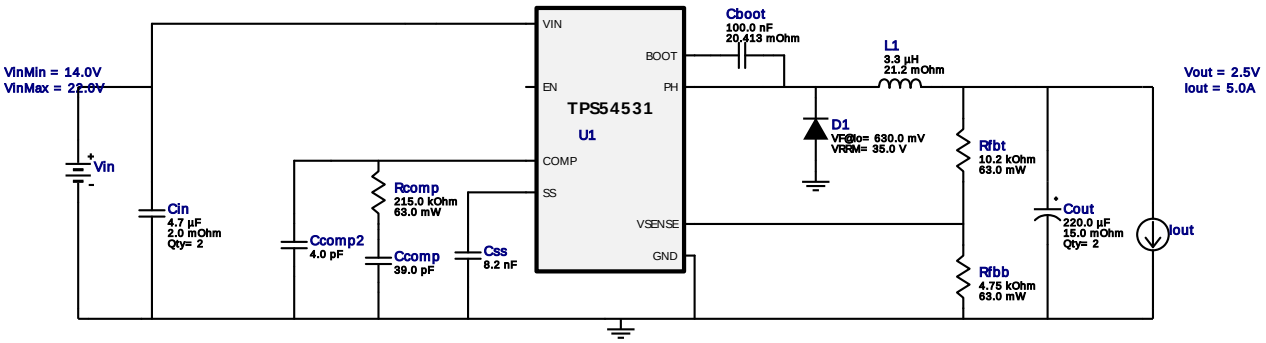
WEBENCH® Design Report

VinMin = 14.0V
VinMax = 22.0V
Vout = 2.5V
Iout = 5.0A

Device = TPS54531DDAR
Topology = Buck
Created = 6/9/15 5:48:23 PM
BOM Cost = $3.02
Footprint = 485.0 mm^2
BOM Count = 14
Total Pd = 4.7W

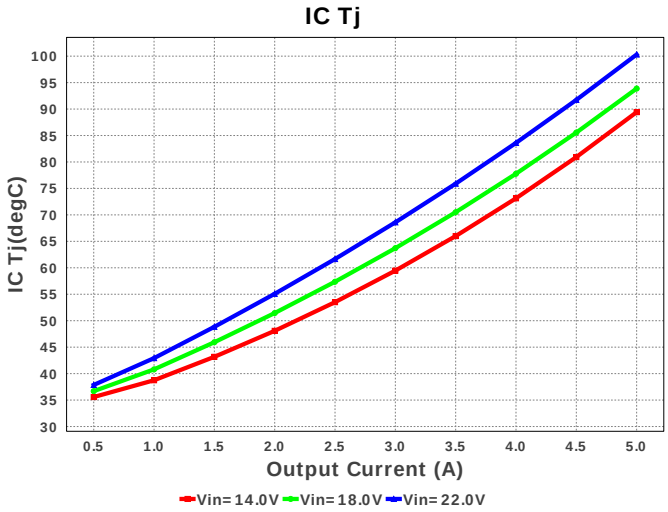
Design : 4387439/1 TPS54531DDAR
TPS54531DDAR 14.0V-22.0V to 2.50V @ 5.0A

