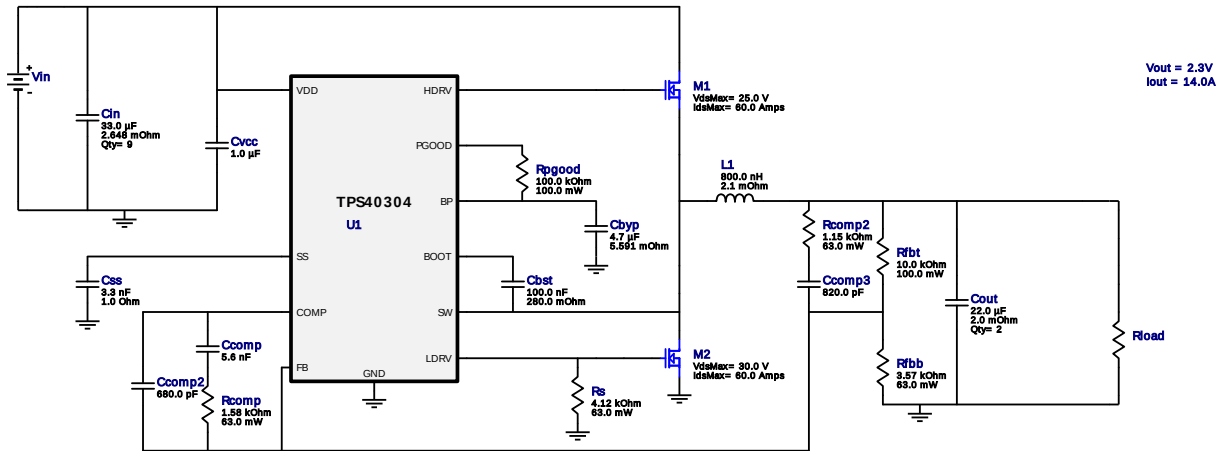
WEBENCH® Design Report

VinMin = 3.0V
VinMax = 14.0V
Vout = 2.3V
Iout = 14.0A

Device = TPS40304DRCR
Topology = Buck
Created = 2017-11-06 15:12:33.520
BOM Cost = $6.71
BOM Count = 28
Total Pd = 2.63W

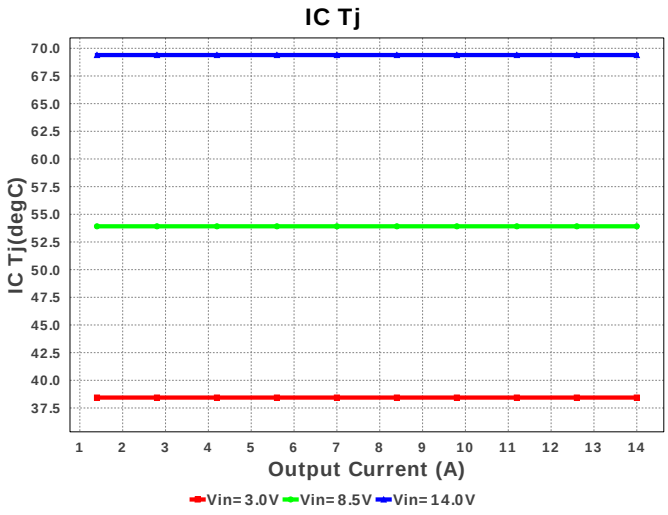
Design : 1090318/129 TPS40304DRCR
TPS40304DRCR 3.0V-14.0V to 2.30V @ 14.0A

