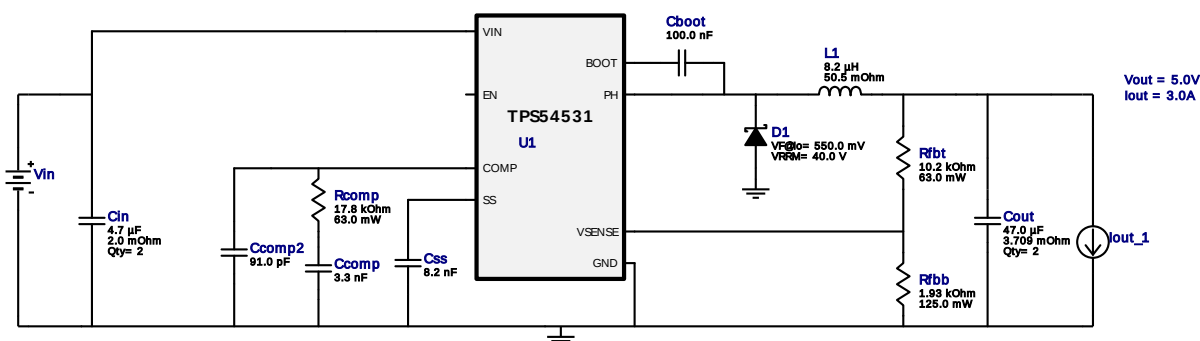


WEBENCH® Design Report

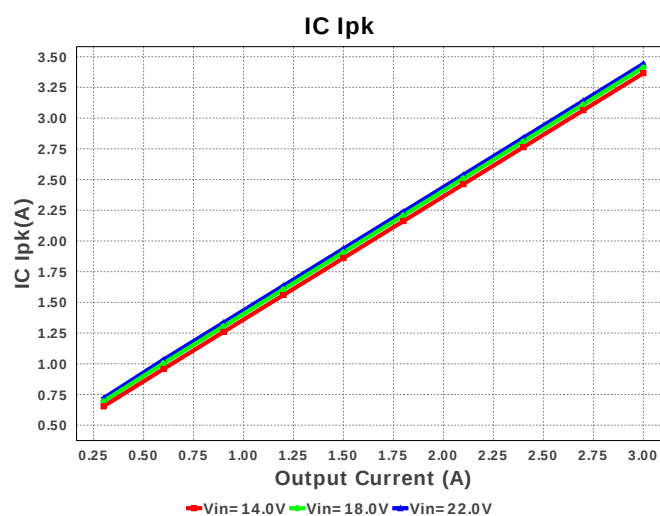
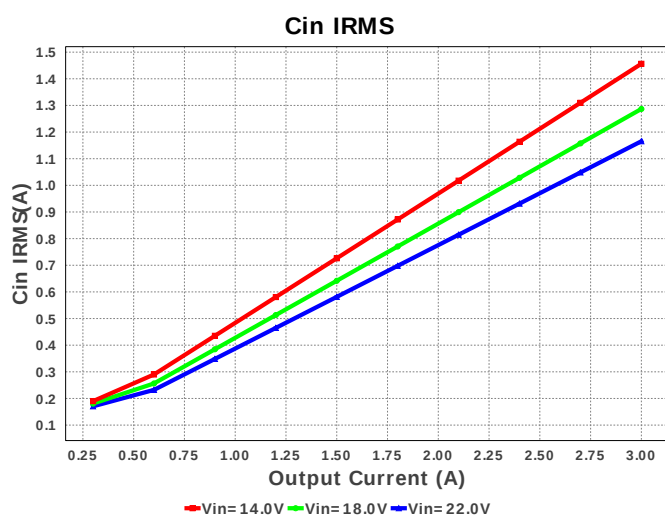
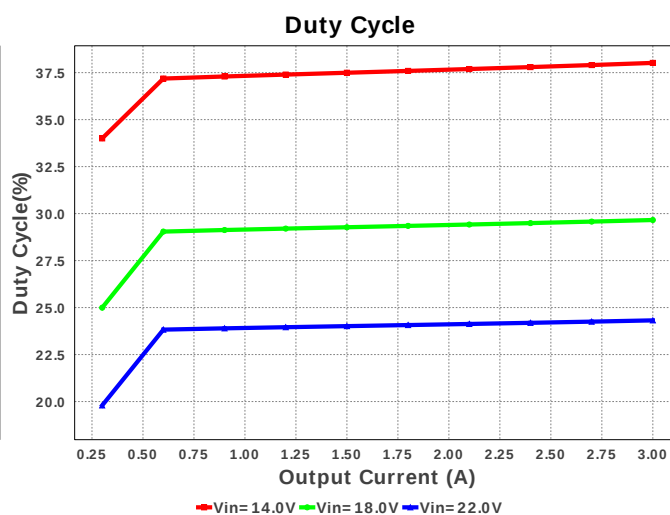
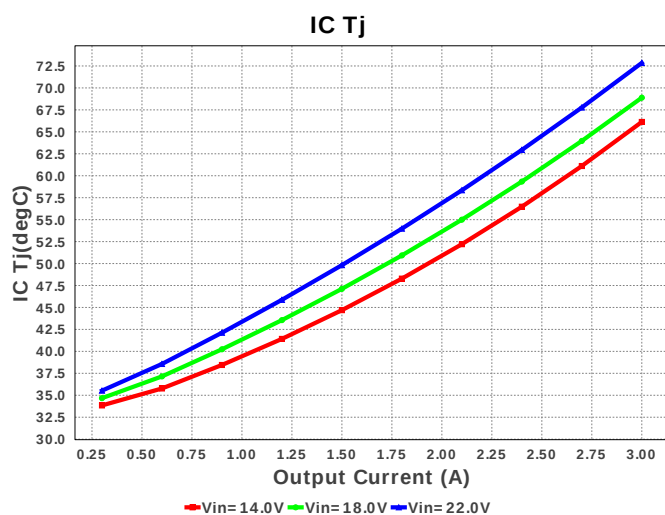
Design : 4632468/34 TPS54531DDAR
TPS54531DDAR 14.0V-22.0V to 5.00V @ 3.0A