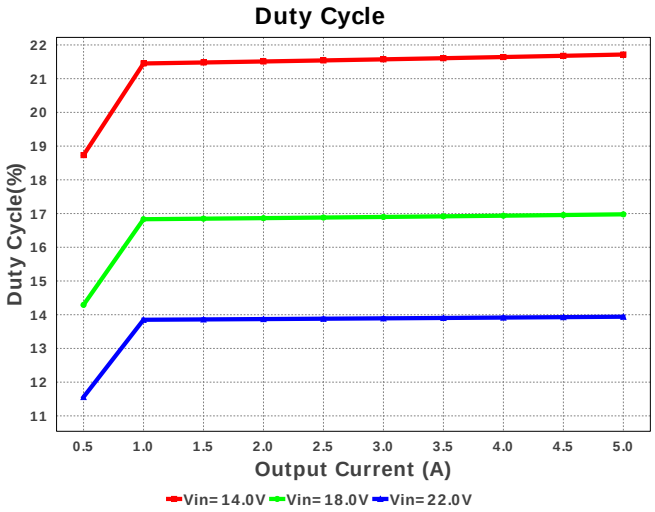


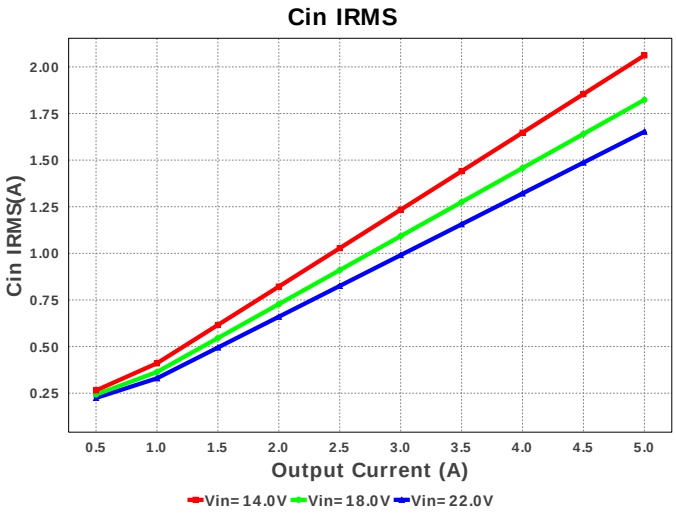
Electrical BOM

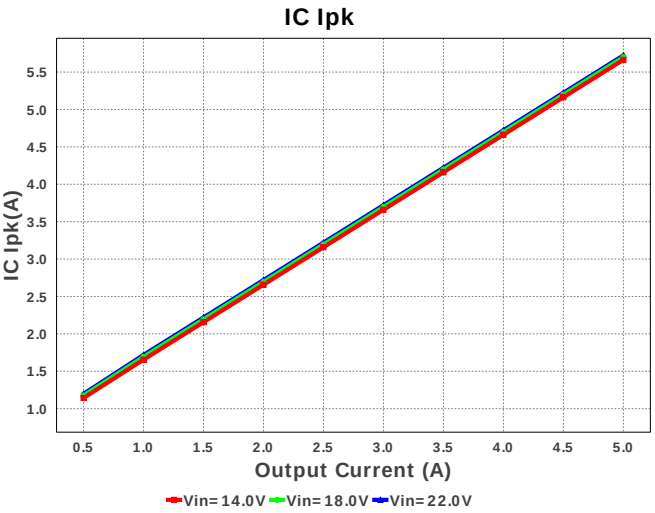
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot	TDK	C1005X5R1A104K Series= X5R	Cap= 100.0 nF ESR= 20.413 mOhm VDC= 10.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm^2
2.	Ccomp	Yageo America	CC0805JRNPO9BN390 Series= C0G/NP0	Cap= 39.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
3.	Ccomp2	Yageo America	CC0805CRNP09BN4R0 Series= C0G/NP0	Cap= 4.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
4.	Cin	MuRata	GRM32ER71H475KA88L Series= X7R	Cap= 4.7 uF ESR= 2.0 mOhm VDC= 50.0 V IRMS= 5.35 A	2	$0.29	1210 15 mm^2
5.	Cout	Panasonic	6SVPE220MW Series= 259	Cap= 220.0 uF ESR= 15.0 mOhm VDC= 6.3 V IRMS= 3.15 A	2	$0.14	CAPSMT_62_E61 53 mm^2
6.	Css	MuRata	GRM033R61A822KA01D Series= X5R	Cap= 8.2 nF VDC= 10.0 V IRMS= 0.0 A	1	$0.01	0201 2 mm^2
7.	D1	Vishay-Semiconductor	MBRB1635PBF	VF@Io= 630.0 mV VRRM= 35.0 V	1	$0.71	DDPAK 210 mm^2
8.	L1	Coilcraft	XAL5030-332MEB	L= 3.3 µH DCR= 21.2 mOhm	1	$0.63	XAL5030 54 mm^2
9.	Rcomp	Vishay-Dale	CRCW0402215KFKED Series= CRCW..e3	Res= 215.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
10.	Rfbb	Vishay-Dale	CRCW04024K75FKED Series= CRCW..e3	Res= 4.75 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2