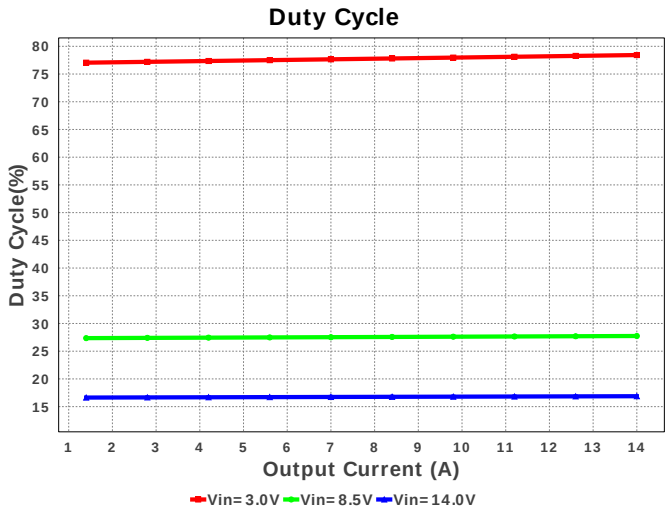


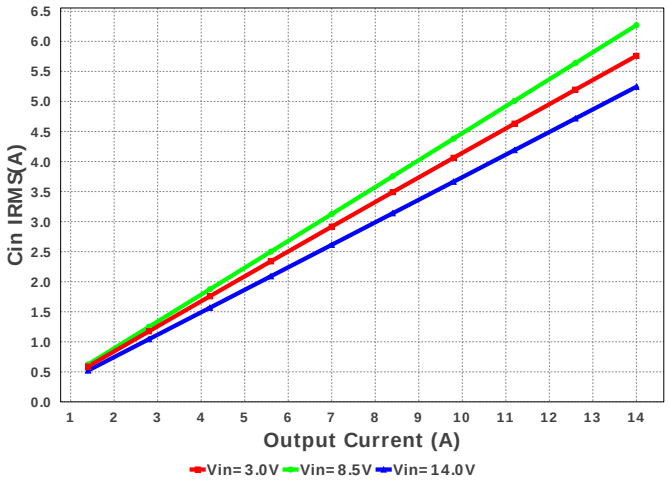
Electrical BOM

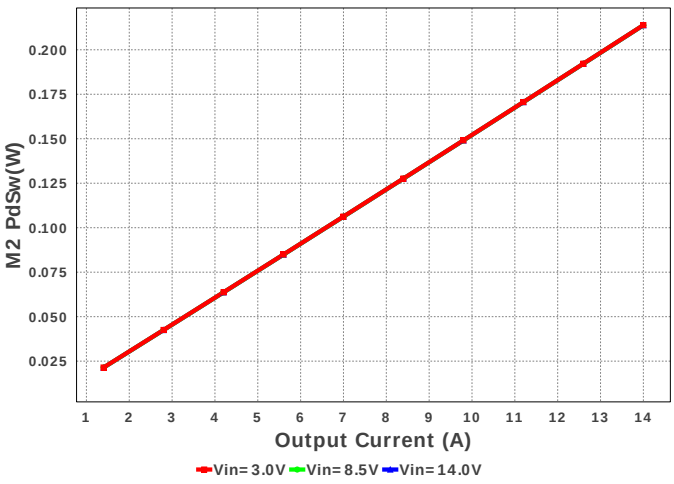
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbst	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
2.	Cbyp	MuRata	GRM219R61A475KE34D Series= X5R	Cap= 4.7 uF ESR= 5.591 mOhm VDC= 10.0 V IRMS= 1.9219 A	1	$0.03	0805 7 mm^2
3.	Ccomp	Yageo America	CC0805KRX7R9BB562 Series= X7R	Cap= 5.6 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
4.	Ccomp2	Yageo America	CC0805KRX7R9BB681 Series= X7R	Cap= 680.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
5.	Ccomp3	Yageo America	CC0805KRX7R9BB821 Series= X7R	Cap= 820.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
6.	Cin	TDK	C3216X5R1E336M160AC Series= X5R	Cap= 33.0 uF ESR= 2.648 mOhm VDC= 25.0 V IRMS= 4.4586 A	9	$0.39	1206_180 11 mm^2
7.	Cout	Taiyo Yuden	JMK212BJ226KG-T Series= X5R	Cap= 22.0 uF ESR= 2.0 mOhm VDC= 6.3 V IRMS= 0.0 A	2	$0.14	0805 7 mm^2
8.	Css	MuRata	GRM188R71E332KA01D Series= X7R	Cap= 3.3 nF ESR= 1.0 Ohm VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0603 5 mm^2
9.	Cvcc	Taiyo Yuden	TMK212B7105KG-T Series= X7R	Cap= 1.0 uF VDC= 25.0 V IRMS= 0.0 A	1	$0.02	0805 7 mm^2

