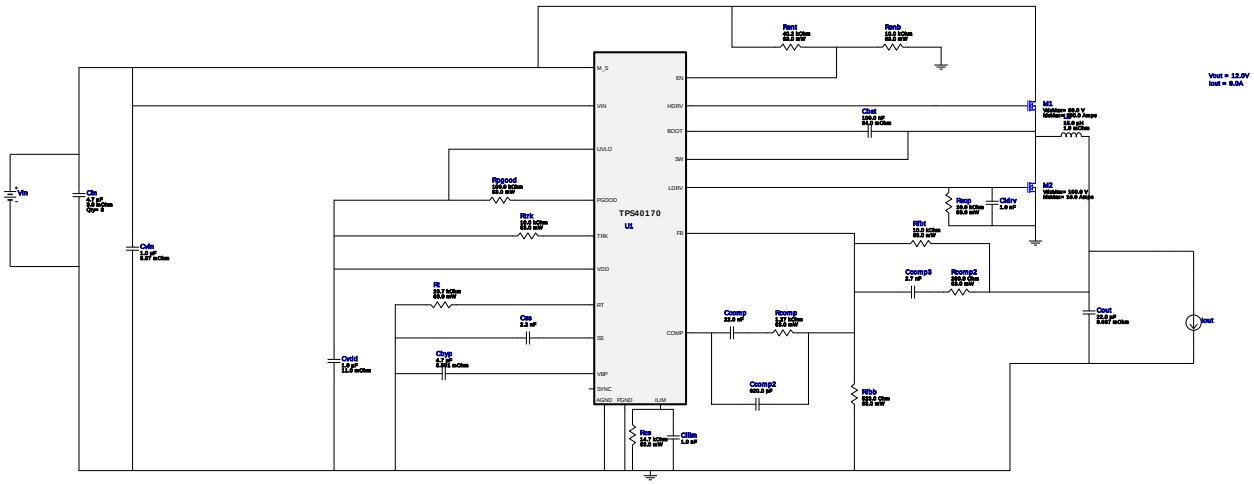
WEBENCH® Design Report

VinMin = 20.0V
VinMax = 40.0V
Vout = 12.0V
Iout = 8.0A

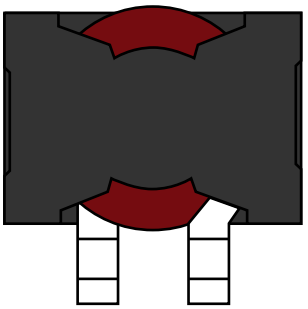
Device = TPS40170RGYR
Topology = Buck
Created = 3/14/16 5:57:15 PM
BOM Cost = $6.32
BOM Count = 29
Total Pd = 2.85W