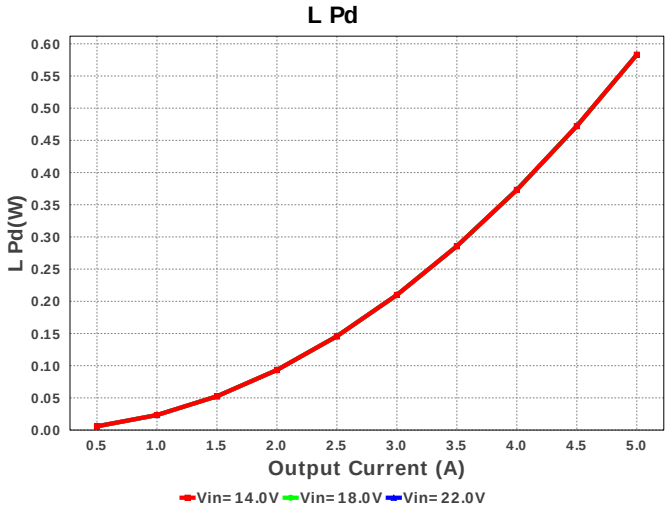
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
11.	Rfbt	Vishay-Dale	CRCW040210K2FKED Series= CRCW..e3	Res= 10.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
12.	U1	Texas Instruments	TPS54531DDAR	Switcher	1	$0.75	DDA0008E 57 mm^2

