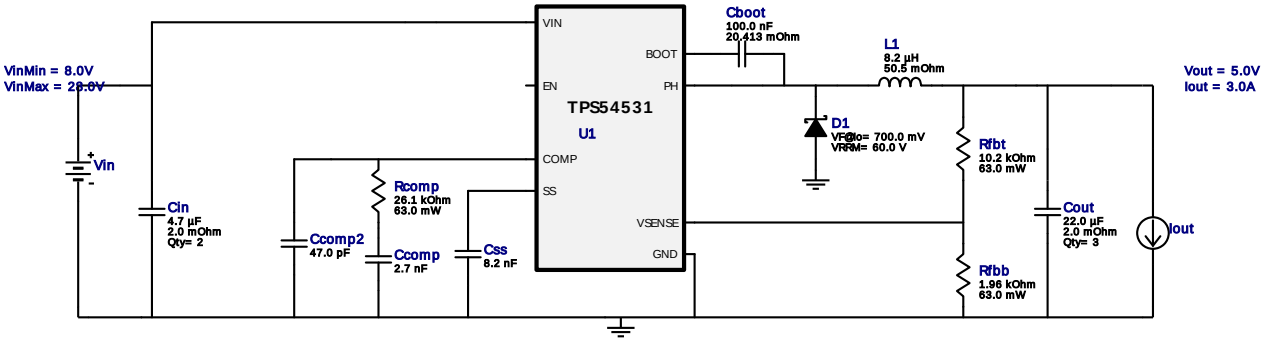
WEBENCH® Design Report

VinMin = 8.0V
VinMax = 28.0V
Vout = 5.0V
Iout = 3.0A

Device = TPS54531DDAR
Topology = Buck
Created = 3/27/15 4:02:59 PM
BOM Cost = $2.96
Footprint = 324.0 mm²
BOM Count = 15
Total Pd = 3.19W

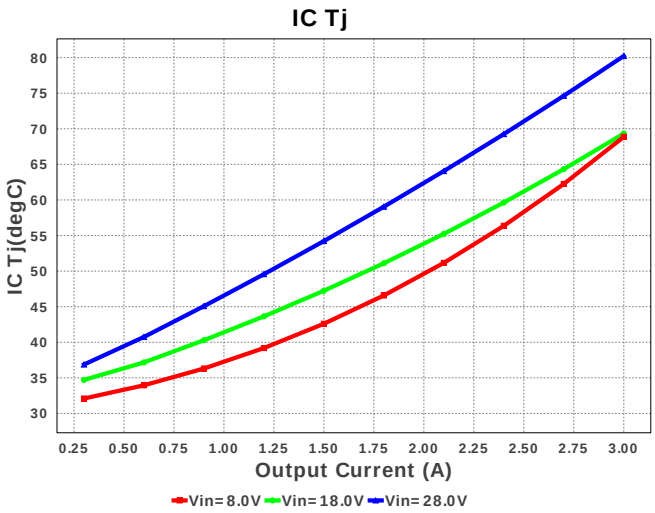
Design : 1231947/67 TPS54531DDAR
TPS54531DDAR 8.0V-28.0V to 5.00V @ 3.0A

