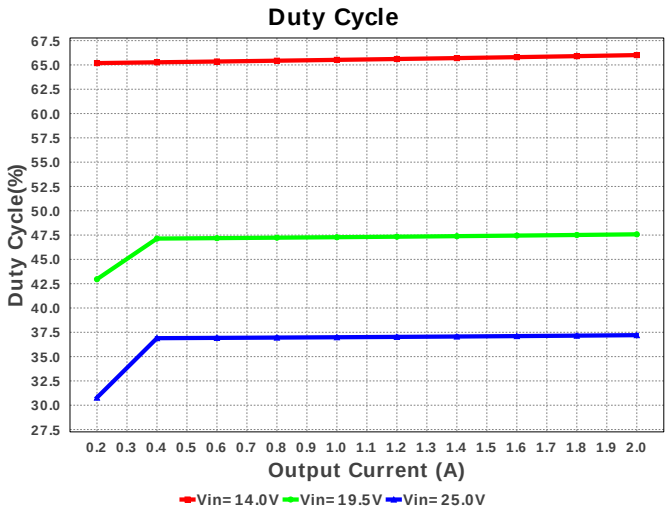
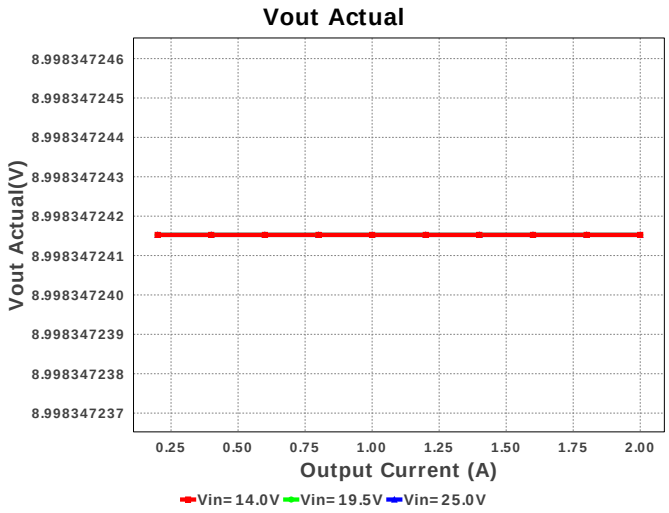
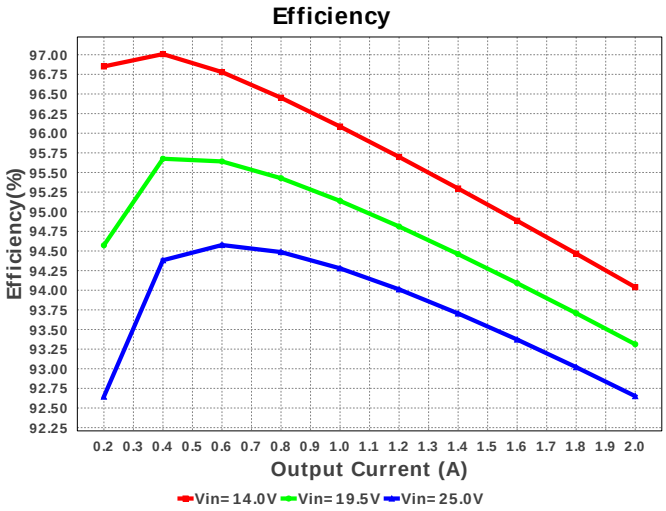
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
12.	Rpg	Vishay-Dale	CRCW04021K00FKED Series= CRCW..e3	Res= 1000.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
13.	Rt	Vishay-Dale	CRCW0402143KFKED Series= CRCW..e3	Res= 143.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
14.	U1	Texas Instruments	TPS54561DPRR	Switcher	1	$3.00	S-PWSON-N10 26 mm²

