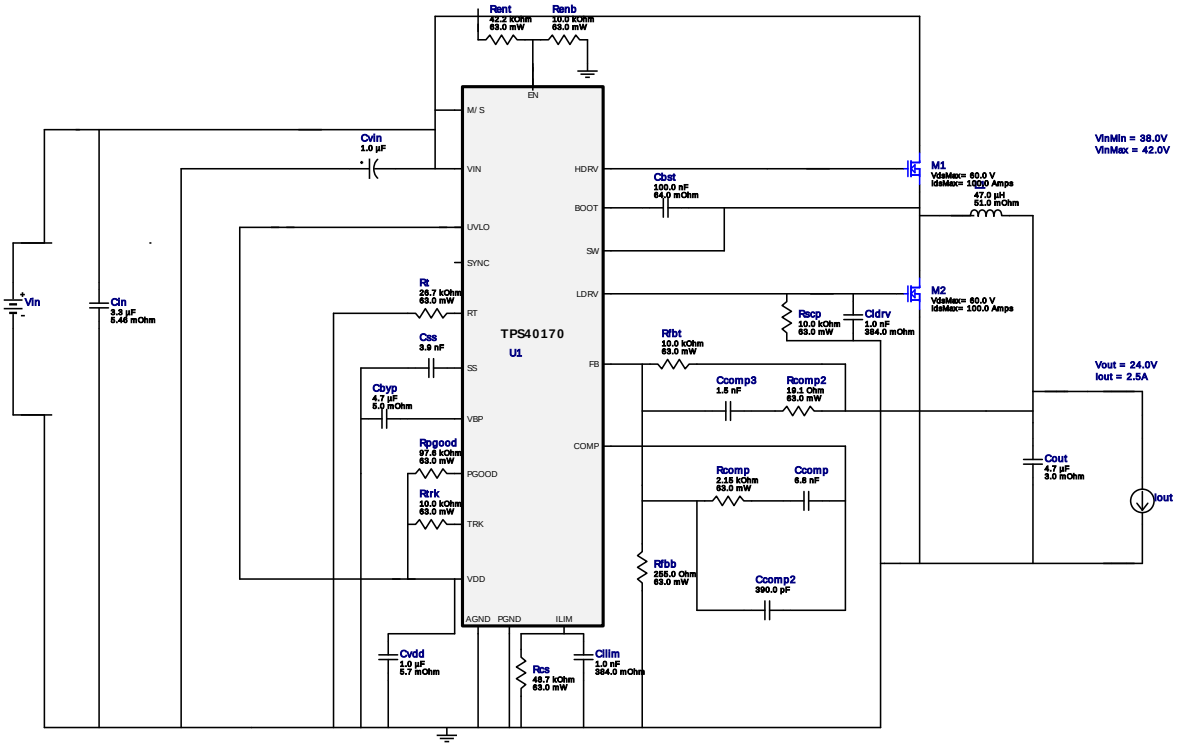
WEBENCH® Design Report

VinMin = 38.0V
VinMax = 42.0V
Vout = 24.0V
Iout = 2.5A

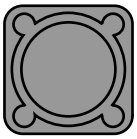
Device = TPS40170RGYR
Topology = Buck
Created = 12/24/13 7:28:23 AM
BOM Cost = $4.91
Total Pd = 1.7W
Footprint = 480.0mm2
BOM Count = 27