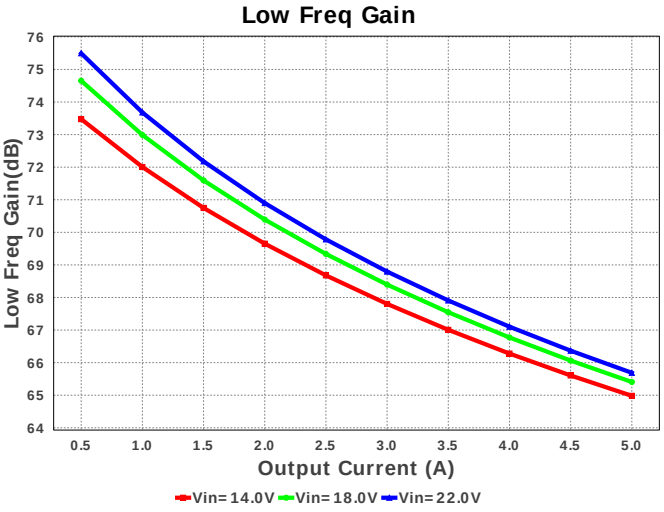


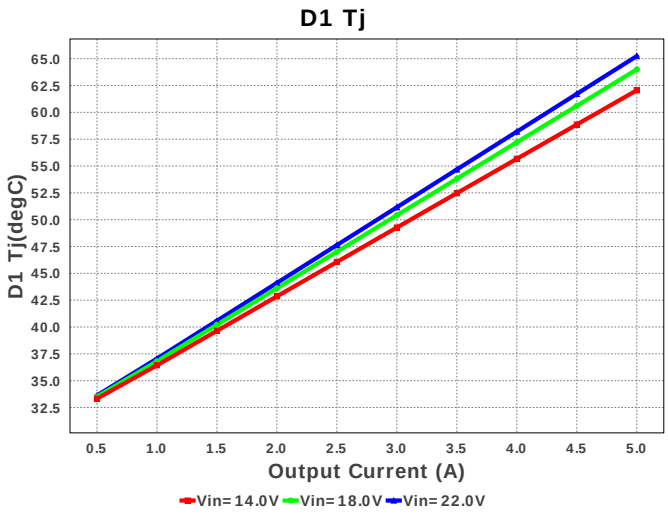


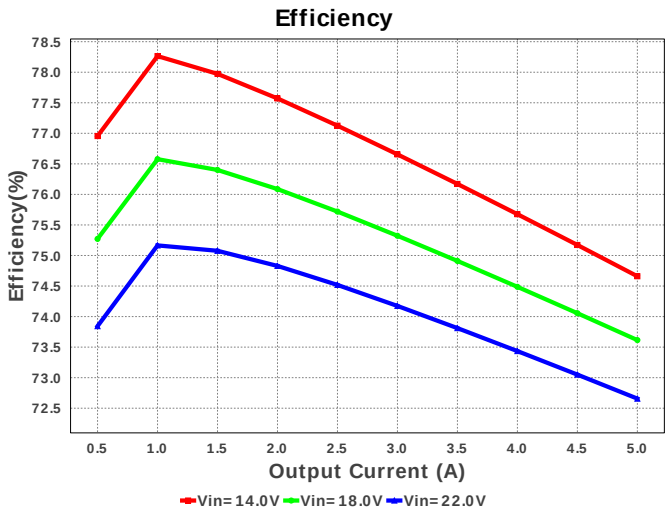


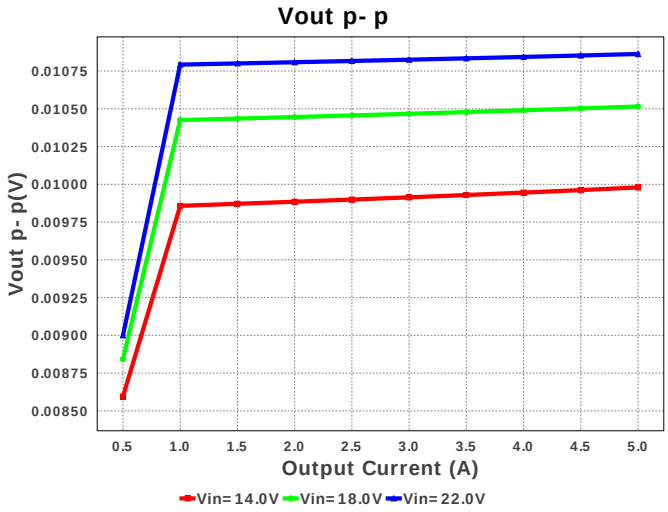


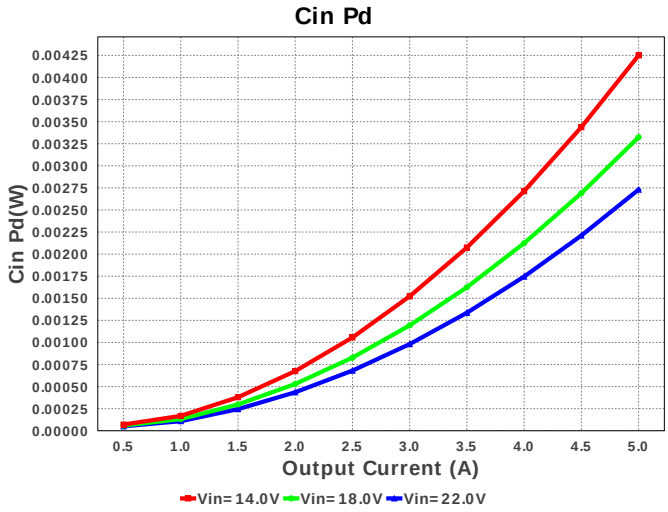


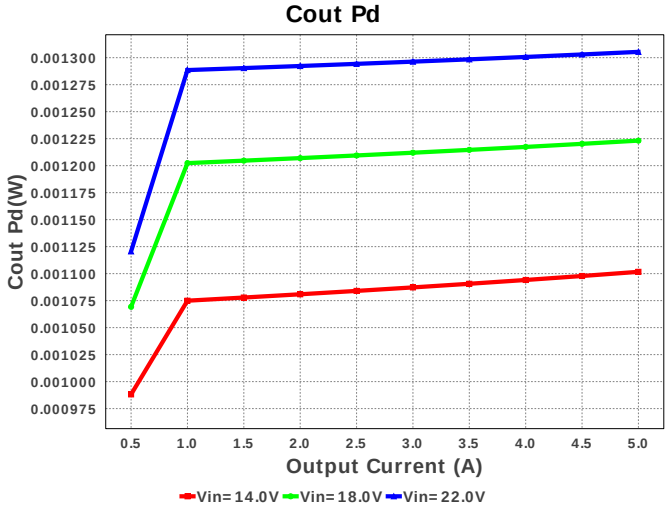


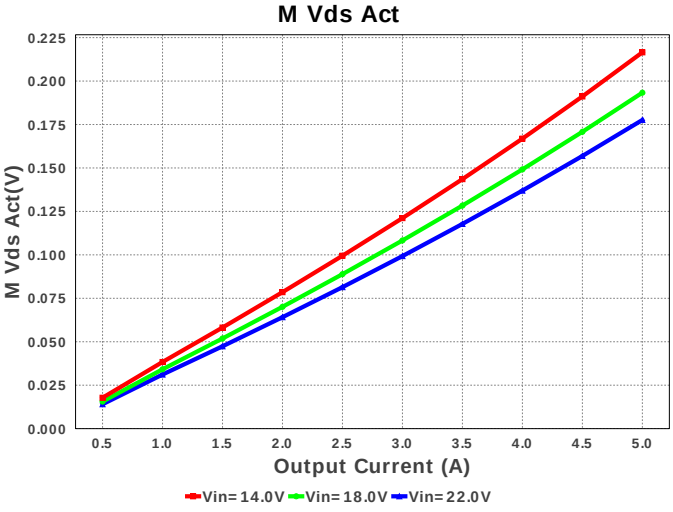


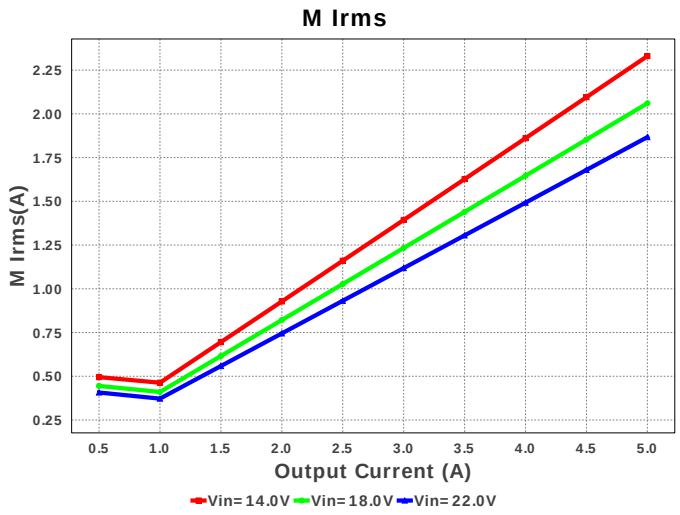


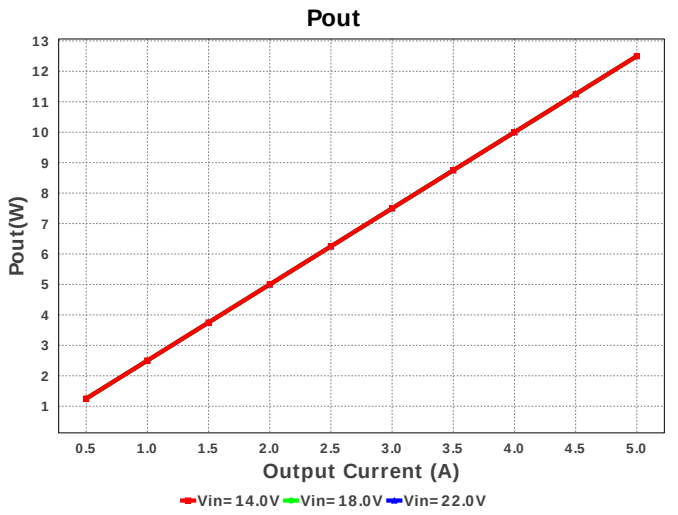


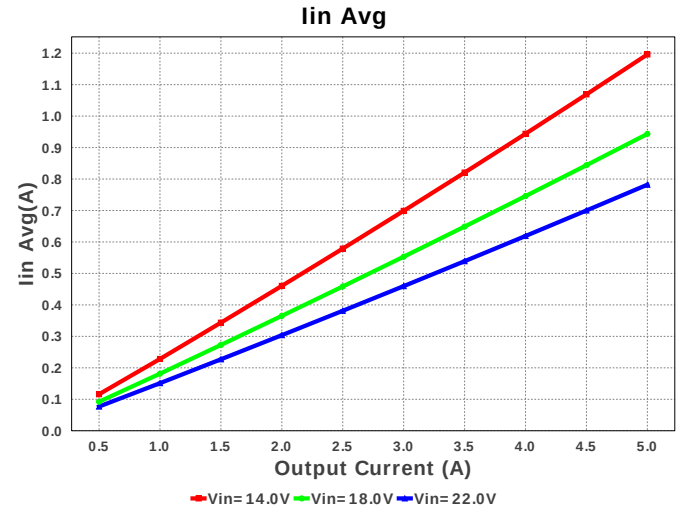


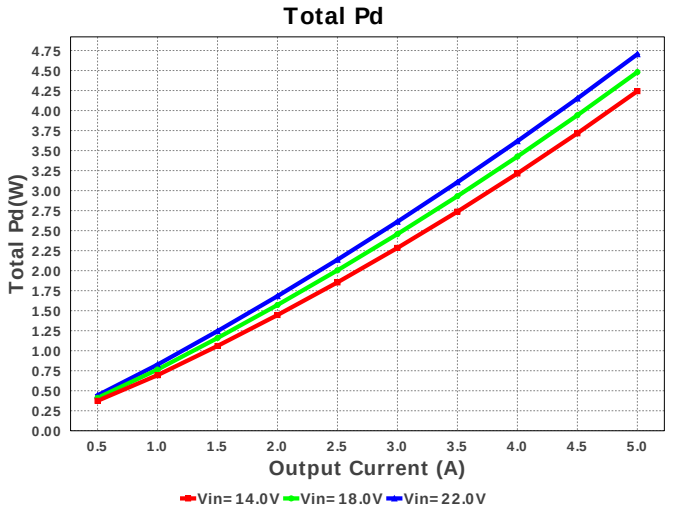


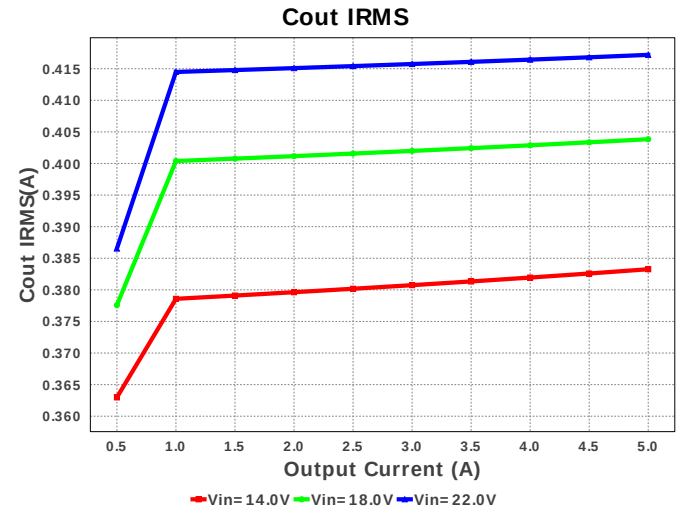


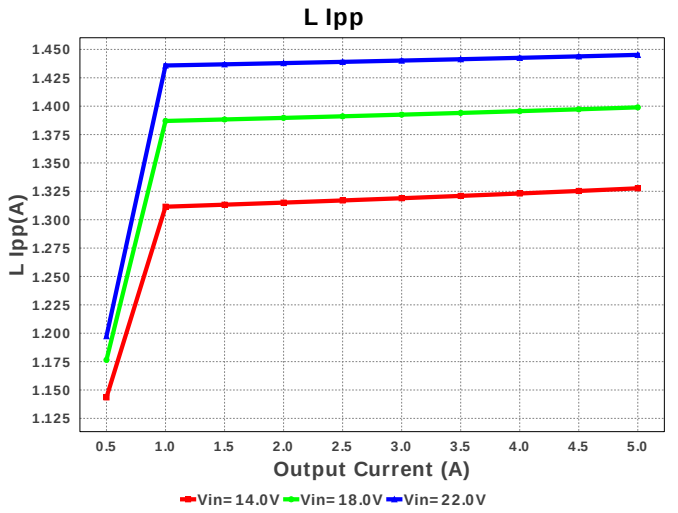


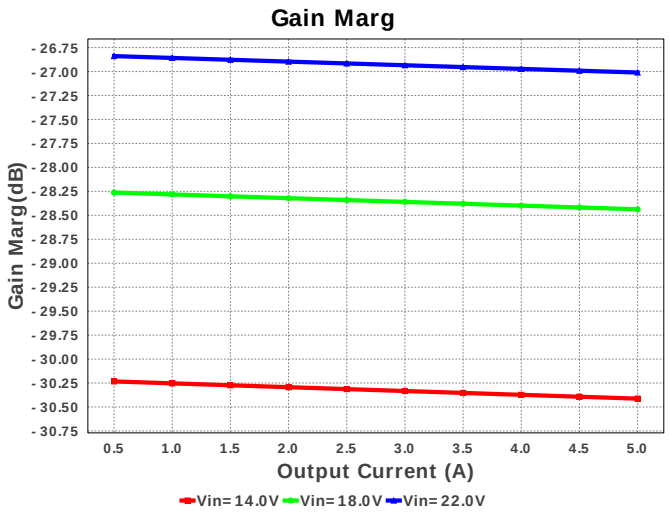