Design : 4161985/20 TPS40170RGYR
TPS40170RGYR 20.0V-40.0V to 12.00V @ 8.0A

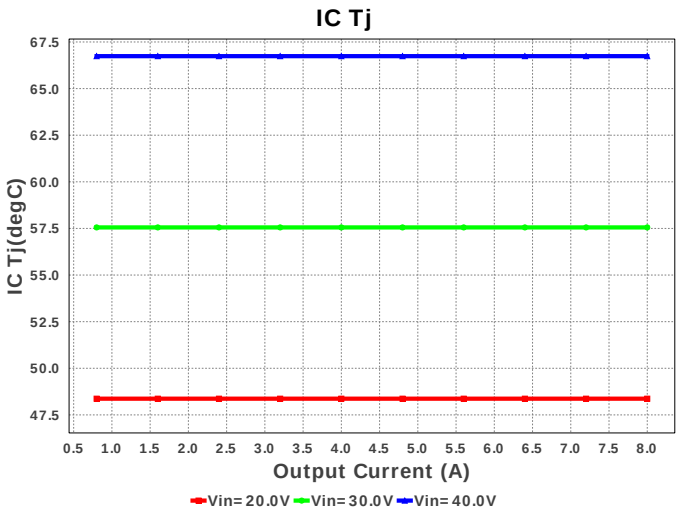


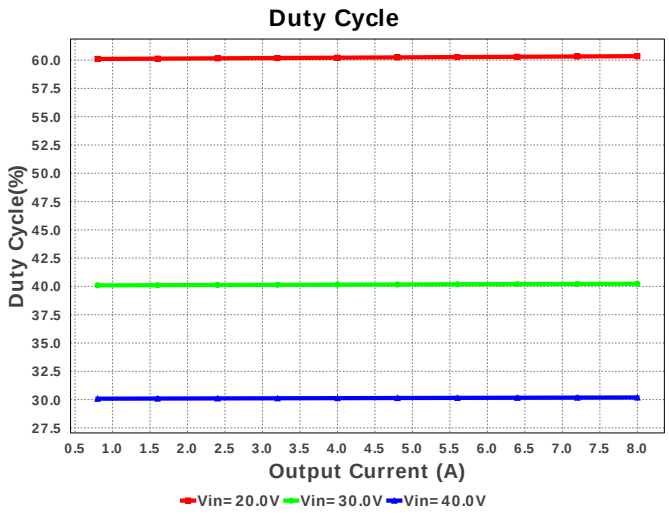
Electrical BOM

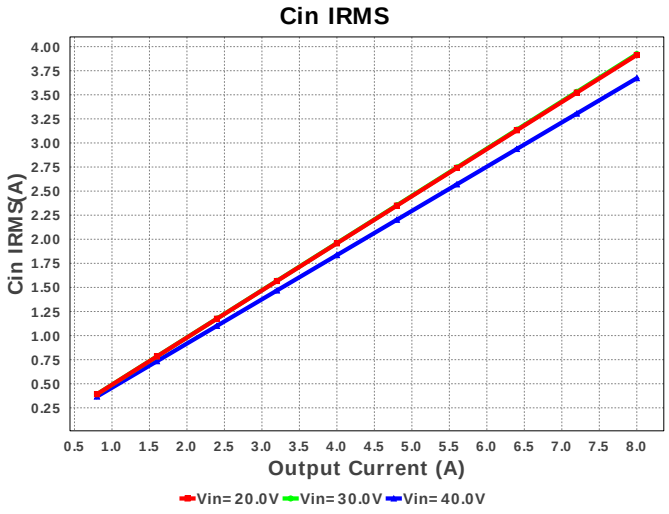
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbst	Kemet	C0805C104K5RACTU Series= X7R	Cap= 100.0 nF ESR= 64.0 mOhm VDC= 50.0 V IRMS= 1.64 A	1	$0.01	0805 7 mm²
2.	Cbyp	MuRata	GRM219R61C475KE15D Series= X5R	Cap= 4.7 uF ESR= 5.591 mOhm VDC= 16.0 V IRMS= 1.8634 A	1	$0.03	0805 7 mm²
3.	Ccomp	Yageo America	CC0805KRX7R9BB223 Series= X7R	Cap= 22.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
4.	Ccomp2	Samsung Electro-Mechanics	CL21C621JBCNNNC Series= C0G/NP0	Cap= 620.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
5.	Ccomp3	Yageo America	CC0805KRX7R9BB272 Series= X7R	Cap= 2.7 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
6.	Cilim	MuRata	GRM216R71E102KA01D Series= X7R	Cap= 1.0 nF VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
7.	Cin	MuRata	GRM31CR71H475KA12L Series= X7R	Cap= 4.7 uF ESR= 3.0 mOhm VDC= 50.0 V IRMS= 4.98 A	3	$0.07	1206 11 mm²
8.	Cldrv	MuRata	GRM033R71C102KA01D Series= X7R	Cap= 1.0 nF VDC= 16.0 V IRMS= 0.0 A	1	$0.01	0201 2 mm²
9.	Cout	MuRata	GRM31CR61C226ME15L Series= X5R	Cap= 22.0 uF ESR= 3.637 mOhm VDC= 16.0 V IRMS= 3.4771 A	1	$0.13	1206_190 11 mm²
10.	Css	MuRata	GRM033R70J222KA01D Series= X7R	Cap= 2.2 nF VDC= 6.3 V IRMS= 0.0 A	1	$0.01	0201 2 mm²

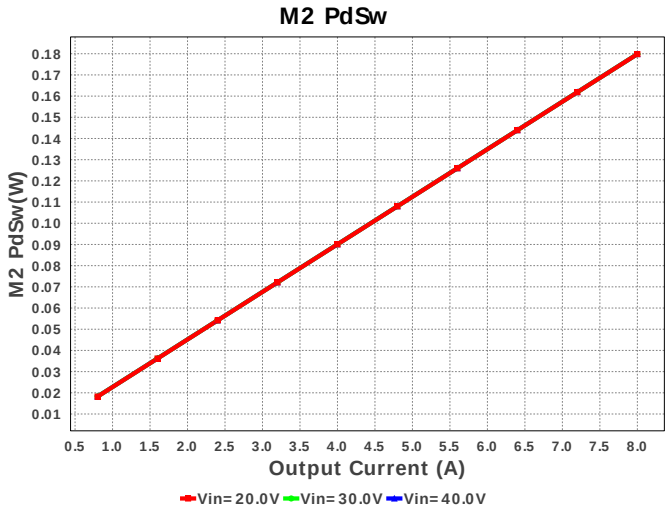
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
11.	Cvdd	MuRata	GRM188R71C105KA12D Series= X7R	Cap= 1.0 uF ESR= 11.0 mOhm VDC= 16.0 V IRMS= 2.72 A	1	$0.01	 0603 5 mm^2
12.	Cvin	TDK	C3216X5R1H105K Series= X5R	Cap= 1.0 uF ESR= 8.97 mOhm VDC= 50.0 V IRMS= 0.0 A	1	$0.02	 1206 11 mm^2
13.	L1	Coilcraft	SER2915H-153KL	L= 15.0 µH DCR= 1.9 mOhm	1	$1.95	 SER2915H 652 mm^2
14.	M1	Texas Instruments	CSD18563Q5A	VdsMax= 60.0 V IdsMax= 100.0 Amps	1	$0.68	 TRANS_NexFET_Q5A 55 mm^2
15.	M2	Texas Instruments	CSD19531Q5A	VdsMax= 100.0 V IdsMax= 16.0 Amps	1	$1.01	 TRANS_NexFET_Q5A 55 mm^2
16.	Rcomp	Vishay-Dale	CRCW04021K27FKED Series= CRCW..e3	Res= 1.27 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
17.	Rcomp2	Vishay-Dale	CRCW0402280RFKED Series= CRCW..e3	Res= 280.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
18.	Rcs	Vishay-Dale	CRCW040214K7FKED Series= CRCW..e3	Res= 14.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
19.	Renb	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
20.	Rent	Vishay-Dale	CRCW040240K2FKED Series= CRCW..e3	Res= 40.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
21.	Rfbb	Vishay-Dale	CRCW0402523RFKED Series= CRCW..e3	Res= 523.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
22.	Rfbt	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
23.	Rpgood	Vishay-Dale	CRCW0402100KFKED Series= CRCW..e3	Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
24.	Rscp	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
25.	Rt	Vishay-Dale	CRCW040226K7FKED Series= CRCW..e3	Res= 26.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
26.	Rtrk	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2