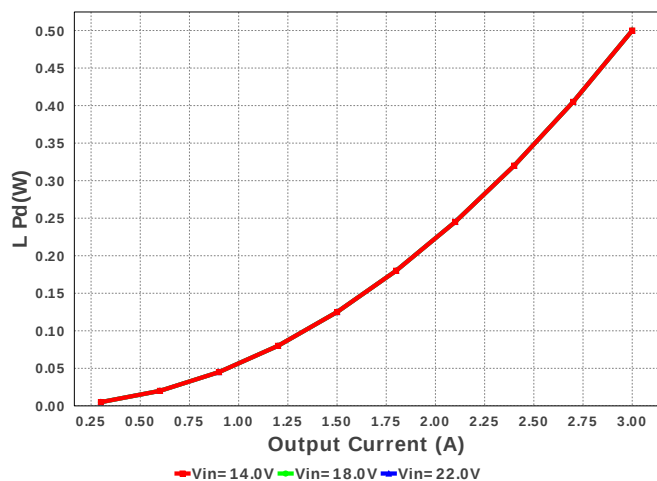
Electrical BOM

#	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 mm ²
2.	Ccomp	MuRata	GRM216R71E332KA01D Series= X7R	Cap= 3.3 nF VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
3.	Ccomp2	Samsung Electro-Mechanics	CL21C910JBANNNC Series= C0G/NP0	Cap= 91.0 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	\$0.19	1210 15 mm ²
5.	Cout	MuRata	GRM31CR61A476KE15L Series= X5R	Cap= 47.0 uF ESR= 3.709 mOhm VDC= 10.0 V IRMS= 4.2862 A	2	\$0.15	1206_190 11 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	Diodes Inc.	B540C-13-F	Vf@Io= 550.0 mV VRRM= 40.0 V	1	\$0.17	SMC 83 mm ²
8.	L1	Bourns	SRP6540-8R2M	L= 8.2 uH DCR= 50.5 mOhm	1	\$0.49	SRP6540 83 mm ²
9.	Rcomp	Vishay-Dale	CRCW040217K8FKED Series= CRCW..e3	Res= 17.8 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
10.	Rfbb	Yageo America	RT0805BRD071K93L Series= RT0805	Res= 1.93 kOhm Power= 125.0 mW Tolerance= 0.1%	1	\$0.05	0805 7 mm ²
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