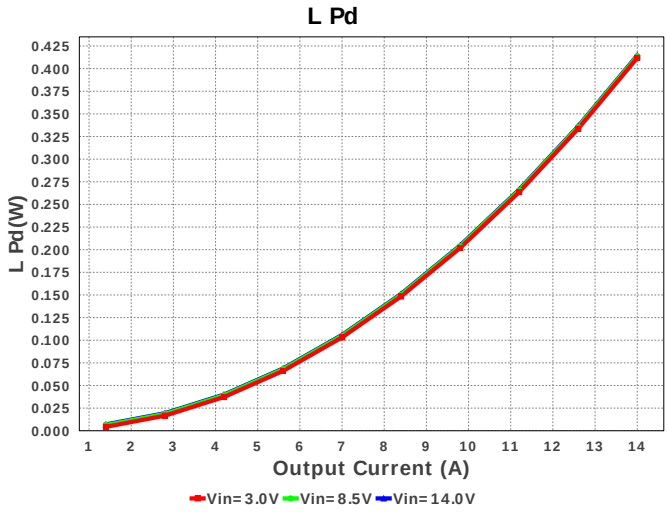
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	L1	Coilcraft	XAL7070-801MEB	L= 800.0 nH DCR= 2.1 mOhm	1	$1.19	XAL7070 87 mm^2
11.	M1	Texas Instruments	CSD16340Q3	VdsMax= 25.0 V IdsMax= 60.0 Amps	1	$0.37	DQG0008A 18 mm^2
12.	M2	Texas Instruments	CSD17575Q3	VdsMax= 30.0 V IdsMax= 60.0 Amps	1	$0.35	DQG0008A 18 mm^2
13.	Rcomp	Vishay-Dale	CRCW04021K58FKED Series= CRCW..e3	Res= 1.58 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
14.	Rcomp2	Vishay-Dale	CRCW04021K15FKED Series= CRCW..e3	Res= 1.15 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
15.	Rfbb	Vishay-Dale	CRCW04023K57FKED Series= CRCW..e3	Res= 3.57 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
16.	Rfbt	Susumu Co Ltd	RR1220P-103-D Series= RR12	Res= 10.0 kOhm Power= 100.0 mW Tolerance= 0.5%	1	$0.01	0805 7 mm^2
17.	Rpgood	Susumu Co Ltd	RR1220P-104-D Series= RR12	Res= 100.0 kOhm Power= 100.0 mW Tolerance= 0.5%	1	$0.01	0805 7 mm^2
18.	Rs	Vishay-Dale	CRCW04024K12FKED Series= CRCW..e3	Res= 4.12 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
19.	U1	Texas Instruments	TPS40304DRCR	Switcher	1	$0.85	S-PVSON-N10 17 mm^2