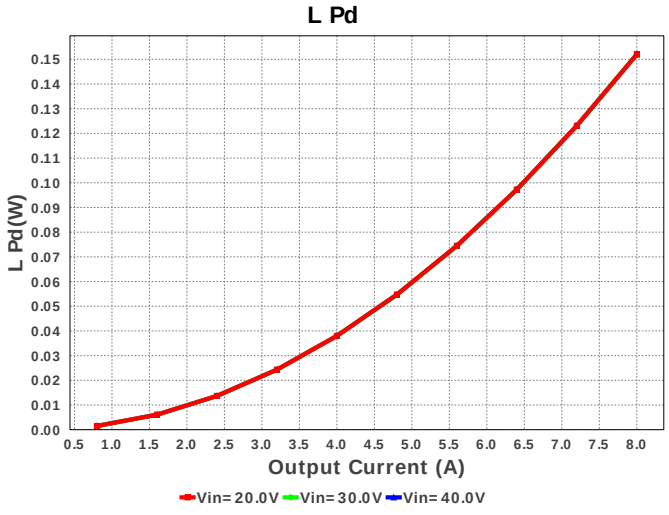
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
27.	U1	Texas Instruments	TPS40170RGYR	Switcher	1	$2.10	RGY0020A 25 mm²

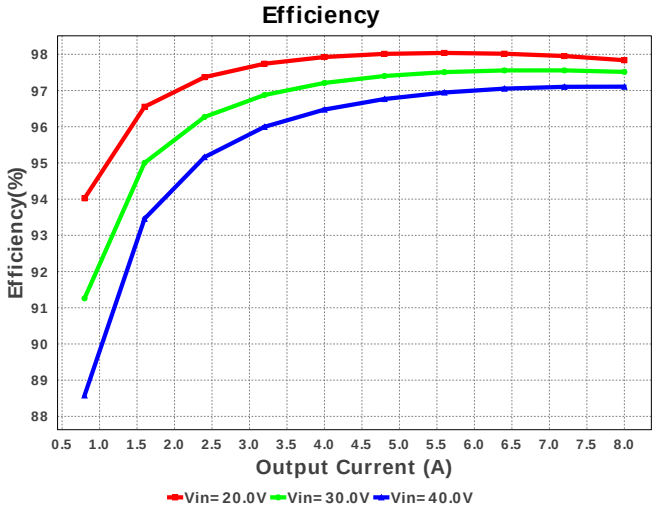


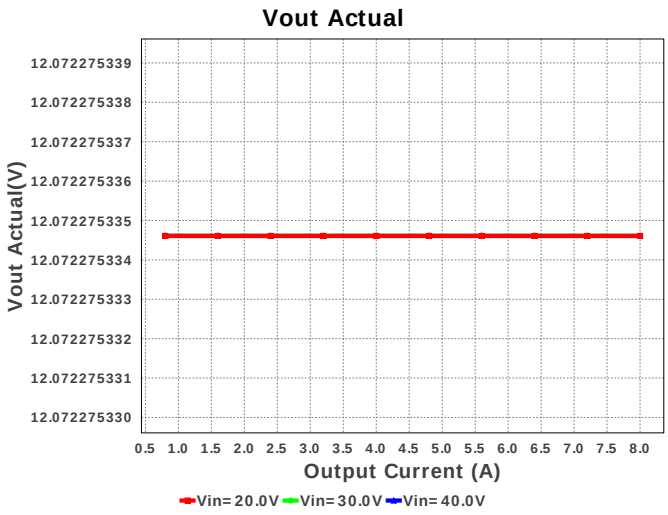


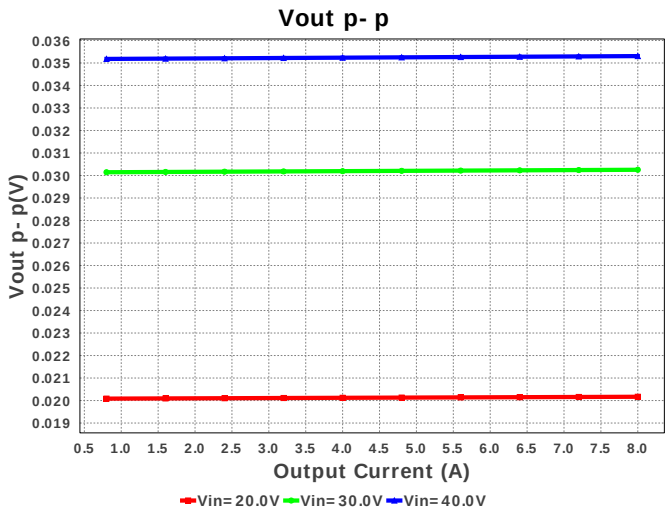


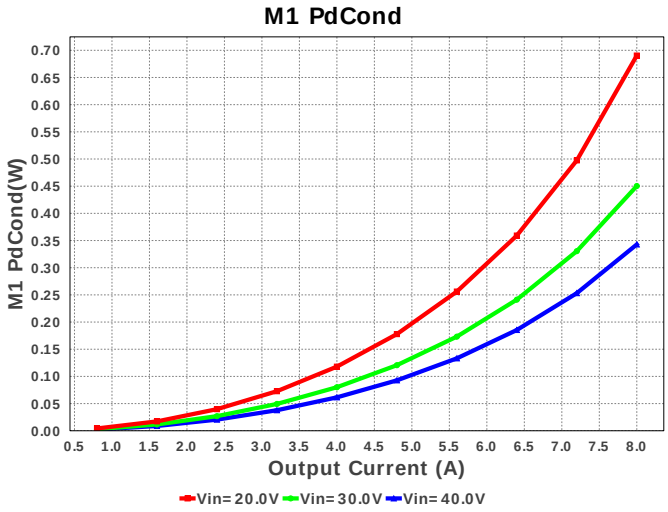


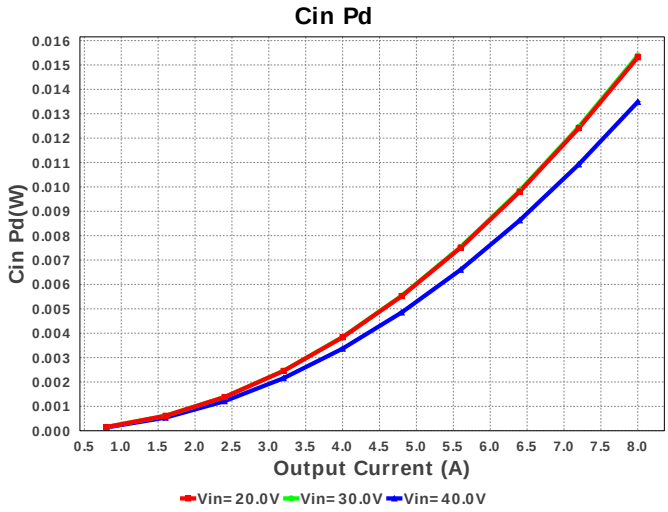


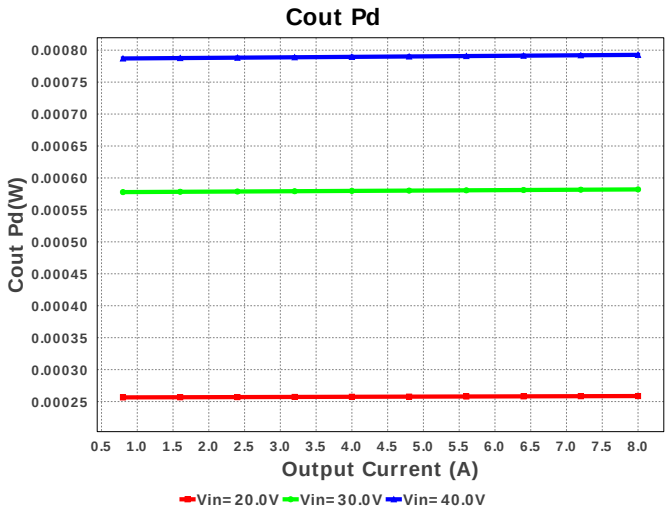


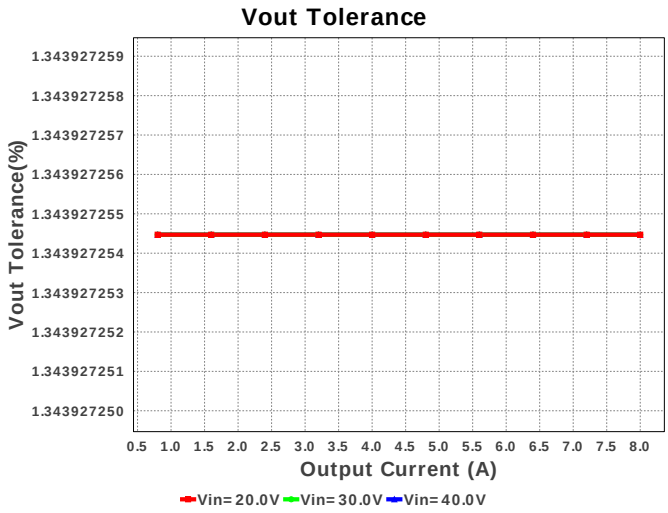


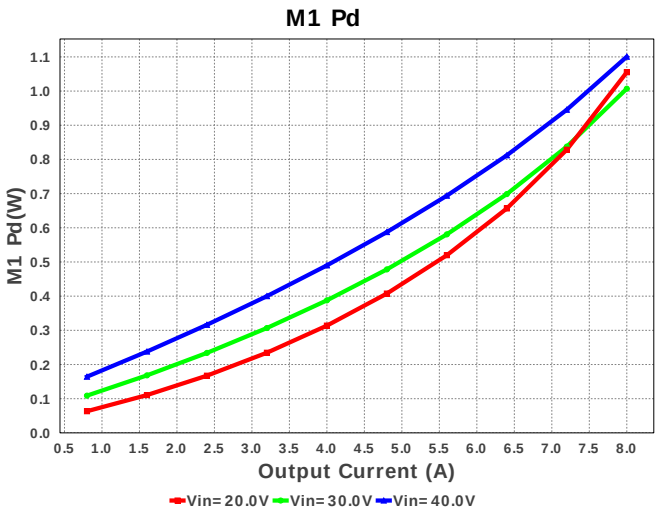


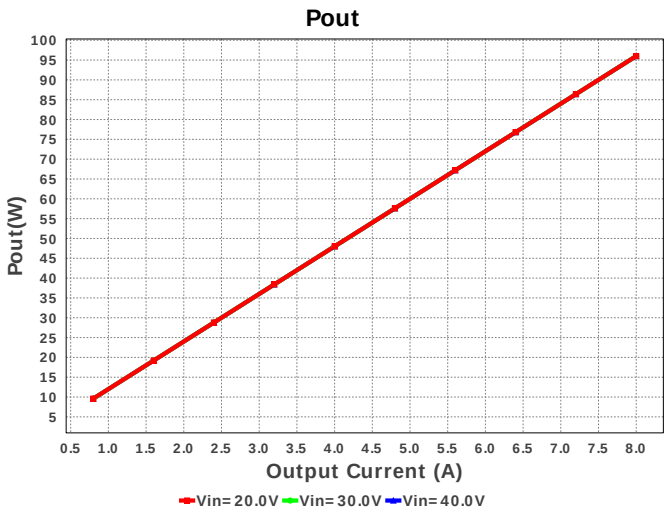


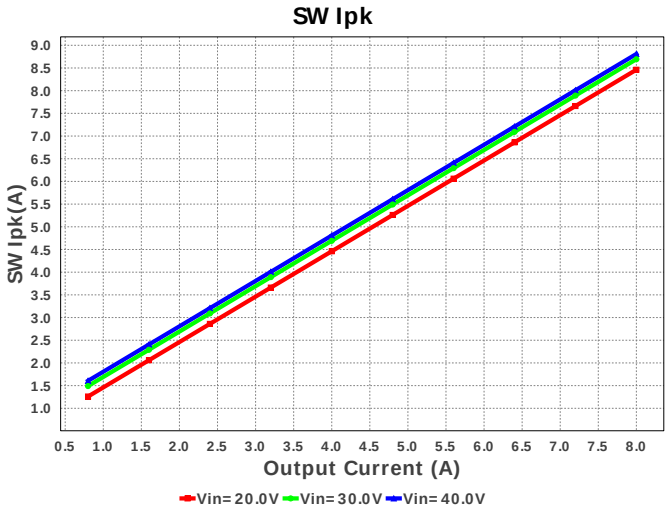