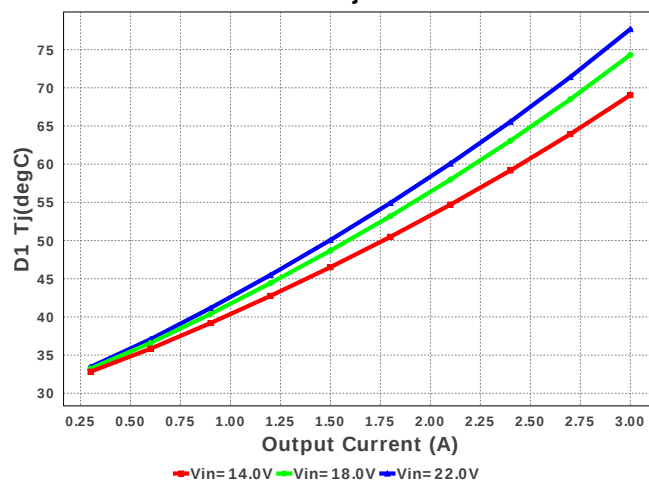
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
12.	U1	Texas Instruments	TPS54531DDAR	Switcher	1	\$0.75	 DDA0008E 57 mm ²



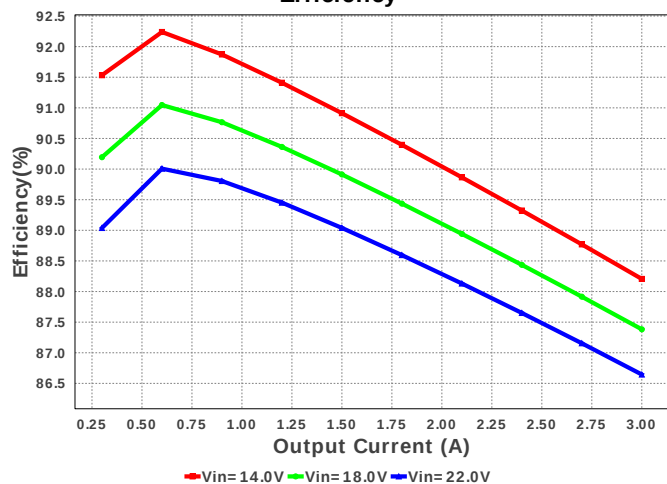