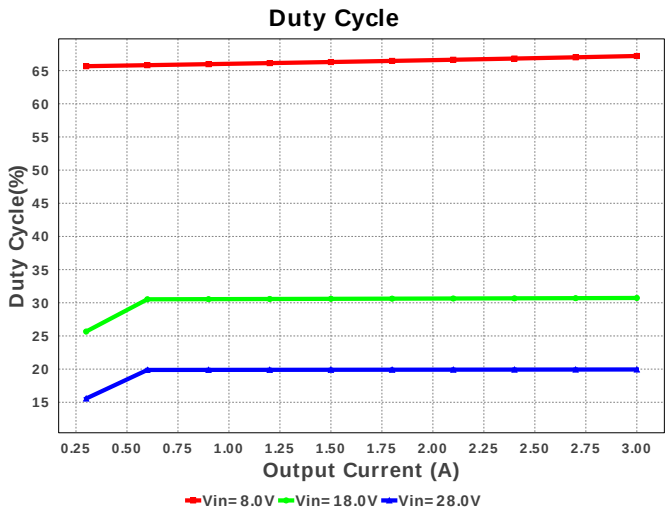


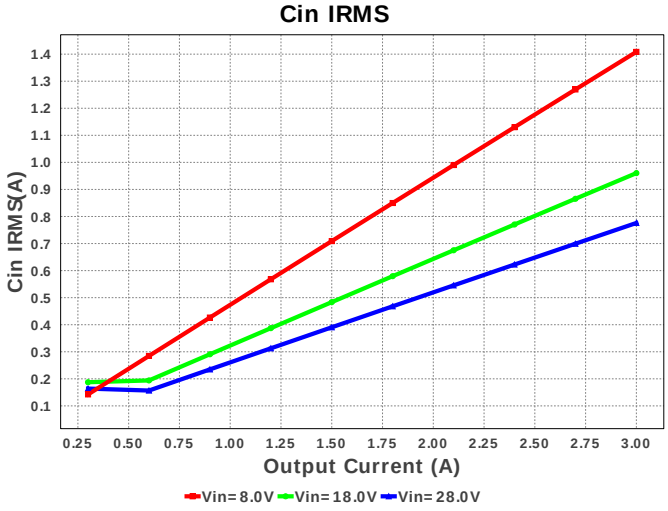
Electrical BOM

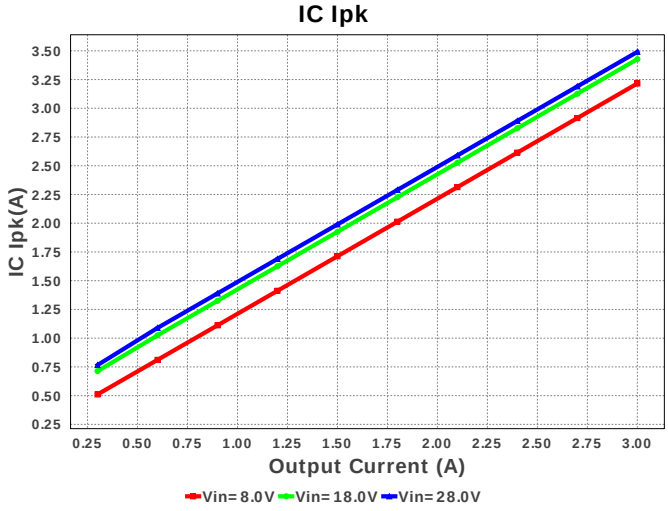
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot	TDK	C1005X5R1A104K Series= X5R	Cap= 100.0 nF ESR= 20.413 mOhm VDC= 10.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
2.	Ccomp	Yageo America	CC0805KRX7R9BB272 Series= X7R	Cap= 2.7 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
3.	Ccomp2	Kemet	C0805C470K5GACTU Series= C0G	Cap= 47.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
4.	Cin	MuRata	GRM32ER71H475KA88L Series= X7R	Cap= 4.7 uF ESR= 2.0 mOhm VDC= 50.0 V IRMS= 5.35 A	2	$0.31	1210 15 mm²
5.	Cout	MuRata	GRM32ER61E226KE15L Series= X5R	Cap= 22.0 uF ESR= 2.0 mOhm VDC= 25.0 V IRMS= 3.67 A	3	$0.28	1210 15 mm²
6.	Css	MuRata	GRM033R61A822KA01D Series= X5R	Cap= 8.2 nF VDC= 10.0 V IRMS= 0.0 A	1	$0.01	0201 2 mm²
7.	D1	Diodes Inc.	B560C-13-F	VF@Io= 700.0 mV VRRM= 60.0 V	1	$0.19	SMC 83 mm²
8.	L1	Bourns	SRP6540-8R2M	L= 8.2 µH DCR= 50.5 mOhm	1	$0.49	SRP6540 83 mm²
9.	Rcomp	Vishay-Dale	CRCW040226K1FKED Series= CRCW..e3	Res= 26.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
10.	Rfbb	Vishay-Dale	CRCW04021K96FKED Series= CRCW..e3	Res= 1.96 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
11.	Rfbt	Vishay-Dale	CRCW040210K2FKED Series= CRCW..e3	Res= 10.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²