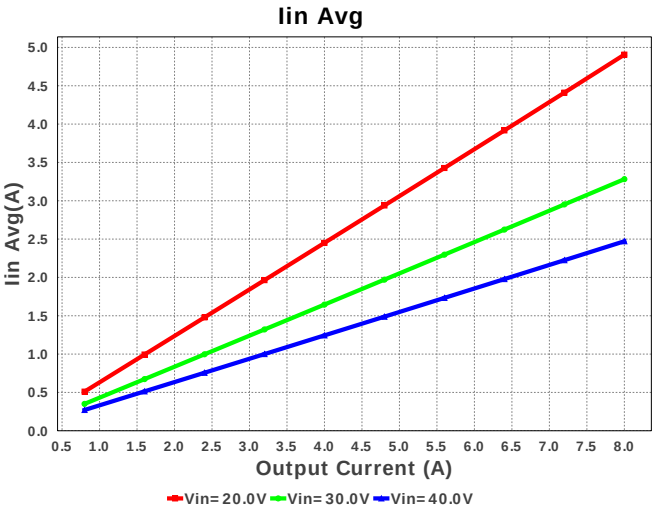


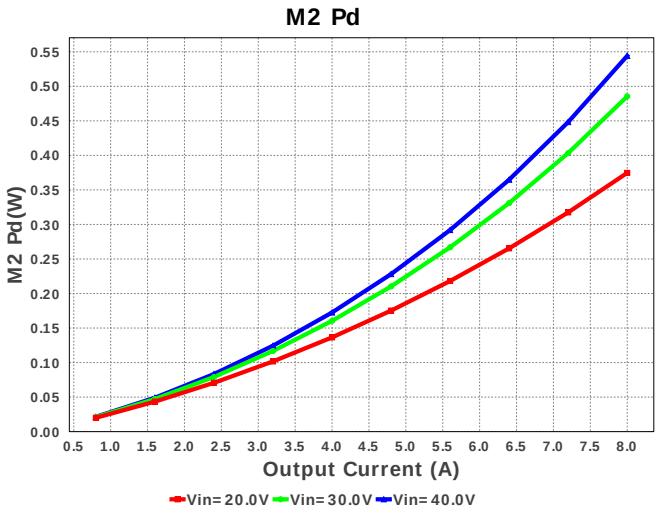


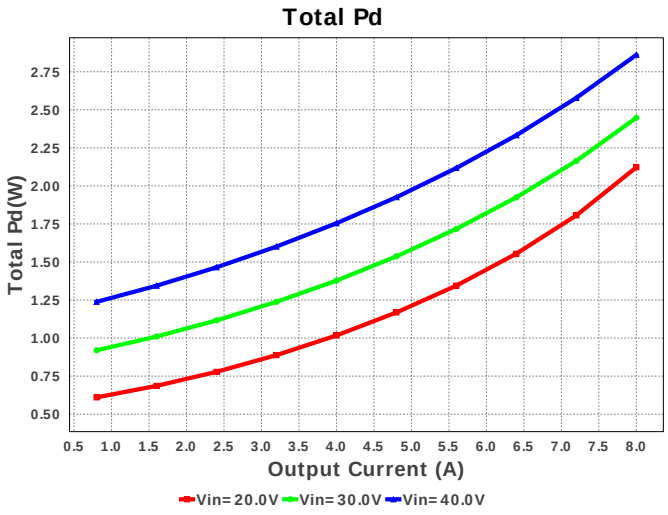


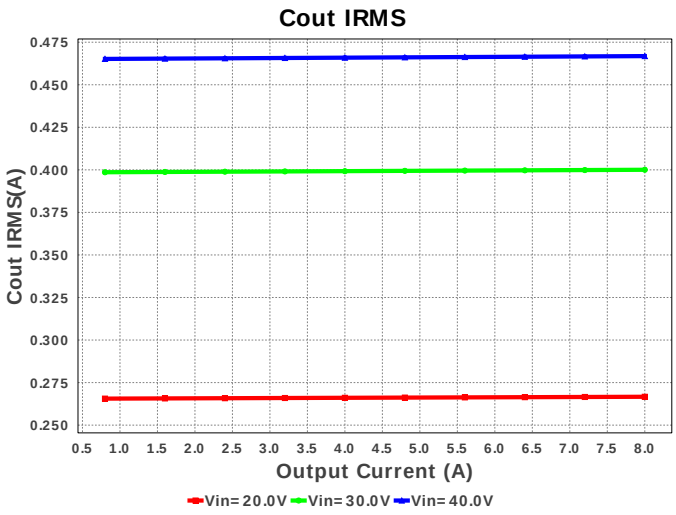


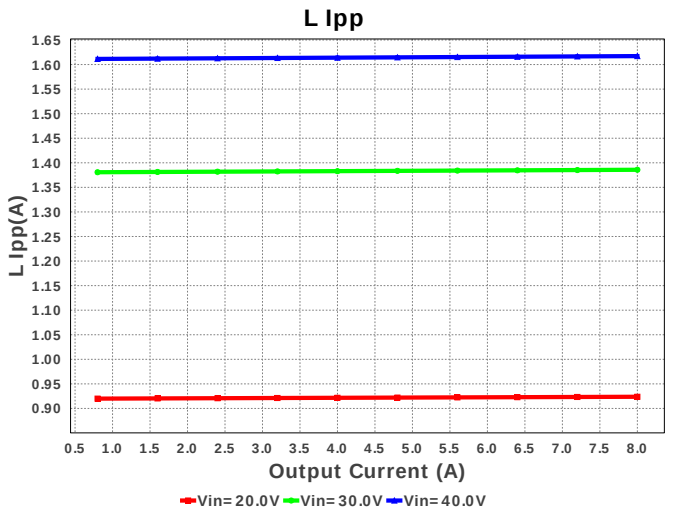


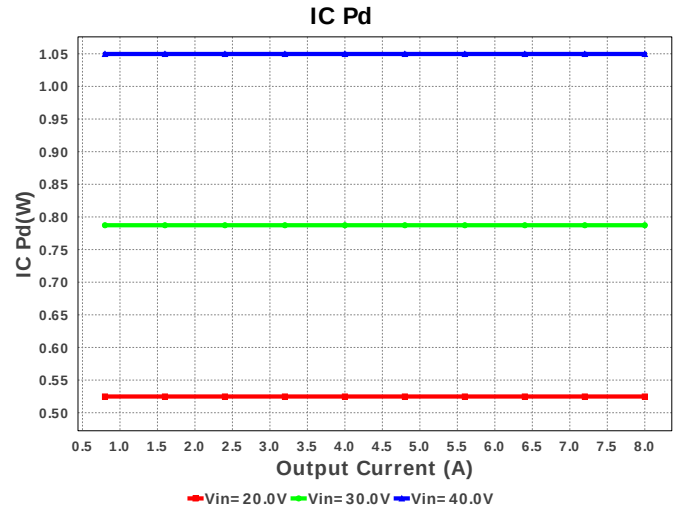


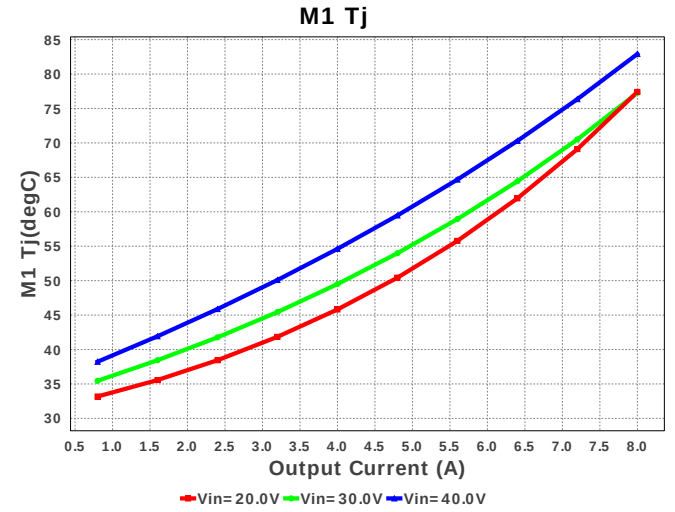


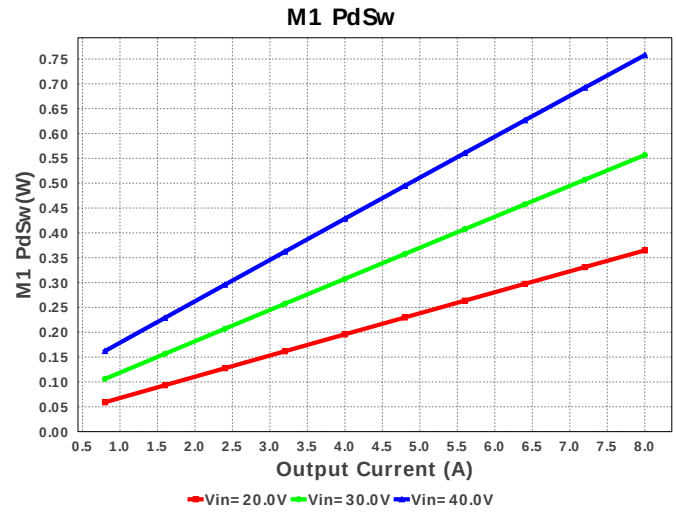


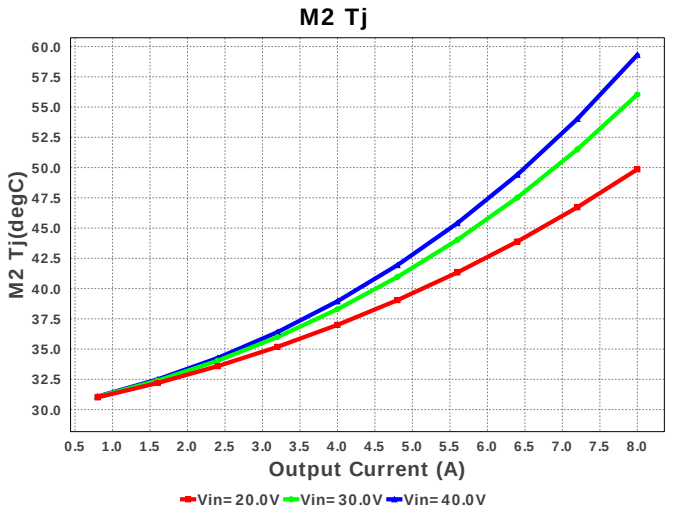


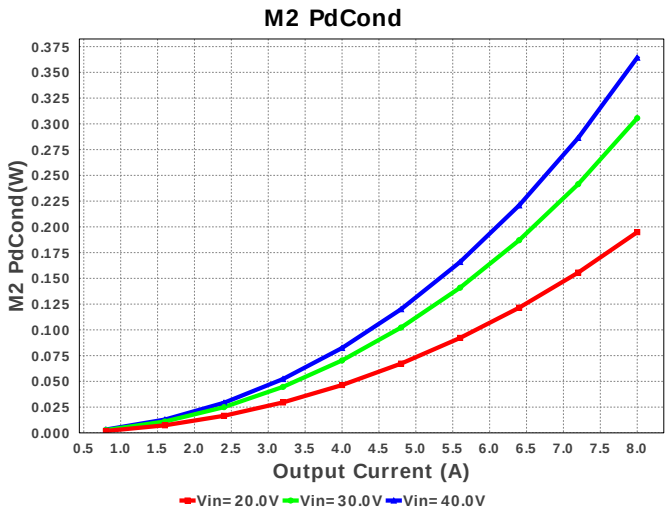


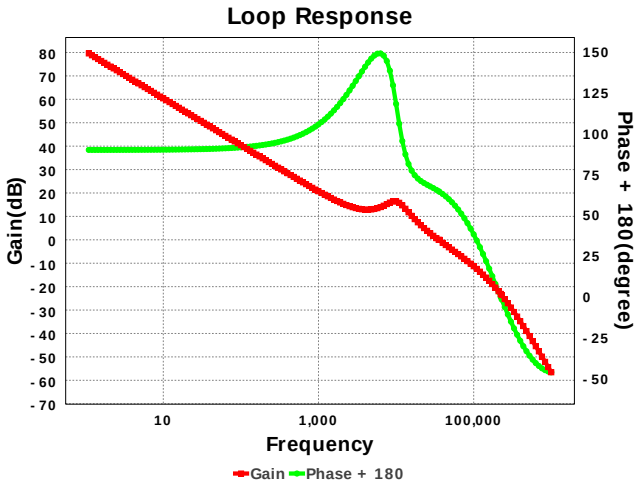












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	3.673 A	Current	Input capacitor RMS ripple current