L Pd



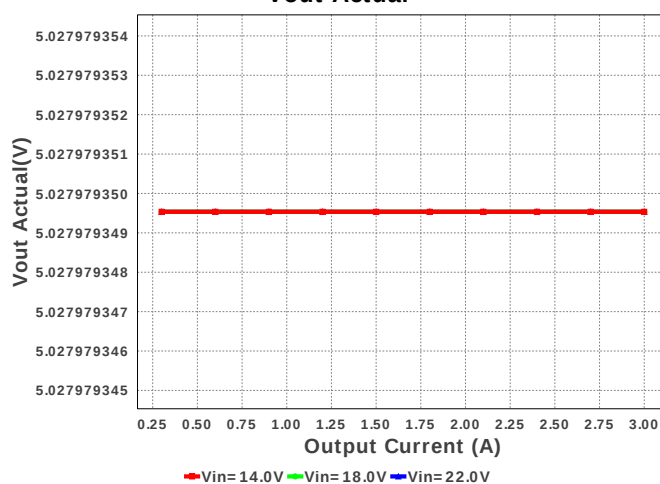
D1 Tj



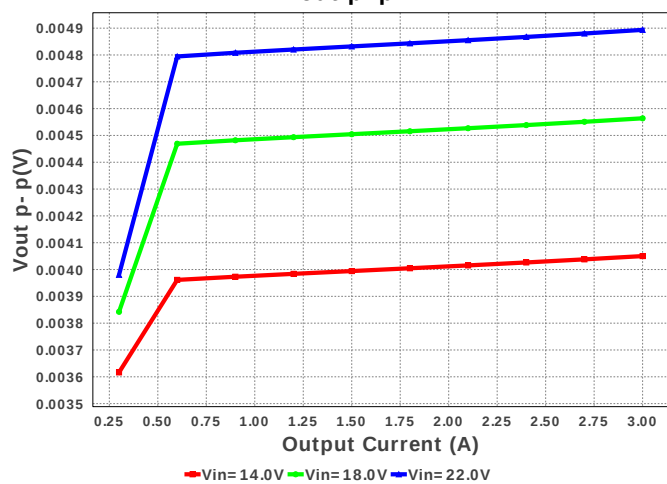
Efficiency



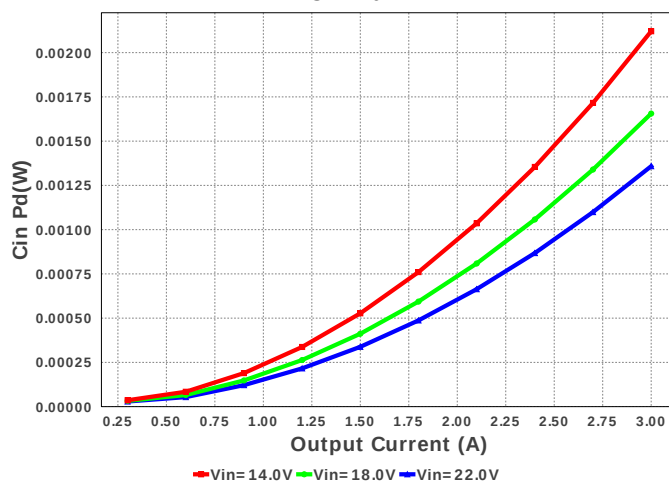
Vout Actual

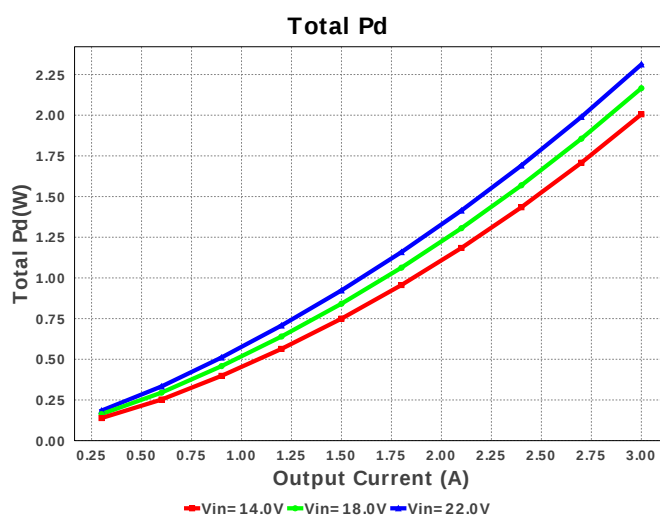