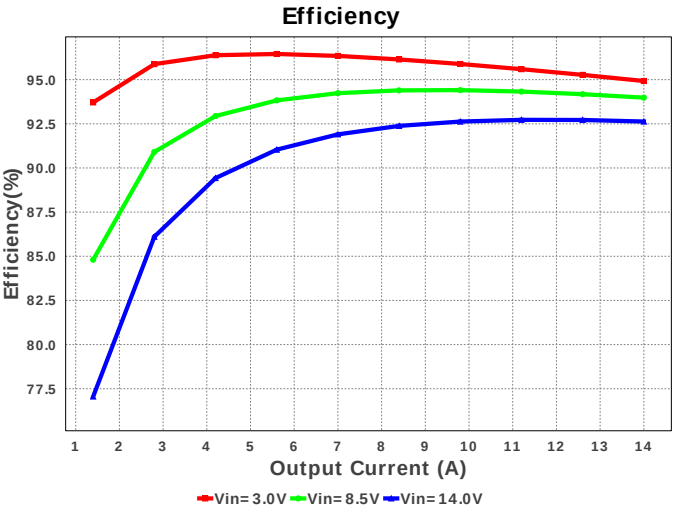


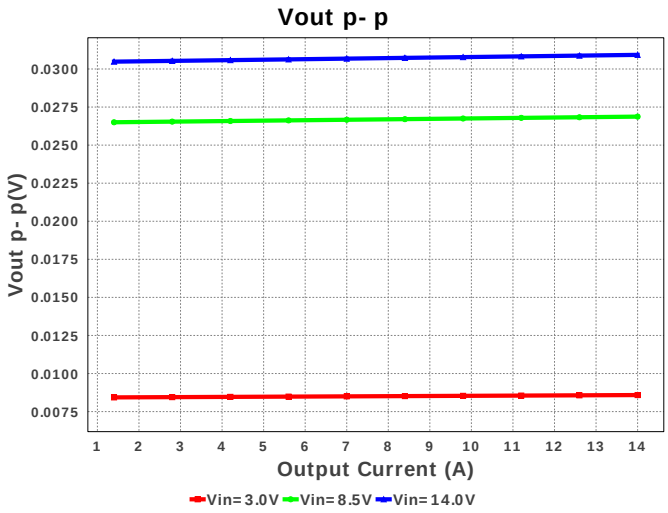


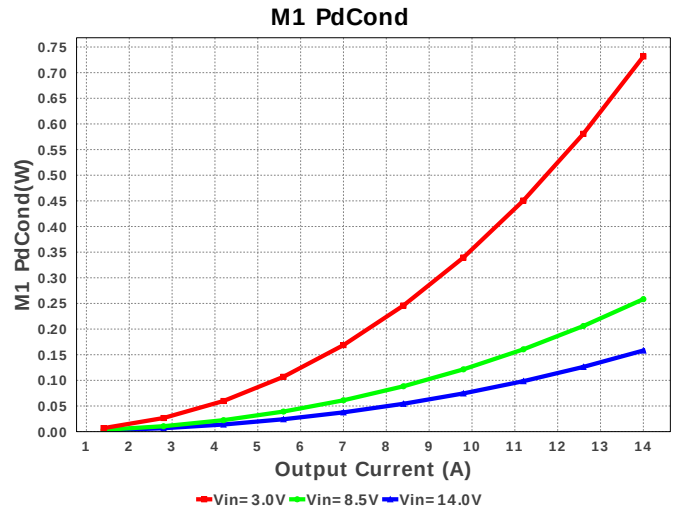


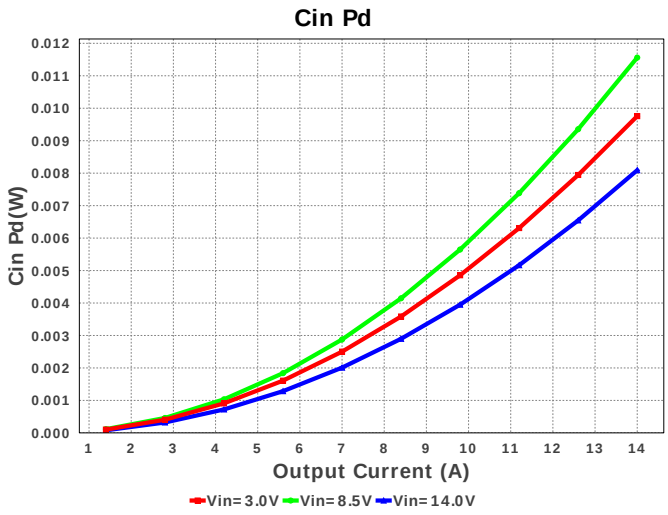


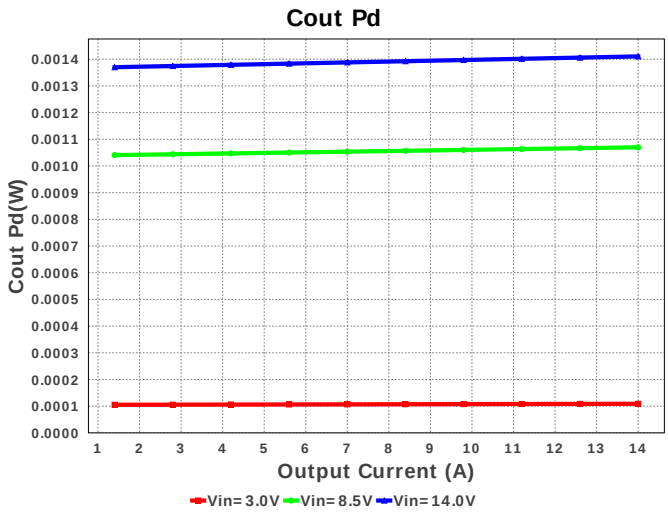


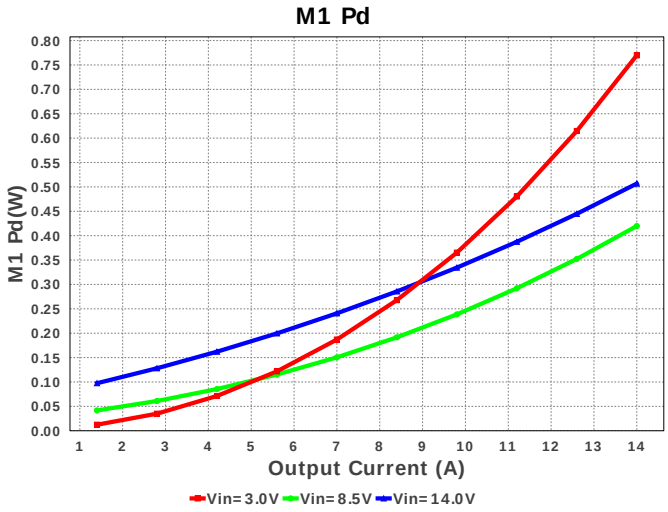


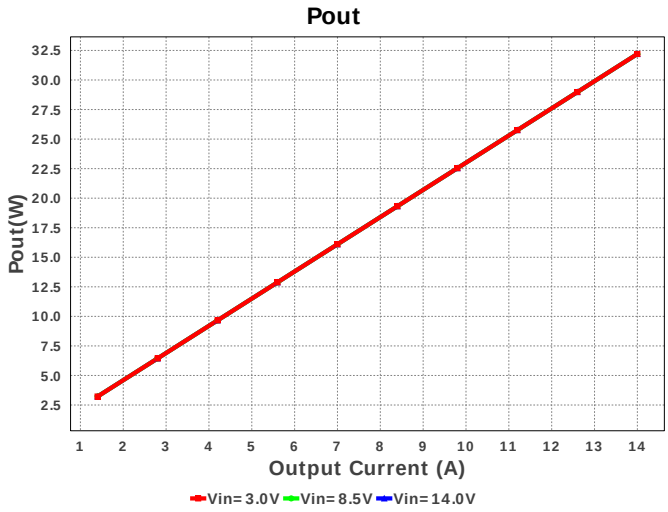


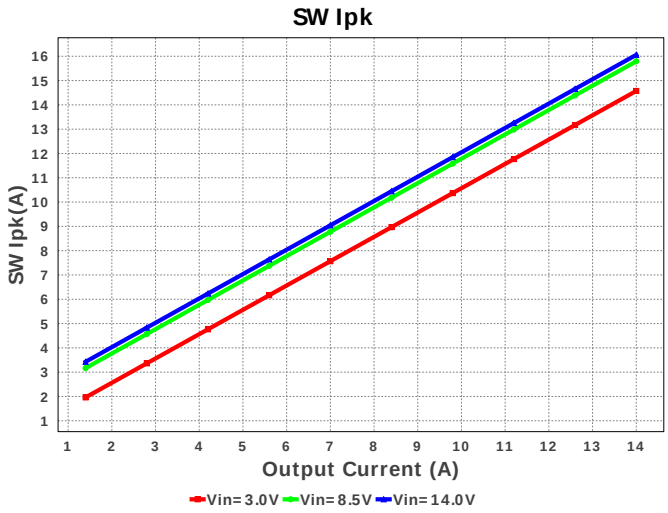


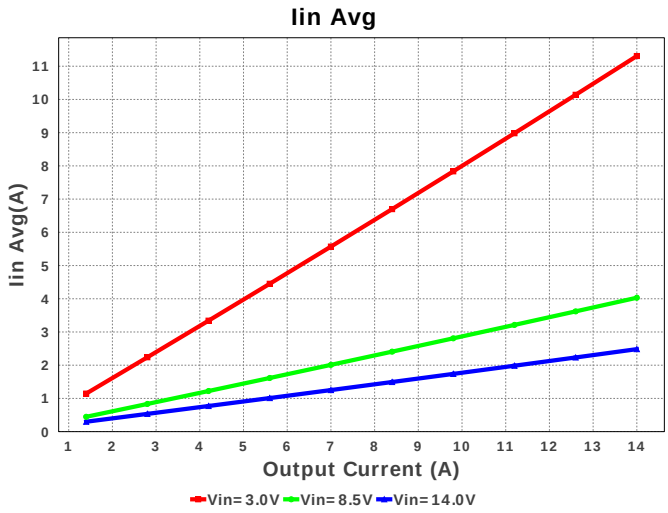


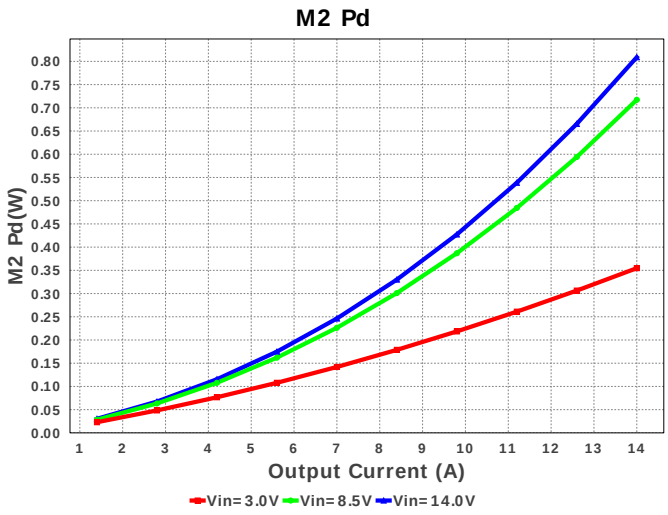


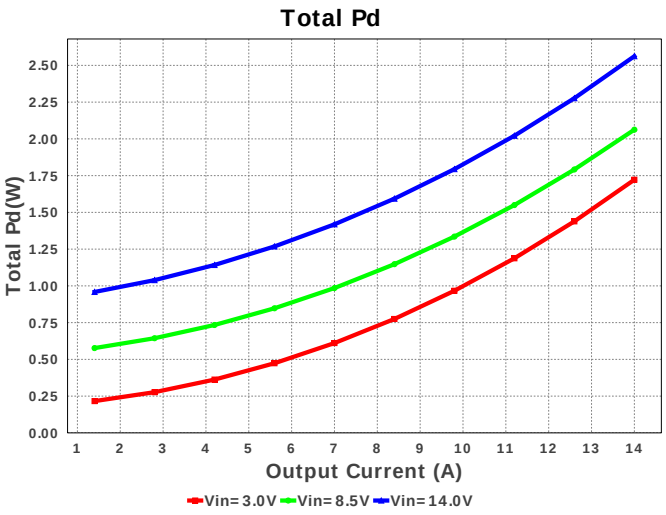


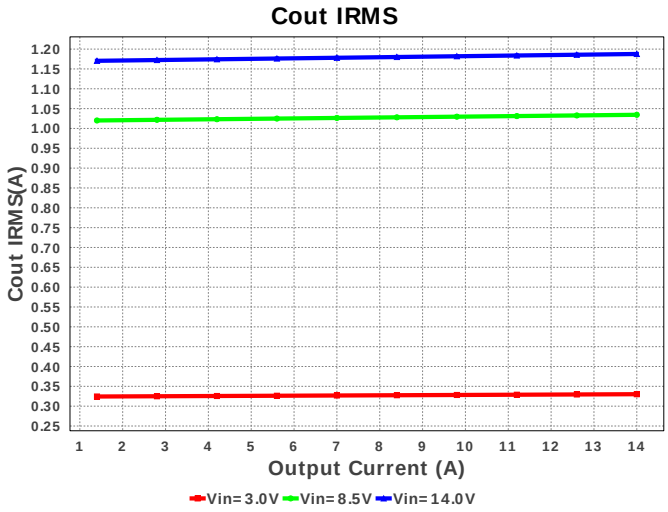


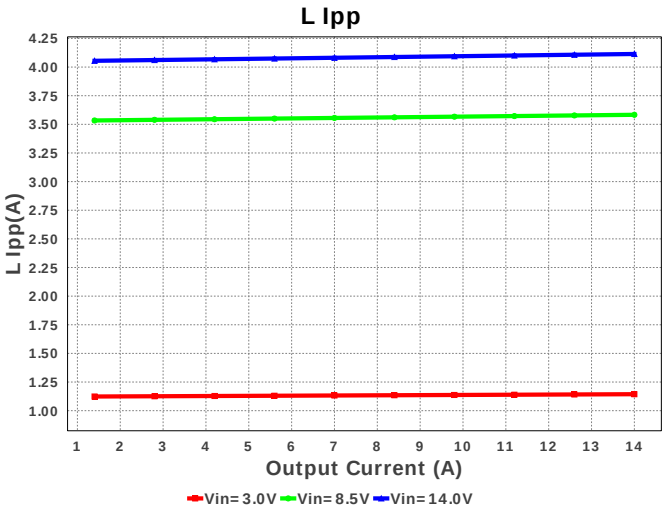


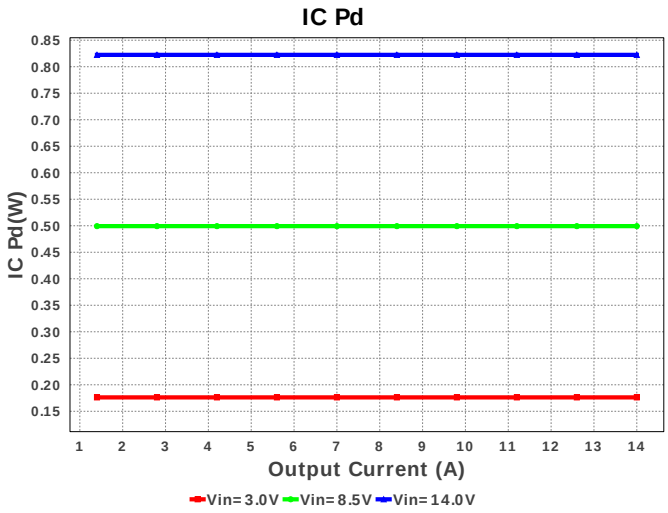


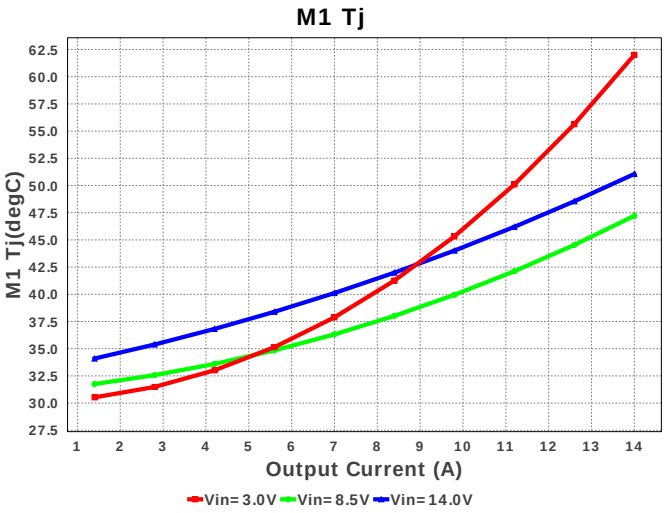


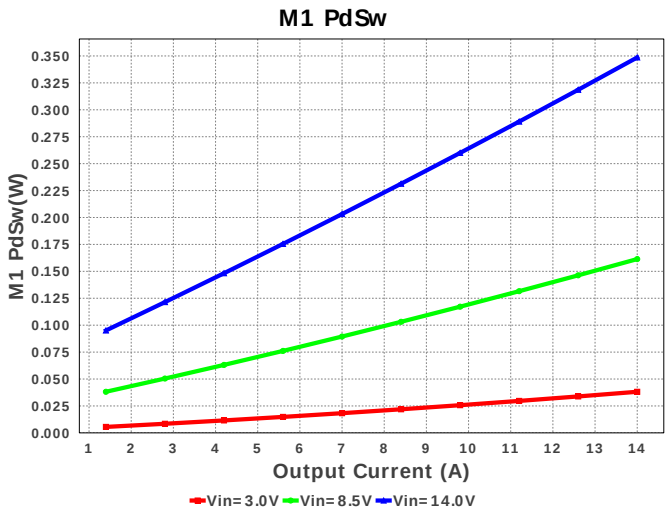