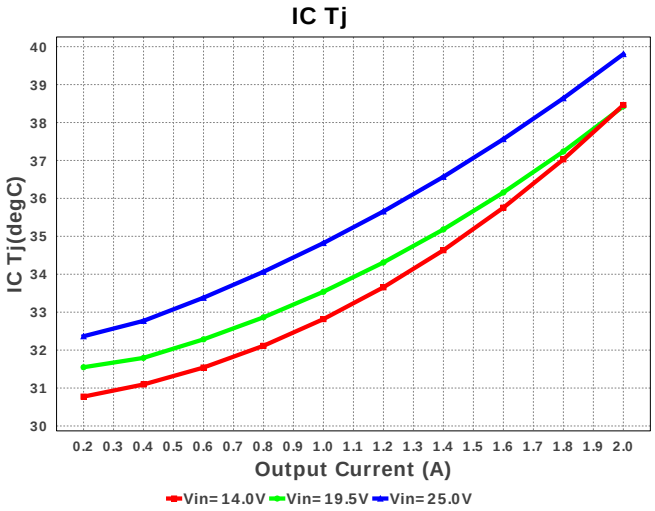


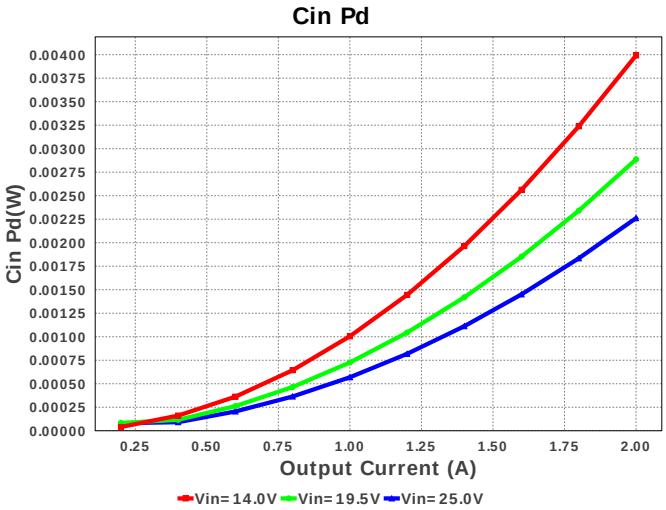


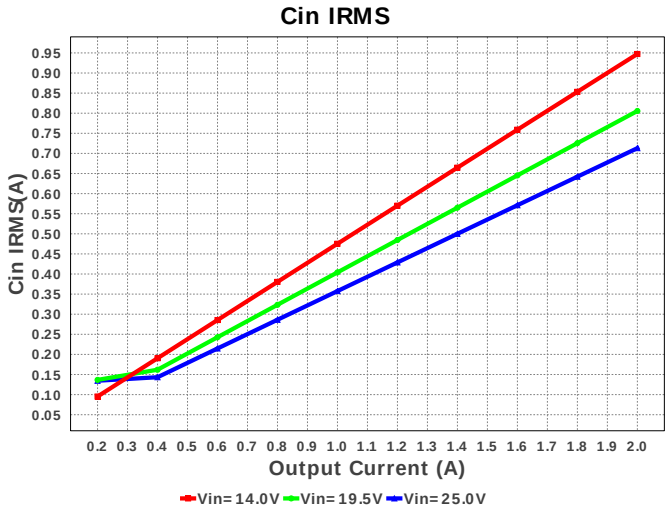


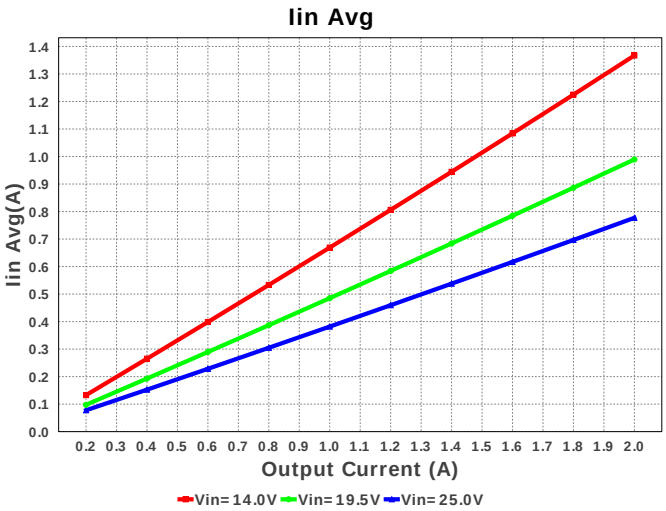


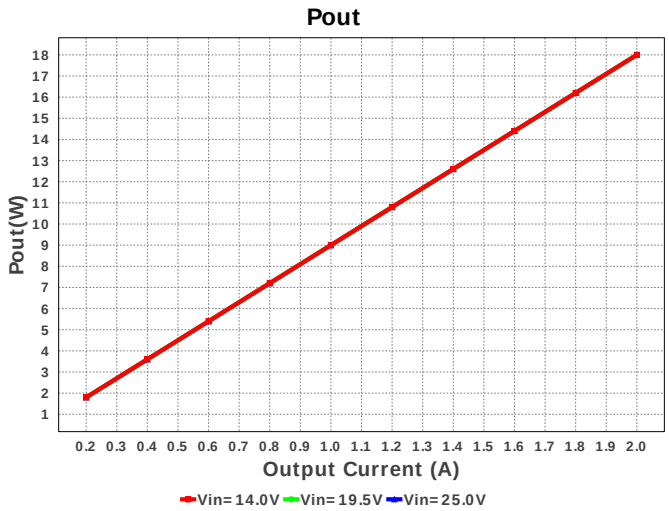

Efficiency
Efficiency(%)
97.00
96.75
96.50
96.25
96.00
95.75
95.50
95.25
95.00
94.75
94.50
94.25
94.00
93.75
93.50
93.25
93.00
92.75
92.50
92.25
0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0
Output Current (A)
Vin=14.0V Vin=19.5V Vin=25.0V