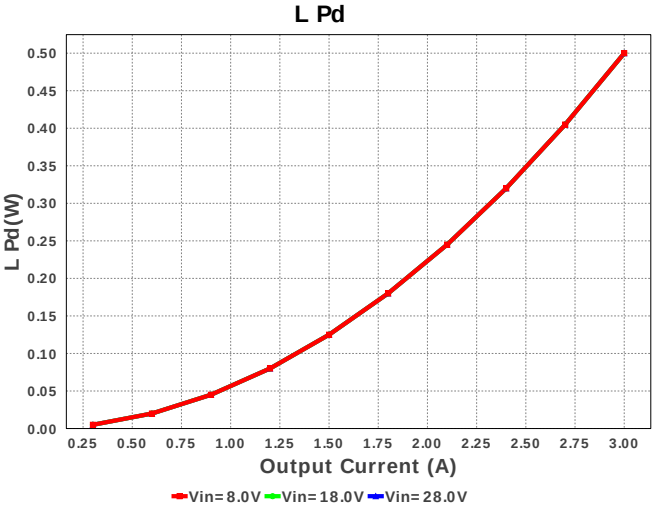
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
12.	U1	Texas Instruments	TPS54531DDAR	Switcher	1	$0.75	DDA0008E 57 mm^2

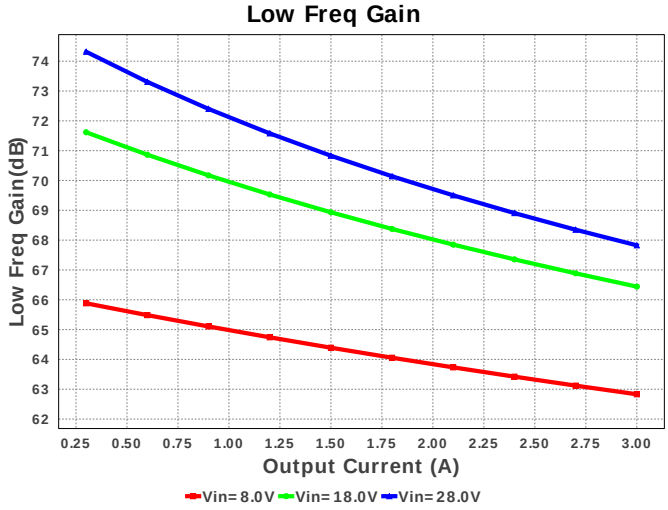


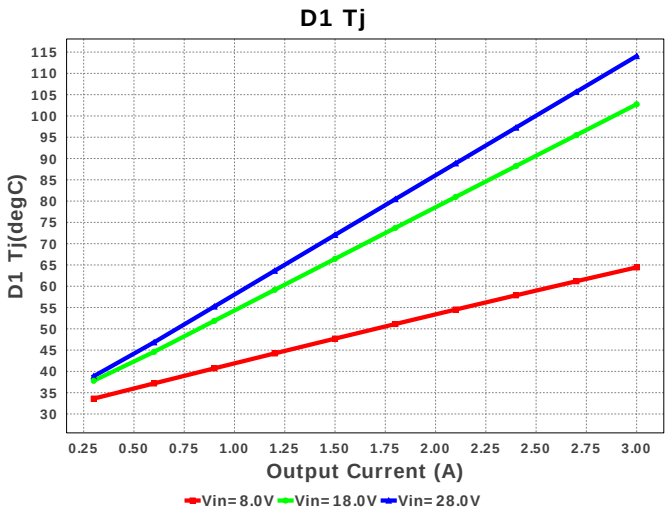


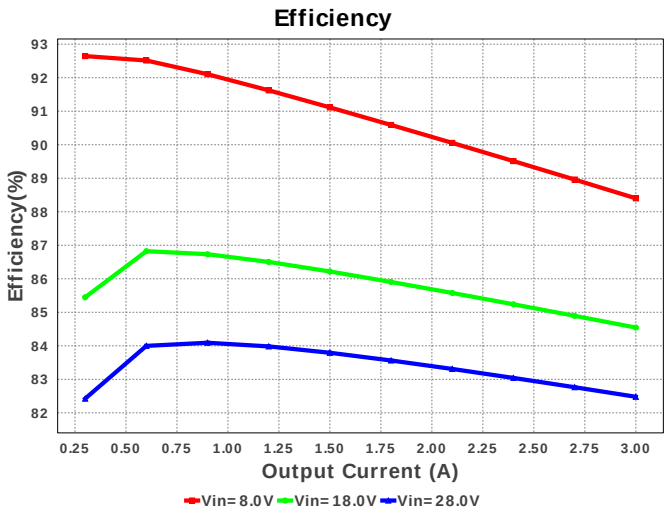


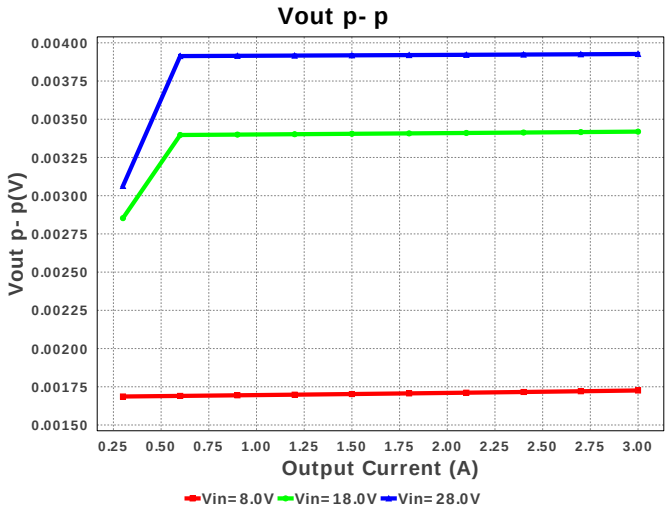


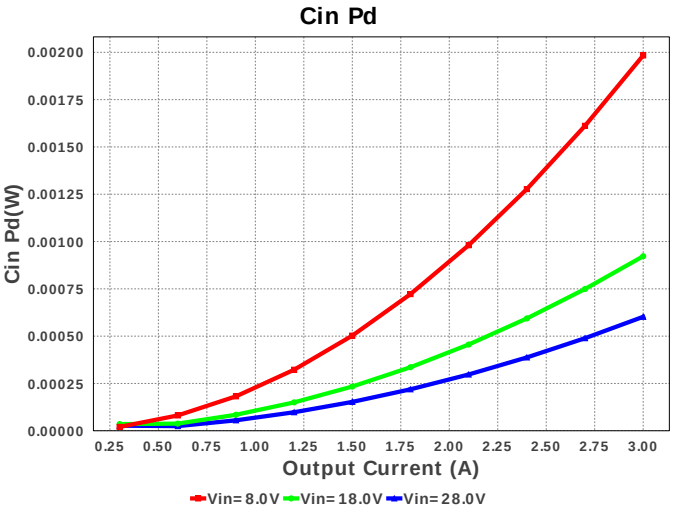


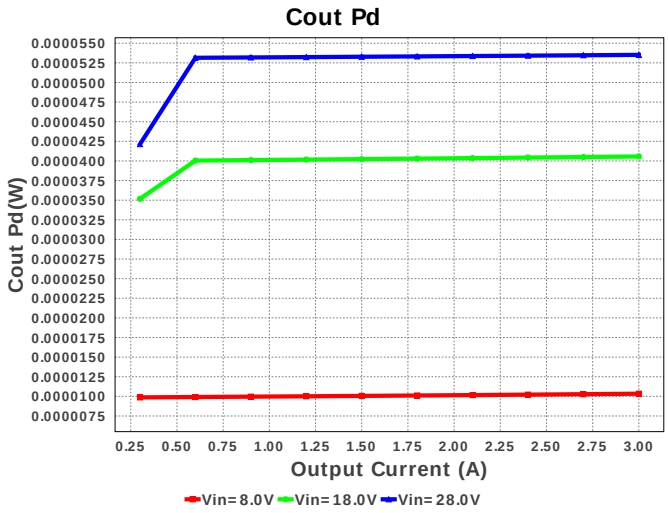


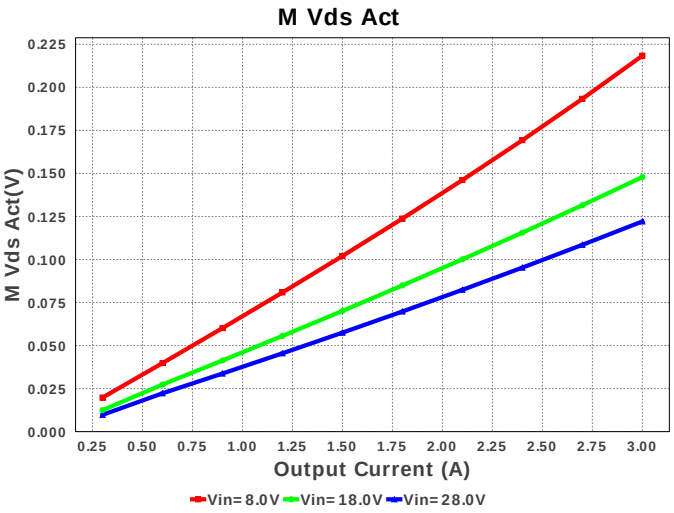


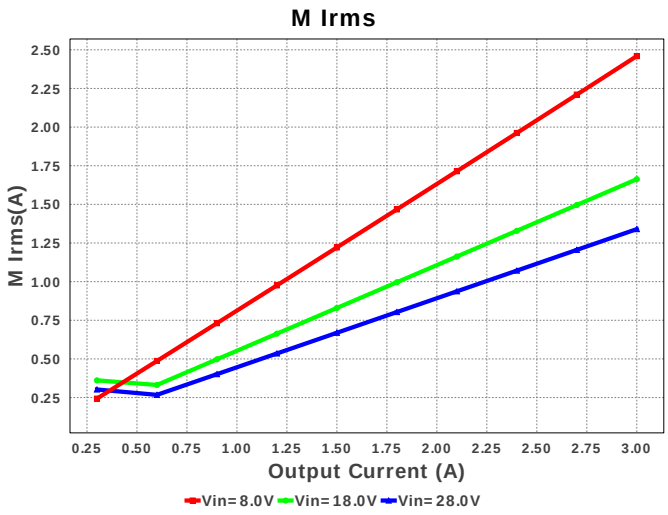