Design : 3640406/13 TPS40170RGYR
TPS40170RGYR 38.0V-42.0V to 24.0V @ 2.5A

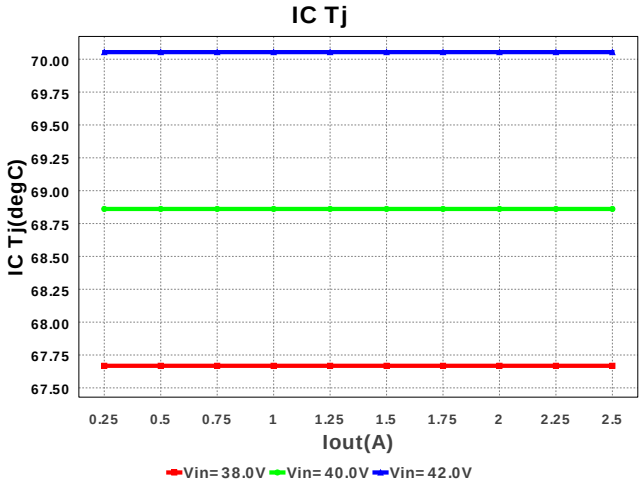


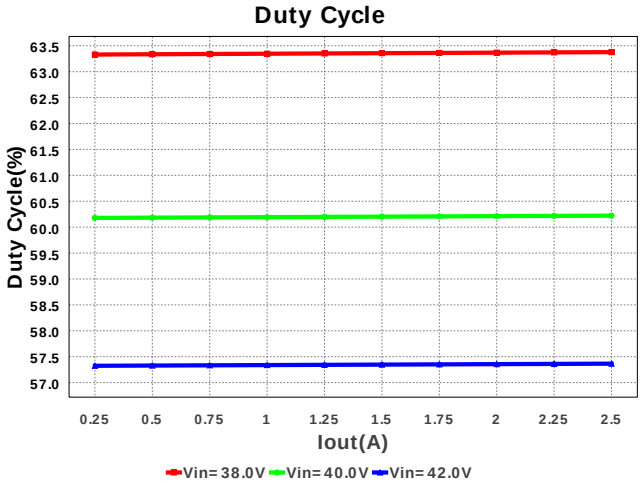
Electrical BOM

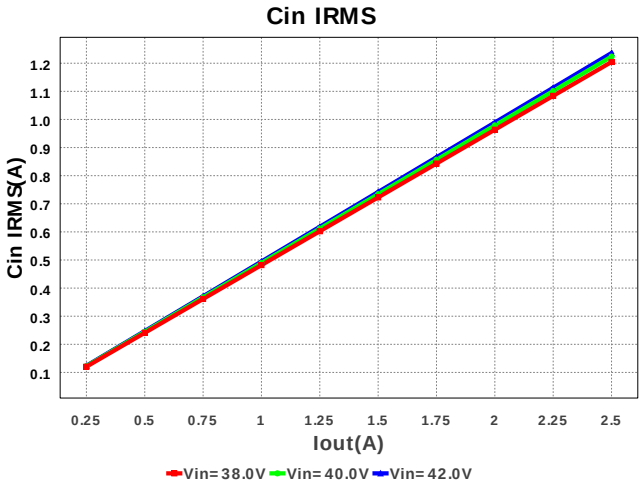
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbst	Kemet	C0805C104K5RACTU Series= X7R	Cap= 100.0 nF ESR= 64.0 mOhm VDC= 50.0 V IRMS= 1.64 A	1	$0.01	0805 7mm2
2.	Cbyp	MuRata	GRM21BR61C475KA88L Series= X5R	Cap= 4.7 µF ESR= 5.0 mOhm VDC= 16.0 V IRMS= 0.0 A	1	$0.04	0805 7mm2
3.	Ccomp	Yageo America	CC0805KRX7R9BB682 Series= X7R	Cap= 6.8 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7mm2
4.	Ccomp2	Yageo America	CC0805KRX7R9BB391 Series= X7R	Cap= 390.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7mm2
5.	Ccomp3	Yageo America	CC0805KRX7R9BB152 Series= X7R	Cap= 1.5 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7mm2
6.	Cilim	Kemet	C0805C102K5RACTU Series= X7R	Cap= 1.0 nF ESR= 384.0 mOhm VDC= 50.0 V IRMS= 214.0 mA	1	$0.01	0805 7mm2
7.	Cin	TDK	C3225X7S2A335K200AB Series= X7R	Cap= 3.3 µF ESR= 5.46 mOhm VDC= 100.0 V IRMS= 7.036 A	1	$0.24	1210 15mm2