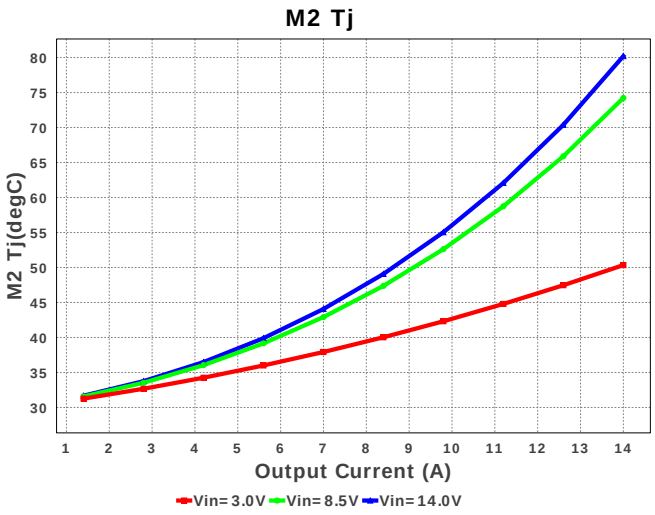


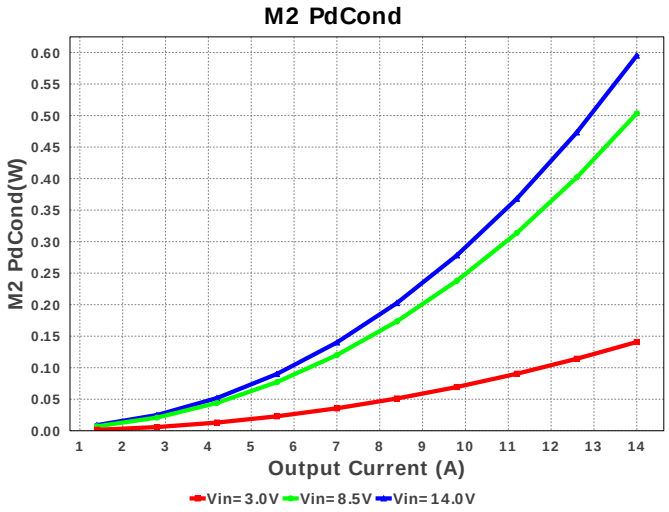


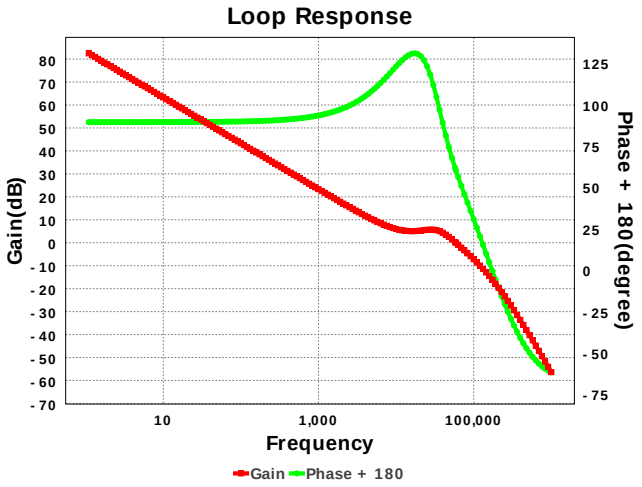












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	5.244 A	Current	Input capacitor RMS ripple current
2.	Cout IRMS	1.188 A	Current	Output capacitor RMS ripple current
3.	Iin Avg	2.488 A	Current	Average input current
4.	L Ipp	4.114 A	Current	Peak-to-peak inductor ripple current
5.	SW Ipk	16.057 A	Current	Peak switch current
6.	BOM Count	28	General	Total Design BOM count
7.	FootPrint	324.0 mm^2	General	Total Foot Print Area of BOM components
8.	Frequency	600.0 kHz	General	Switching frequency