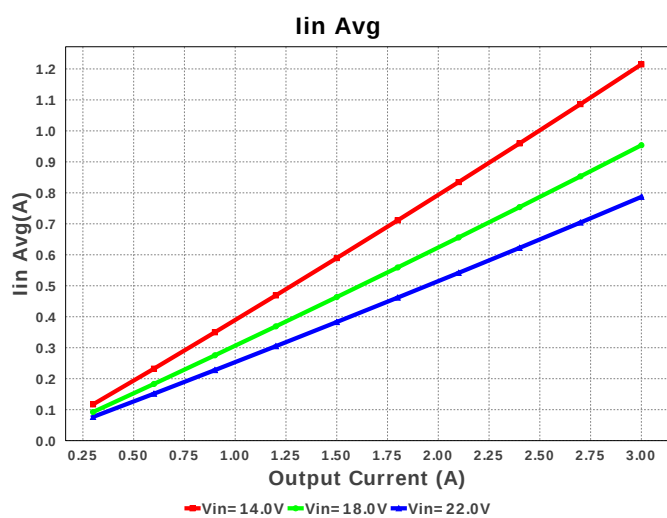
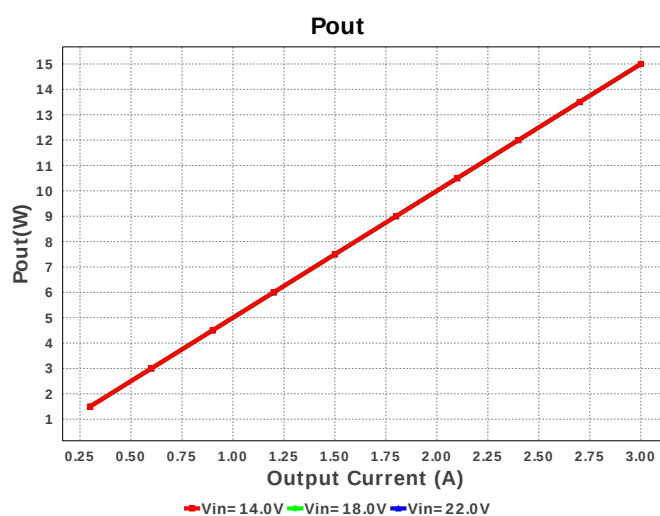
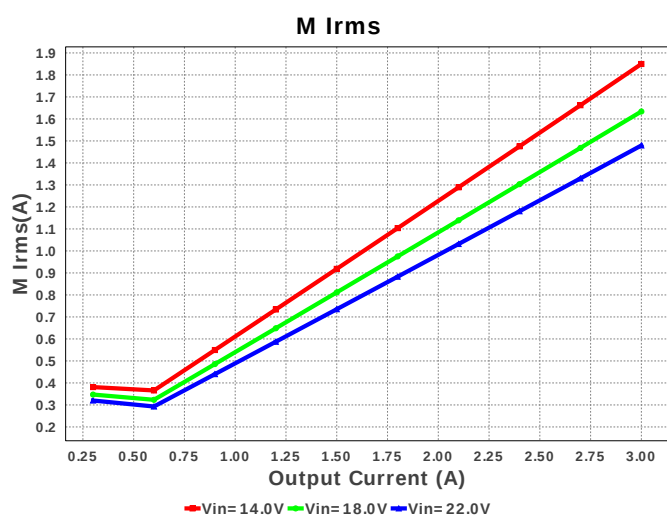
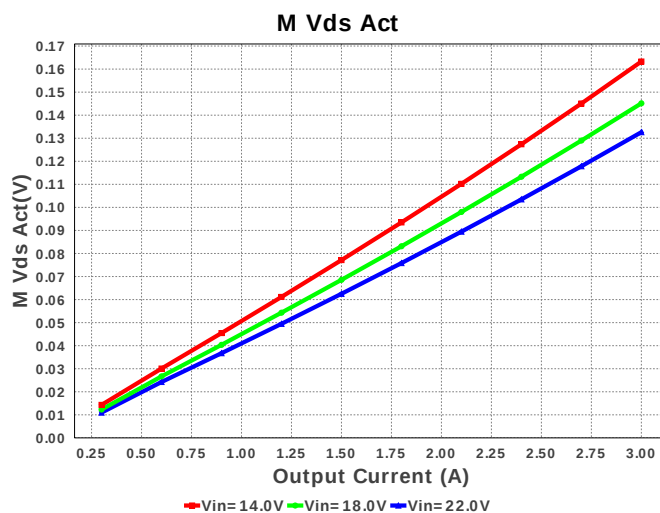
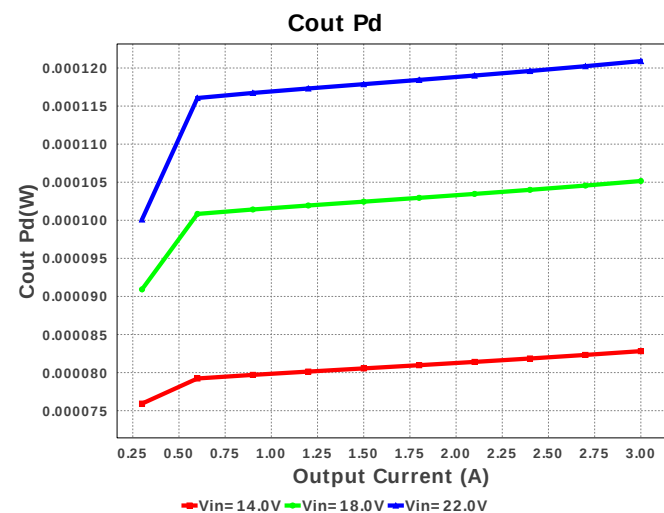