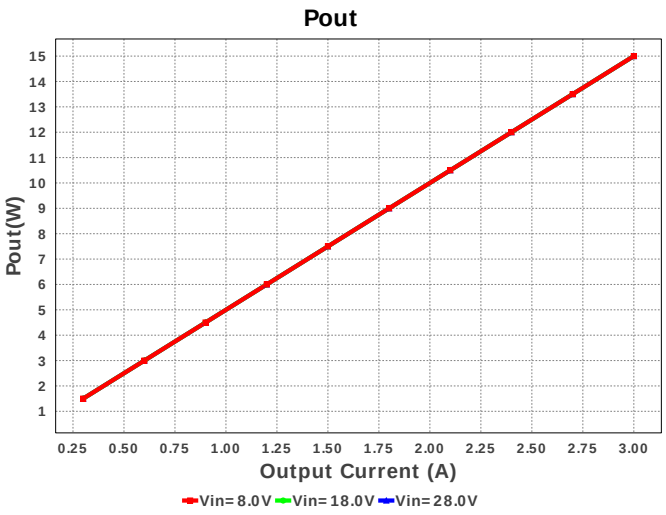


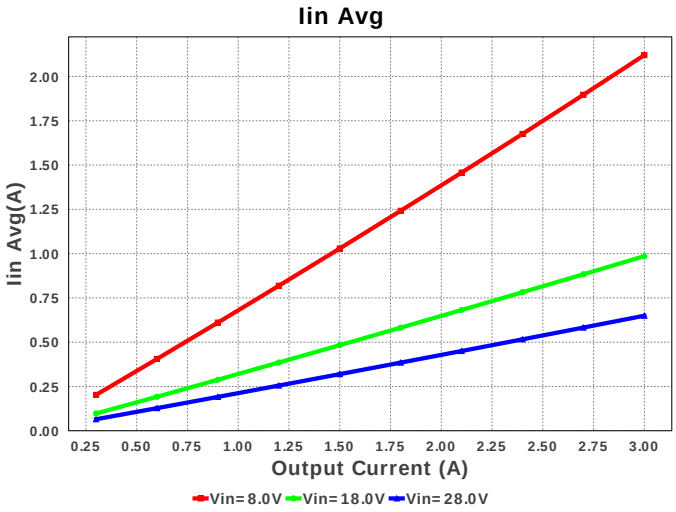


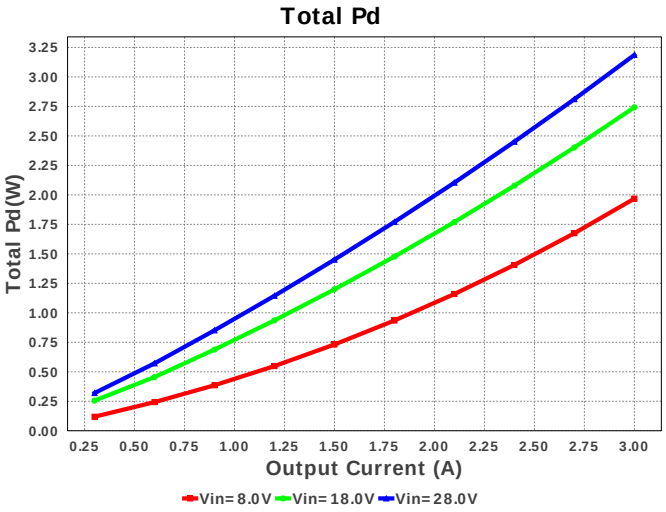


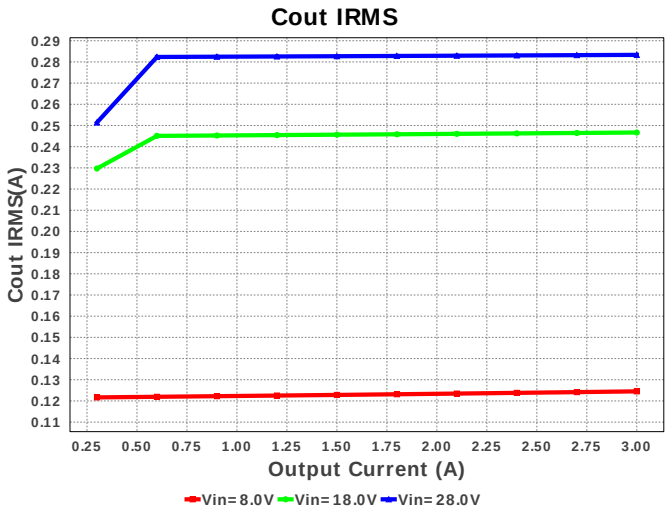


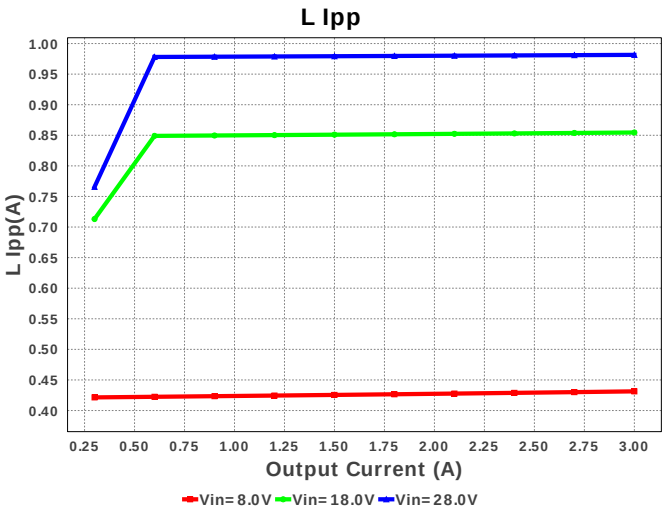


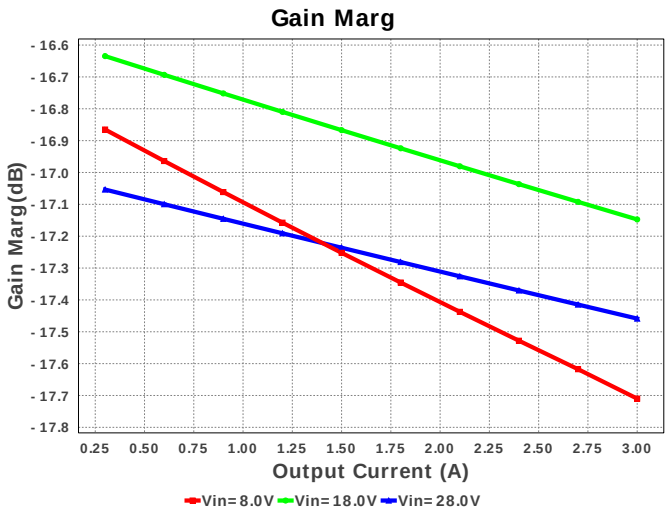


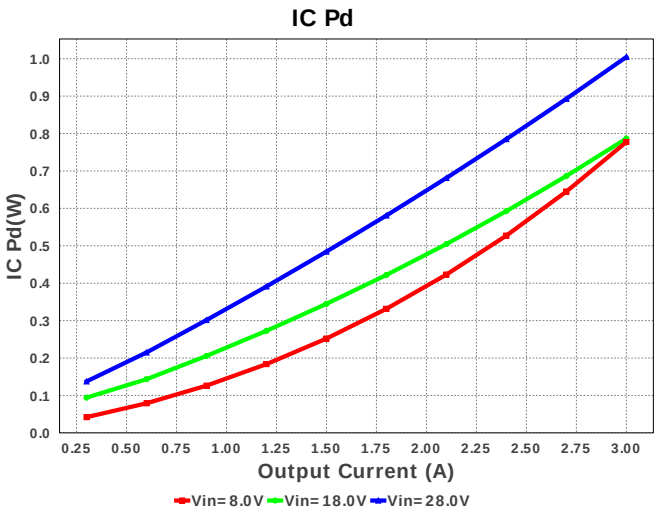


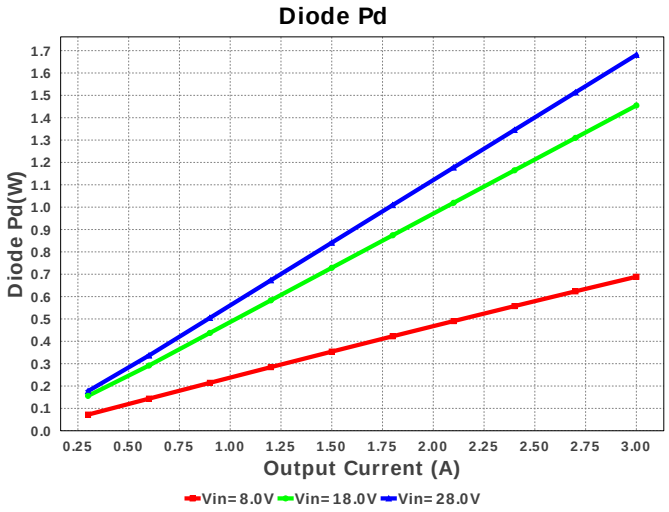


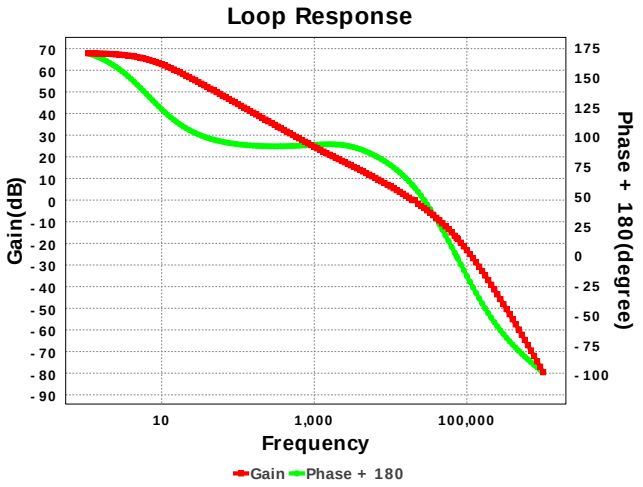












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	776.051 