2.	Cout IRMS	466.841 mA	Current	Output capacitor RMS ripple current
3.	Iin Avg	2.471 A	Current	Average input current
4.	L Ipp	1.617 A	Current	Peak-to-peak inductor ripple current
5.	SW Ipk	8.809 A	Current	Peak switch current
6.	BOM Count	29	General	Total Design BOM count
7.	FootPrint	924.0 mm^2	General	Total Foot Print Area of BOM components
8.	Frequency	348.432 kHz	General	Switching frequency
9.	IC Tolerance	6.0 µV	General	IC Feedback Tolerance
10.	Pout	96.0 W	General	Total output power
11.	Total BOM	$6.32	General	Total BOM Cost
12.	Low Freq Gain	79.595 dB	Op_Point	Gain at 10Hz
13.	Vout Actual	12.072 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
14.	Cross Freq	35.351 kHz	Op_point	Bode plot crossover frequency
15.	Duty Cycle	30.186 %	Op_point	Duty cycle
16.	Efficiency	97.114 %	Op_point	Steady state efficiency
17.	Gain Marg	-23.086 dB	Op_point	Bode Plot Gain Margin
18.	IC Tj	66.739 degC	Op_point	IC junction temperature
19.	IOUT_OP	8.0 A	Op_point	Iout operating point
20.	M1 Tj	82.914 degC	Op_point	M1 MOSFET junction temperature
21.	M2 Tj	59.314 degC	Op_point	M2 MOSFET junction temperature
22.	Phase Marg	64.737 deg	Op_point	Bode Plot Phase Margin
23.	VIN_OP	40.0 V	Op_point	Vin operating point