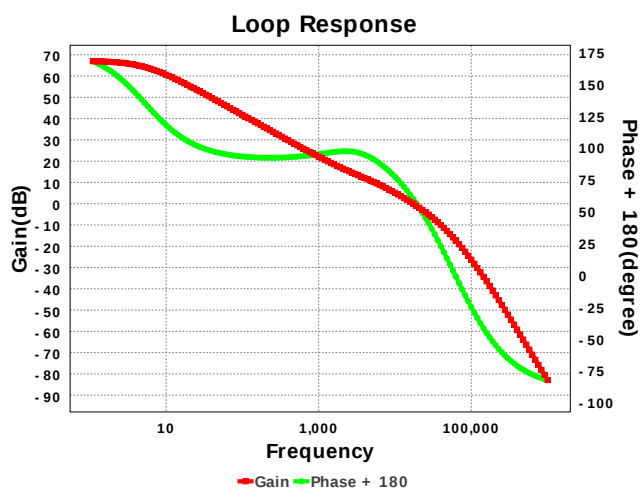
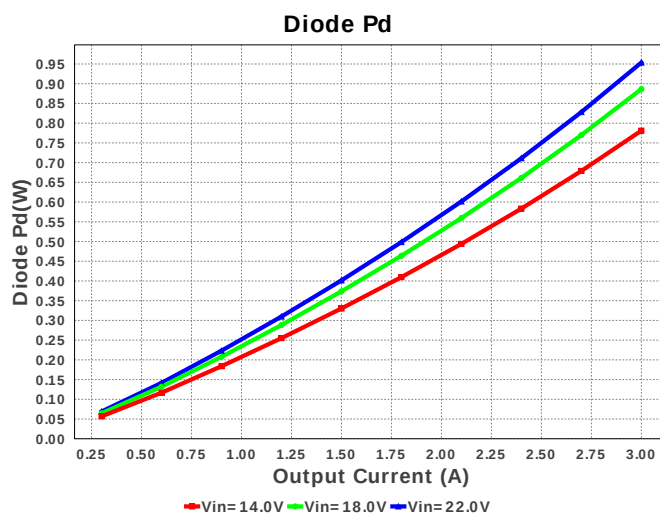
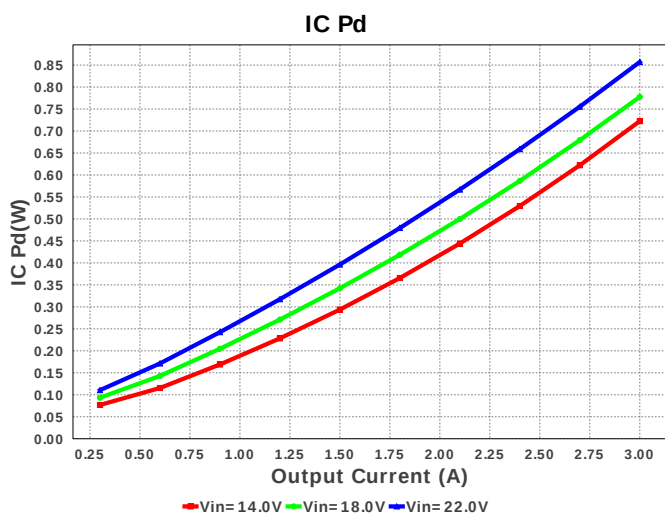
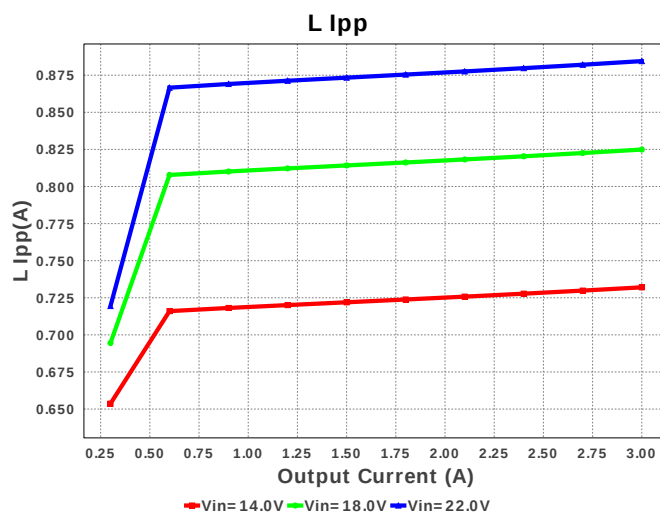
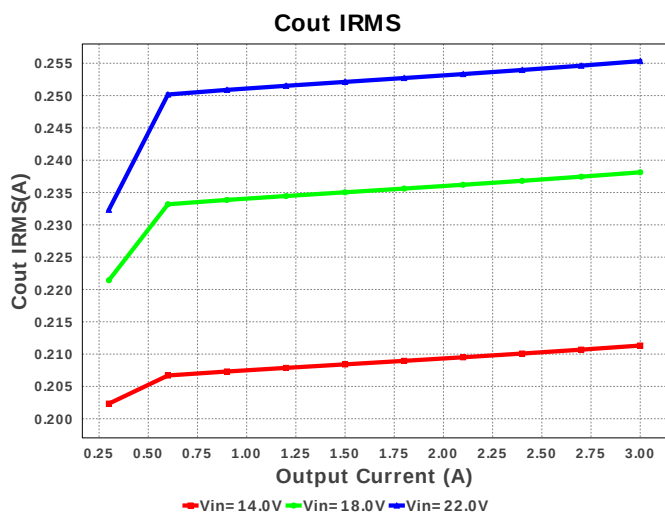
Vout p-p