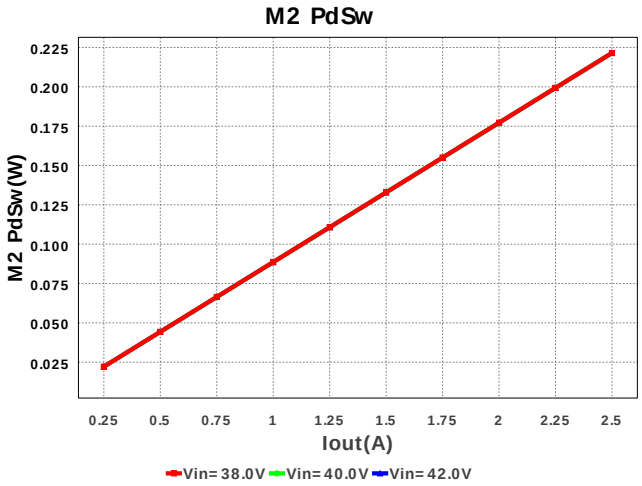
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
8.	Cldrv	Kemet	C0805C102K5RACTU Series= X7R	Cap= 1.0 nF ESR= 384.0 mOhm VDC= 50.0 V IRMS= 214.0 mA	1	$0.01	 0805 7mm2
9.	Cout	MuRata	GRM31CR71H475KA12L Series= X7R	Cap= 4.7 µF ESR= 3.0 mOhm VDC= 50.0 V IRMS= 4.98 A	1	$0.10	 1206 11mm2
10.	Css	MuRata	GRM033R70J392KA01D Series= X7R	Cap= 3.9 nF VDC= 6.3 V IRMS= 0.0 A	1	$0.01	 0201 2mm2
11.	Cvdd	TDK	C1608X5R1C105K Series= X5R	Cap= 1.0 µF ESR= 5.7 mOhm VDC= 16.0 V IRMS= 0.0 A	1	$0.01	 0603 5mm2
12.	Cvin	Nippon Chemi-Con	EMVA630ADA1R0MD55G Series= MVA	Cap= 1.0 µF VDC= 63.0 V IRMS= 8.0 mA	1	$0.07	 CAPSMT_62_D55 28mm2
13.	L1	Coilcraft	MSS1210-473MEB	L= 47.0 µH DCR= 51.0 mOhm	1	$0.81	 MSS1210 204mm2
14.	M1	Texas Instruments	CSD18563Q5A	VdsMax= 60.0 V IdsMax= 100.0 Amps	1	$0.68	 TRANS_NexFET_Q5A 55mm2
15.	M2	Texas Instruments	CSD18563Q5A	VdsMax= 60.0 V IdsMax= 100.0 Amps	1	$0.68	 TRANS_NexFET_Q5A 55mm2
16.	Rcomp	Vishay-Dale	CRCW04022K15FKED Series= CRCW..e3	Res= 2.15 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3mm2
17.	Rcomp2	Vishay-Dale	CRCW040219R1FKED Series= CRCW..e3	Res= 19.1 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3mm2
18.	Rcs	Vishay-Dale	CRCW040248K7FKED Series= CRCW..e3	Res= 48.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3mm2
19.	Renb	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3mm2
20.	Rent	Vishay-Dale	CRCW040242K2FKED Series= CRCW..e3	Res= 42.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3mm2
21.	Rfbb	Vishay-Dale	CRCW0402255RFKED Series= CRCW..e3	Res= 255.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3mm2
22.	Rfbt	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3mm2
23.	Rpgood	Vishay-Dale	CRCW040297K6FKED Series= CRCW..e3	Res= 97.6 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3mm2
24.	Rscp	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3mm2
25.	Rt	Vishay-Dale	CRCW040226K7FKED Series= CRCW..e3	Res= 26.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3mm2