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	283.33 mA	Current	Output capacitor RMS ripple current
3.	IC Ipk	3.491 A	Current	Peak switch current in IC
4.	Iin Avg	649.52 mA	Current	Average input current
5.	L Ipp	981.49 mA	Current	Peak-to-peak inductor ripple current
6.	M1 Irms	1.34 A	Current	Q Iavg
7.	BOM Count	15	General	Total Design BOM count
8.	FootPrint	324.0 mm^2	General	Total Foot Print Area of BOM components
9.	Frequency	570.0 kHz	General	Switching frequency
10.	M Vds Act	122.113 mV	General	Voltage drop across the MosFET
11.	Pout	15.0 W	General	Total output power
12.	Total BOM	$2.96	General	Total BOM Cost
13.	D1 Tj	114.057 degC	Op_Point	D1 junction temperature
14.	Vout OP	5.0 V	Op_Point	Operational Output Voltage
15.	Cross Freq	19.489 kHz	Op_point	Bode plot crossover frequency
16.	Duty Cycle	19.945 %	Op_point	Duty cycle
17.	Efficiency	82.479 %	Op_point	Steady state efficiency
18.	Gain Marg	-18.104 dB	Op_point	Bode Plot Gain Margin
19.	IC Tj	80.229 degC	Op_point	IC junction temperature