Cin Pd







Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	1.166 A	Current	Input capacitor RMS ripple current
2.	Cout IRMS	255.336 mA	Current	Output capacitor RMS ripple current
3.	IC Ipk	3.442 A	Current	Peak switch current in IC
4.	Iin Avg	786.91 mA	Current	Average input current
5.	L Ipp	884.51 mA	Current	Peak-to-peak inductor ripple current
6.	M1 Irms	1.479 A	Current	Q lavg
7.	BOM Count	14	General	Total Design BOM count
8.	FootPrint	306.0 mm ²	General	Total Foot Print Area of BOM components
9.	Frequency	570.0 kHz	General	Switching frequency
10.	M Vds Act	132.623 mV	General	Voltage drop across the MosFET
11.	Mode	CCM	General	Conduction Mode

#	Name	Value	Category	Description
12.	Pout	15.0 W	General	Total output power
13.	Total BOM	\$2.2	General	Total BOM Cost
14.	D1 Tj	77.683 degC	Op_Point	D1 junction temperature
15.	Low Freq Gain	66.982 dB	Op_Point	Gain at 10Hz
16.	Vout Actual	5.028 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
17.	Vout OP	5.0 V	Op_Point	Operational Output Voltage
18.	Cross Freq	17.352 kHz	Op_point	Bode plot crossover frequency
19.	Duty Cycle	24.319 %	Op_point	Duty cycle
20.	Efficiency	86.645 %	Op_point	Steady state efficiency
21.	Gain Marg	-17.151 dB	Op_point	Bode Plot Gain Margin
22.	IC Tj	72.849 degC	Op_point	IC junction temperature
23.	ICThetaJA	50.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
24.	IOUT_OP	3.0 A	Op_point	Iout operating point
25.	Phase Marg	60.403 deg	Op_point	Bode Plot Phase Margin
26.	VIN_OP	22.0 V	Op_point	Vin operating point
27.	Vout p-p	4.894 mV	Op_point	Peak-to-peak output ripple voltage
28.	Cin Pd	1.358 mW	Power	Input capacitor power dissipation
29.	Cout Pd	120.907 μW	Power	Output capacitor power dissipation
30.	Diode Pd	953.667 mW	Power	Diode power dissipation
31.	IC Pd	856.975 mW	Power	IC power dissipation
32.	L Pd	499.95 mW	Power	Inductor power dissipation
33.	Total Pd	2.312 W	Power	Total Power Dissipation
34.	Vout Tolerance	4.458 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	3.0	Maximum Output Current
2.	VinMax	22.0	Maximum input voltage
3.	VinMin	14.0	Minimum input voltage
4.	Vout	5.0	Output Voltage
5.	base_pn	TPS54531	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	30.0	Ambient temperature

Design Assistance

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

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