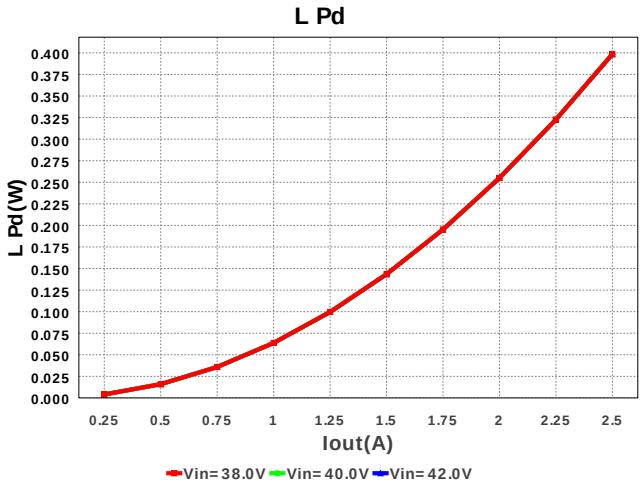
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
26.	Rtrk	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3mm2
27.	U1	Texas Instruments	TPS40170RGYR	Switcher	1	$2.10	RGY-20 25mm2

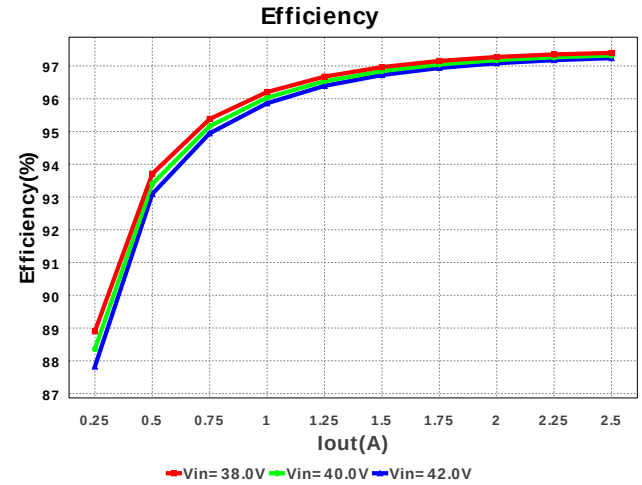




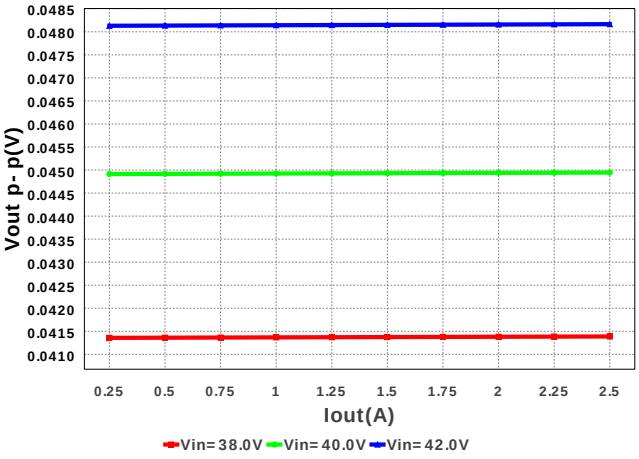




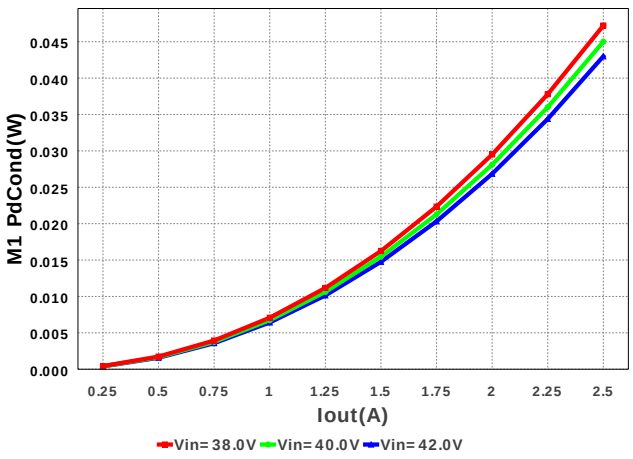




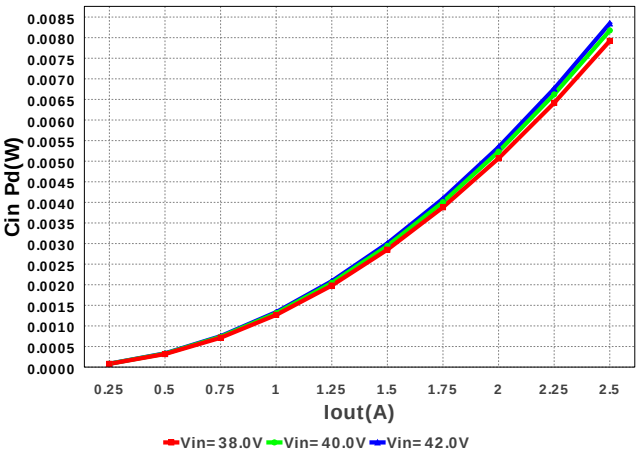
Vout p- p



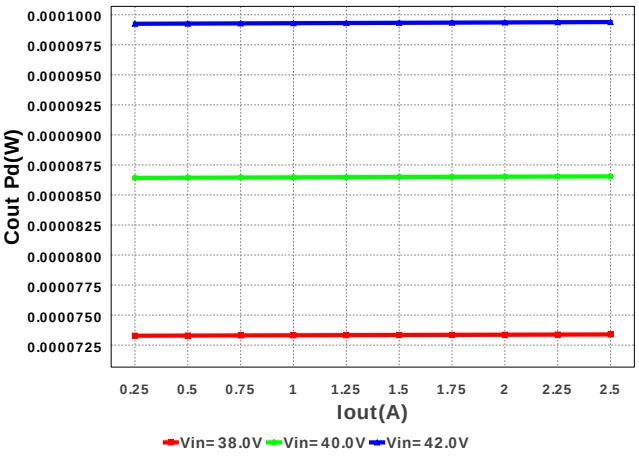