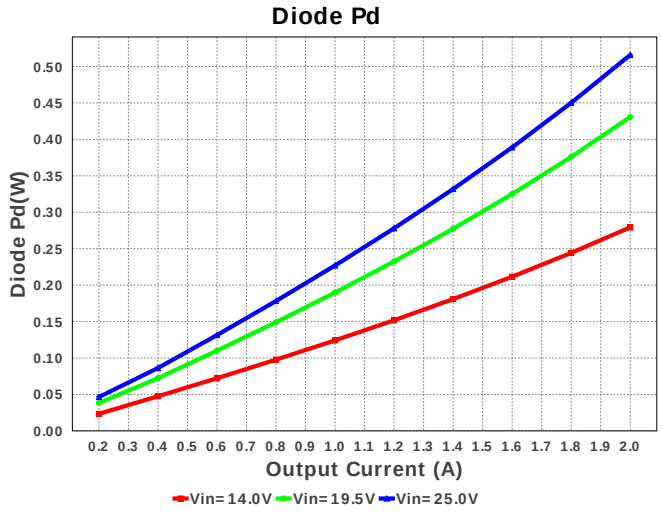

IC Tj
IC Tj(degC)
40
39
38
37
36
35
34
33
32
31
30
0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0
Output Current (A)
Vin=14.0V Vin=19.5V Vin=25.0V

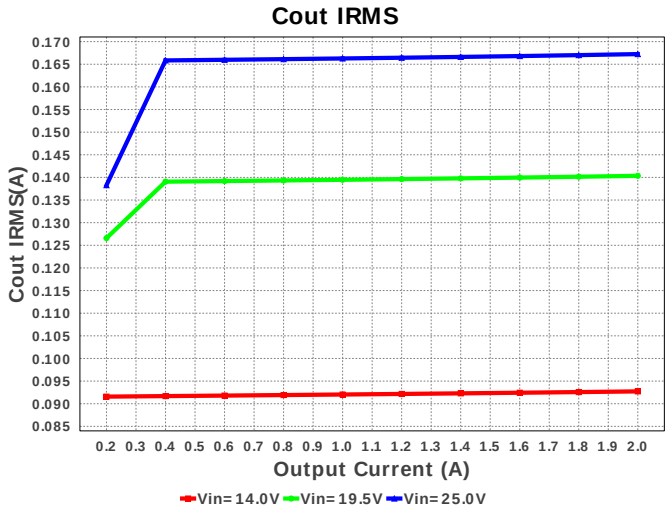

Cin Pd
Cin Pd(W)
0.00400
0.00375
0.00350
0.00325
0.00300
0.00275
0.00250
0.00225
0.00200
0.00175
0.00150
0.00125
0.00100
0.00075
0.00050
0.00025
0.00000
0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00
Output Current (A)
Vin=14.0V Vin=19.5V Vin=25.0V