9.	IC Tolerance	10.0 mV	General	IC Feedback Tolerance
10.	Mode	CCM	General	Conduction Mode
11.	Pout	32.2 W	General	Total output power
12.	Total BOM	$6.71	General	Total BOM Cost
13.	Low Freq Gain	82.73 dB	Op_Point	Gain at 1Hz
14.	Vout Actual	2.281 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
15.	Cross Freq	59.11 kHz	Op_point	Bode plot crossover frequency
16.	Duty Cycle	16.879 %	Op_point	Duty cycle
17.	Efficiency	92.461 %	Op_point	Steady state efficiency
18.	Gain Marg	-16.098 dB	Op_point	Bode Plot Gain Margin
19.	IC Tj	69.391 degC	Op_point	IC junction temperature
20.	IOUT_OP	14.0 A	Op_point	Iout operating point
21.	M1 Tj	51.061 degC	Op_point	M1 MOSFET junction temperature
22.	M2 Tj	80.204 degC	Op_point	M2 MOSFET junction temperature
23.	Phase Marg	59.761 deg	Op_point	Bode Plot Phase Margin
24.	VIN_OP	14.0 V	Op_point	Vin operating point
25.	Vout p-p	30.927 mV	Op_point	Peak-to-peak output ripple voltage
26.	Cin Pd	8.091 mW	Power	Input capacitor power dissipation
27.	Cout Pd	1.411 mW	Power	Output capacitor power dissipation
28.	IC Pd	822.36 mW	Power	IC power dissipation
29.	L Pd	414.562 mW	Power	Inductor power dissipation
30.	M1 Pd	512.859 mW	Power	M1 MOSFET total power dissipation
31.	M1 PdCond	164.248 mW	Power	M1 MOSFET conduction losses

#	Name	Value	Category	Description
32.	M1 PdSw	348.611 mW	Power	M1 MOSFET switching losses
33.	M2 Pd	866.178 mW	Power	M2 MOSFET total power dissipation
34.	M2 PdCond	652.38 mW	Power	M2 MOSFET conduction losses
35.	M2 PdSw	213.798 mW	Power	M2 MOSFET switching losses
36.	Total Pd	2.625 W	Power	Total Power Dissipation
37.	Vout Tolerance	2.802 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	14.0	Maximum Output Current
2.	VinMax	14.0	Maximum input voltage
3.	VinMin	3.0	Minimum input voltage
4.	Vout	2.3	Output Voltage
5.	base_pn	TPS40304	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	30.0	Ambient temperature

Design Assistance

1. **TPS40304** Product Folder : http://www.ti.com/product/TPS40304 : contains the data sheet and other resources.