M1 PdCond



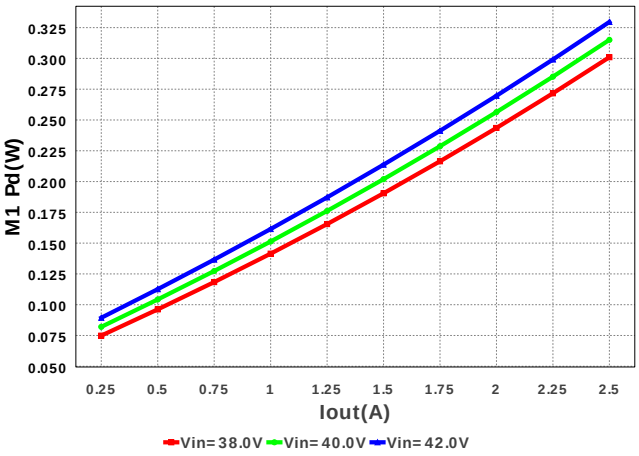
Cin Pd



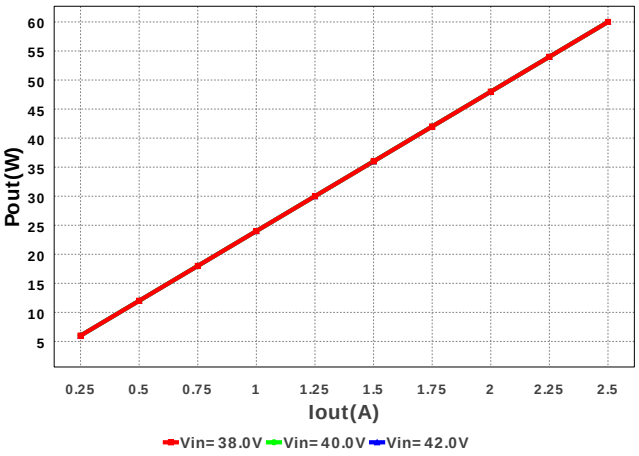
Cout Pd

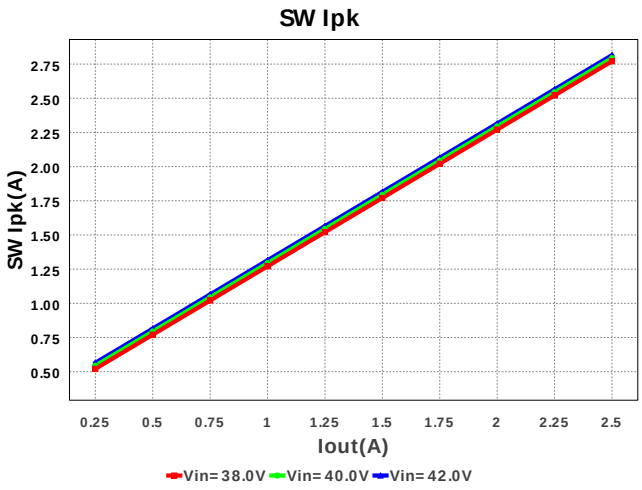


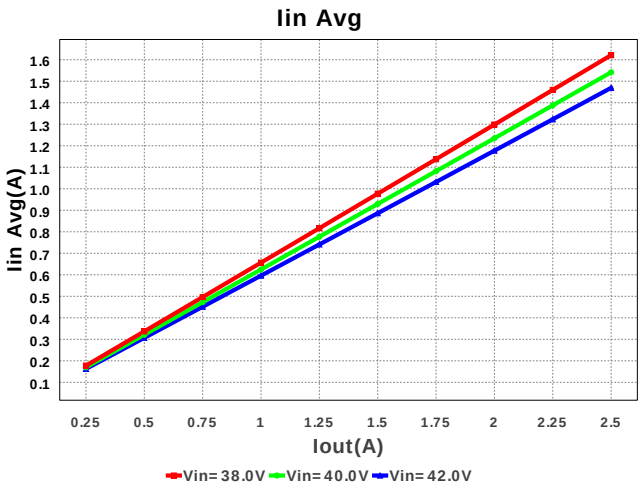
M1 Pd