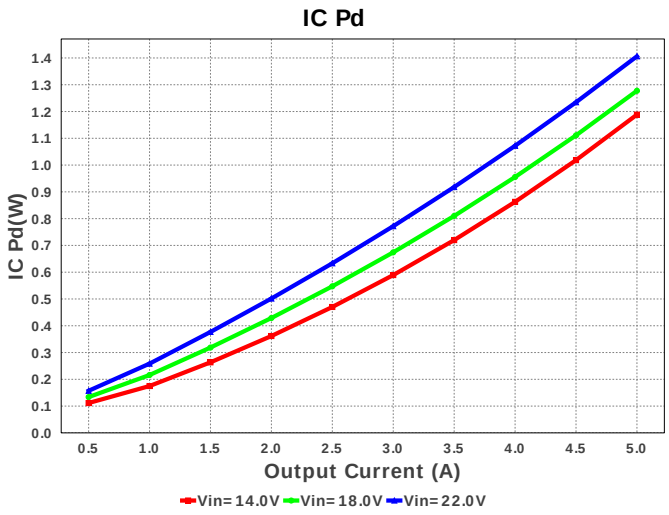


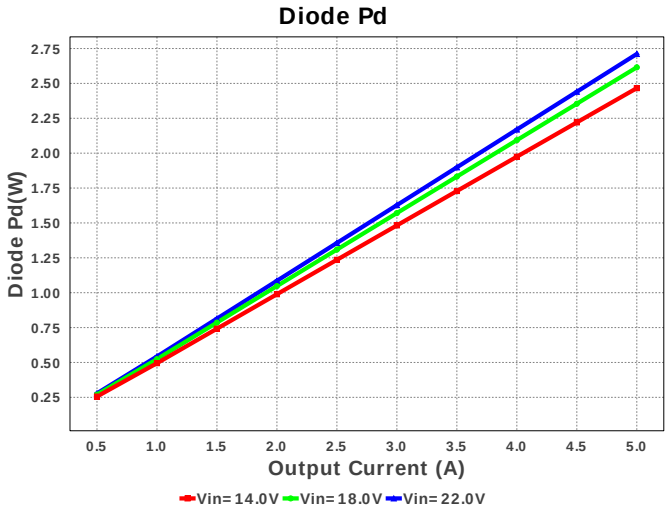


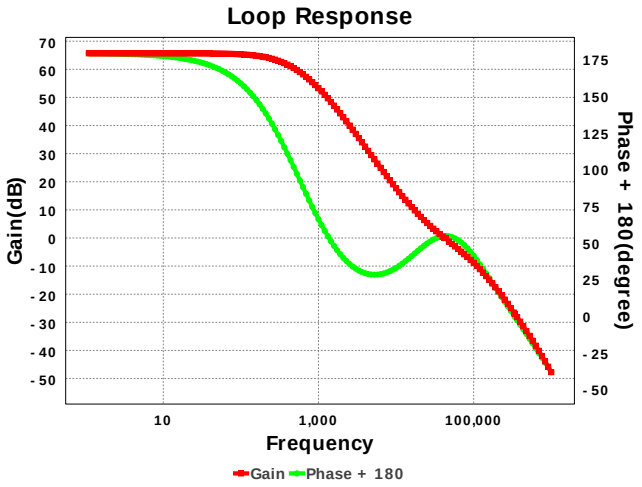












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	1.652 A	Current	Input capacitor RMS ripple current
2.	Cout IRMS	417.193 mA	Current	Output capacitor RMS ripple current
3.	IC Ipk	5.723 A	Current	Peak switch current in IC
4.	Iin Avg	782.0 mA	Current	Average input current
5.	L Ipp	1.445 A	Current	Peak-to-peak inductor ripple current
6.	M Irms	1.867 A	Current	MOSFET RMS current
7.	BOM Count	14	General	Total Design BOM count