24.	Vout p-p	35.306 mV	Op_point	Peak-to-peak output ripple voltage
25.	Cin Pd	13.487 mW	Power	Input capacitor power dissipation
26.	Cout Pd	792.648 µW	Power	Output capacitor power dissipation
27.	IC Pd	1.05 W	Power	IC power dissipation
28.	L Pd	152.0 mW	Power	Inductor power dissipation
29.	M1 Pd	1.069 W	Power	M1 MOSFET total power dissipation
30.	M1 PdCond	310.758 mW	Power	M1 MOSFET conduction losses
31.	M1 PdSw	757.797 mW	Power	M1 MOSFET switching losses
32.	M2 Pd	568.024 mW	Power	M2 MOSFET total power dissipation
33.	M2 PdCond	388.175 mW	Power	M2 MOSFET conduction losses
34.	M2 PdSw	179.849 mW	Power	M2 MOSFET switching losses
35.	Total Pd	2.853 W	Power	Total Power Dissipation
36.	Vout Tolerance	1.344 %		Vout Tolerance based on IC Tolerance and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	8.0	Maximum Output Current
2.	VinMax	40.0	Maximum input voltage
3.	VinMin	20.0	Minimum input voltage
4.	Vout	12.0	Output Voltage
5.	base_pn	TPS40170	Texas Instruments Base Part Number
6.	source	DC	Input Source Type
7.	ta	30.0	Ambient temperature

Design Assistance

1. TPS40170 Product Folder : http://www.ti.com/product/TPS40170 : contains the data sheet and other resources.