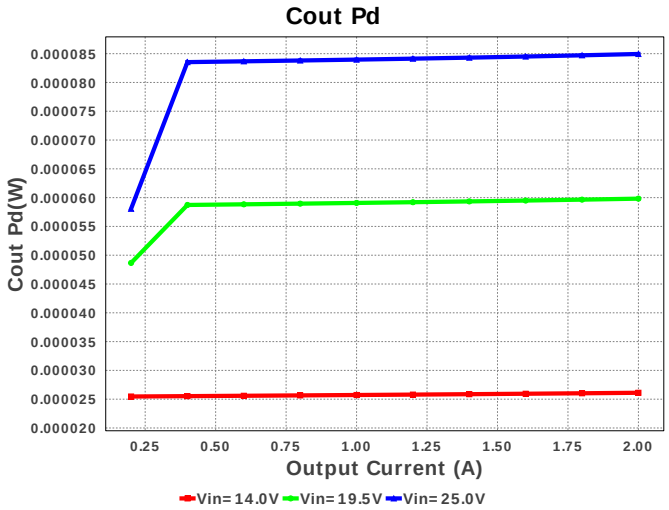

Cin IRMS
Cin IRMS(A)
0.95
0.90
0.85
0.80
0.75
0.70
0.65
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0
Output Current (A)
Vin=14.0V Vin=19.5V Vin=25.0V

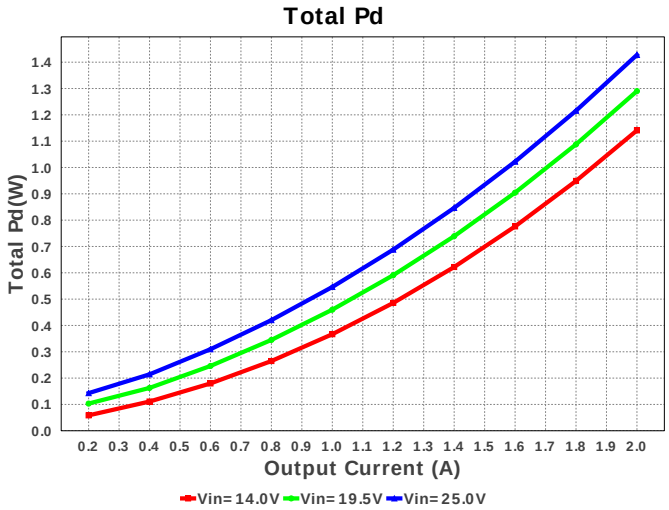

Iin Avg
Iin Avg(A)
1.4
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0
Output Current (A)
Vin=14.0V Vin=19.5V Vin=25.0V

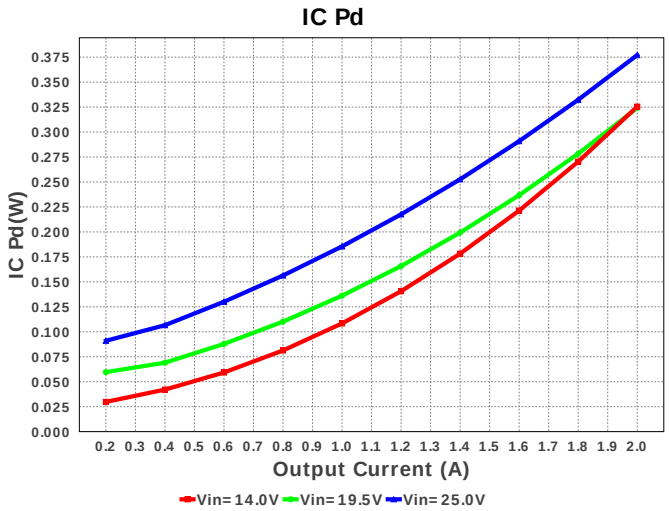

Pout
Pout(W)
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0
Output Current (A)
Vin=14.0V Vin=19.5V Vin=25.0V