20.	ICThetaJA	50.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
21.	IOUT_OP	3.0 A	Op_point	Iout operating point
22.	Phase Marg	60.185 deg	Op_point	Bode Plot Phase Margin
23.	VIN_OP	28.0 V	Op_point	Vin operating point
24.	Vout p-p	4.341 mV	Op_point	Peak-to-peak output ripple voltage
25.	Cin Pd	602.255 µW	Power	Input capacitor power dissipation
26.	Cout Pd	160.552 µW	Power	Output capacitor power dissipation
27.	Diode Pd	1.681 W	Power	Diode power dissipation
28.	IC Pd	1.005 W	Power	IC power dissipation
29.	L Pd	499.95 mW	Power	Inductor power dissipation
30.	Total Pd	3.186 W	Power	Total Power Dissipation
31.	Low Freq Gain	67.825 dB	Unknown	Gain at 10Hz

Design Inputs

#	Name	Value	Description
1.	Iout	3.0	Maximum Output Current
2.	Iout1	3.0	Output Current #1
3.	VinMax	28.0	Maximum input voltage
4.	VinMin	8.0	Minimum input voltage
5.	Vout	5.0	Output Voltage
6.	Vout1	5.0	Output Voltage #1
7.	base_pn	TPS54531	Base Product 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.