8.	FootPrint	485.0 mm^2	General	Total Foot Print Area of BOM components
9.	Frequency	570.0 kHz	General	Switching frequency
10.	M Vds Act	177.607 mV	General	Voltage drop across the MosFET
11.	Pout	12.5 W	General	Total output power
12.	Total BOM	$3.02	General	Total BOM Cost
13.	D1 Tj	65.241 degC	Op_Point	D1 junction temperature
14.	Vout OP	2.5 V	Op_Point	Operational Output Voltage
15.	Cross Freq	42.058 kHz	Op_point	Bode plot crossover frequency
16.	Duty Cycle	13.941 %	Op_point	Duty cycle
17.	Efficiency	72.657 %	Op_point	Steady state efficiency
18.	Gain Marg	-27.01 dB	Op_point	Bode Plot Gain Margin
19.	IC Tj	100.308 degC	Op_point	IC junction temperature
20.	ICThetaJA	50.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
21.	IOUT_OP	5.0 A	Op_point	Iout operating point
22.	Phase Marg	55.128 deg	Op_point	Bode Plot Phase Margin
23.	VIN_OP	22.0 V	Op_point	Vin operating point
24.	Vout p-p	10.863 mV	Op_point	Peak-to-peak output ripple voltage
25.	Cin Pd	2.73 mW	Power	Input capacitor power dissipation
26.	Cout Pd	1.305 mW	Power	Output capacitor power dissipation
27.	Diode Pd	2.711 W	Power	Diode power dissipation
28.	IC Pd	1.406 W	Power	IC power dissipation
29.	L Pd	583.0 mW	Power	Inductor power dissipation
30.	Total Pd	4.704 W	Power	Total Power Dissipation
31.	Low Freq Gain	65.688 dB	Unknown	Gain at 10Hz

Design Inputs

#	Name	Value	Description
1.	Iout	5.0	Maximum Output Current
2.	Iout1	5.0	Output Current #1
3.	VinMax	22.0	Maximum input voltage
4.	VinMin	14.0	Minimum input voltage
5.	Vout	2.5	Output Voltage
6.	Vout1	2.5	Output Voltage #1
7.	base_pn	TPS54531	Texas Instruments Base Part Number
8.	source	DC	Input Source Type
9.	ta	30.0	Ambient temperature

Design Assistance

1. TPS54531 Product Folder : http://www.ti.com/product/TPS54531 : contains the data sheet and other resources.