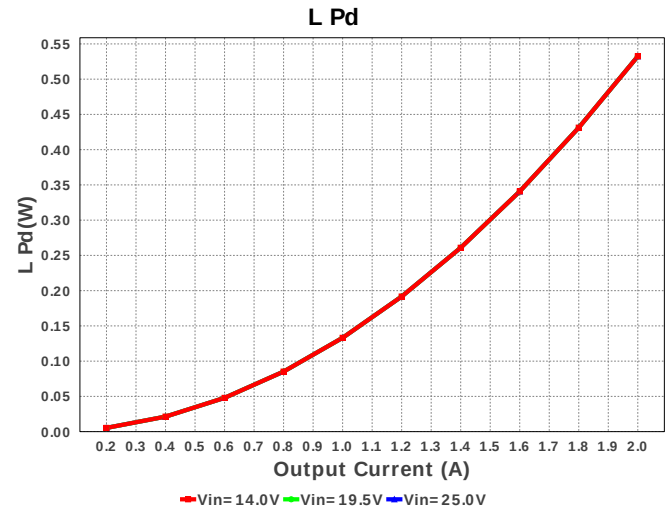












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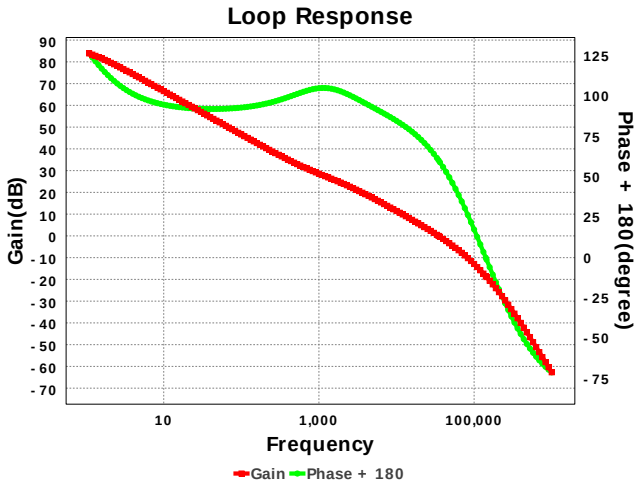

Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	712.96 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	167.803 mA	Current	Output capacitor RMS ripple current
3.	Iin Avg	779.61 mA	Current	Average input current
4.	L Ipp	581.29 mA	Current	Peak-to-peak inductor ripple current
5.	BOM Count	14	General	Total Design BOM count
6.	FootPrint	206.0 mm^2	General	Total Foot Print Area of BOM components
7.	Frequency	685.024 kHz	General	Switching frequency
8.	Pout	18.0 W	General	Total output power
9.	Total BOM	$4.09	General	Total BOM Cost
10.	ICThetaJA Effective	26.0 degC/W	Op_Point	Effective IC Junction-to-Ambient Thermal Resistance
11.	Low Freq Gain	83.866 dB	Op_Point	Gain at 10Hz
12.	Vout Actual	8.998 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
13.	Vout OP	9.0 V	Op_Point	Operational Output Voltage
14.	Cross Freq	34.776 kHz	Op_point	Bode plot crossover frequency
15.	Duty Cycle	37.331 %	Op_point	Duty cycle
16.	Efficiency	92.354 %	Op_point	Steady state efficiency
17.	Gain Marg	-18.559 dB	Op_point	Bode Plot Gain Margin
18.	IC Tj	39.816 degC	Op_point	IC junction temperature
19.	IOUT_OP	2.0 A	Op_point	Iout operating point
20.	Phase Marg	60.465 deg	Op_point	Bode Plot Phase Margin
21.	VIN_OP	25.0 V	Op_point	Vin operating point
22.	Vout p-p	2.698 mV	Op_point	Peak-to-peak output ripple voltage
23.	Cin Pd	2.261 mW	Power	Input capacitor power dissipation
24.	Cout Pd	85.515 µW	Power	Output capacitor power dissipation
25.	Diode Pd	577.934 mW	Power	Diode power dissipation
26.	IC Pd	377.556 mW	Power	IC power dissipation
27.	L Pd	532.4 mW	Power	Inductor power dissipation
28.	Total Pd	1.49 W	Power	Total Power Dissipation
29.	Vout Tolerance	2.859 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	2.0	Maximum Output Current
2.	VinMax	25.0	Maximum input voltage
3.	VinMin	14.0	Minimum input voltage
4.	Vout	9.0	Output Voltage
5.	base_pn	TPS54561	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	30.0	Ambient temperature

Design Assistance

1. **TPS54561** Product Folder : http://www.ti.com/product/TPS54561 : contains the data sheet and other resources.

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