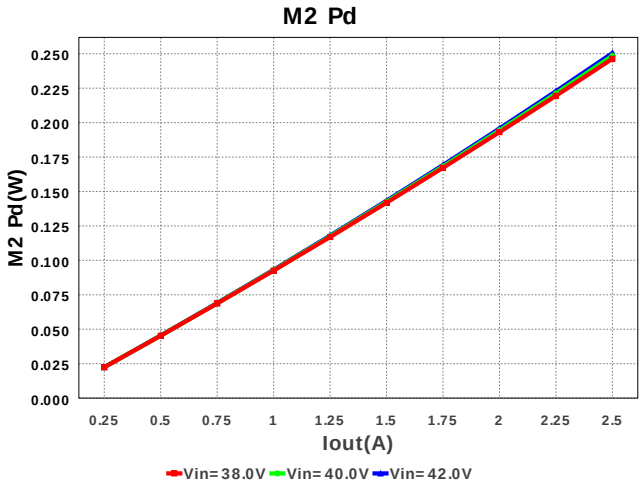


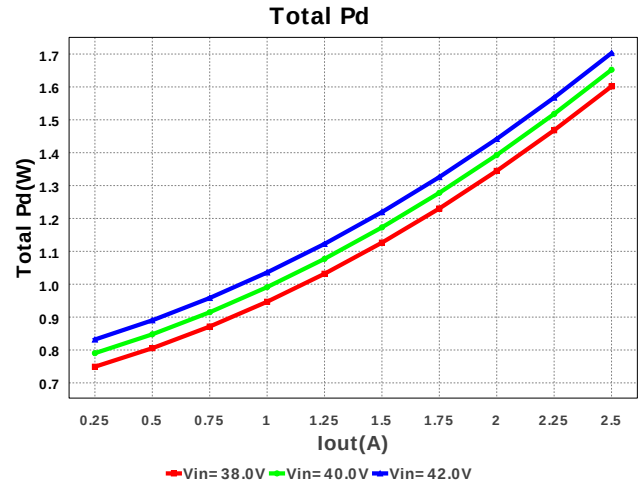
Pout

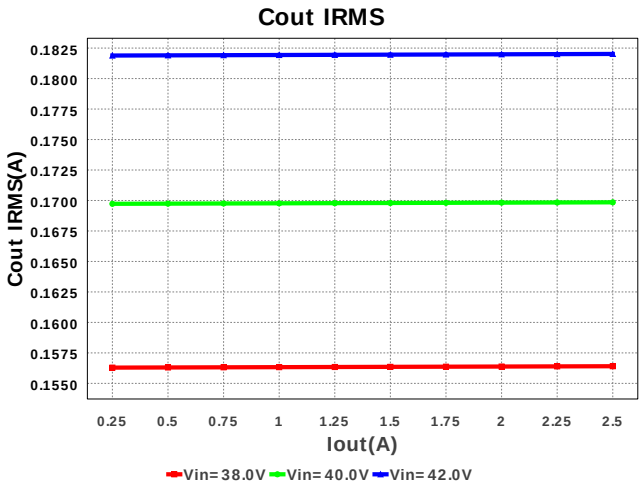


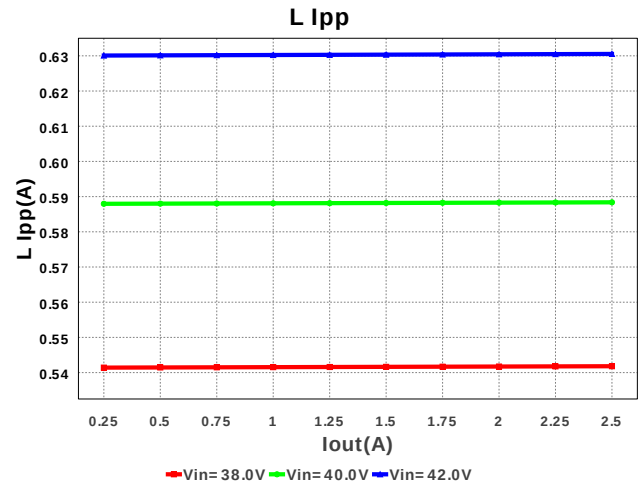


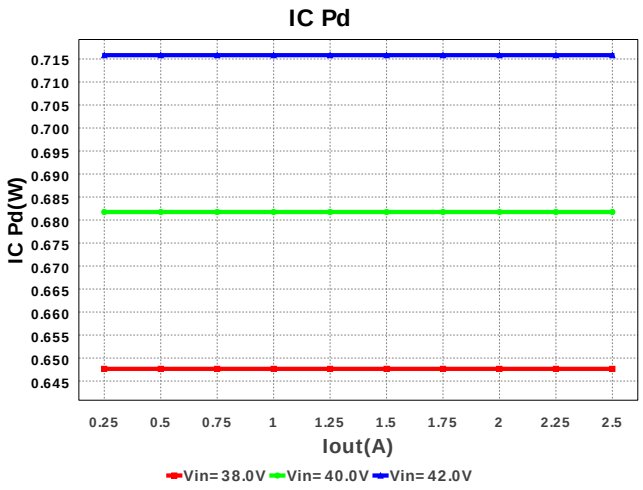


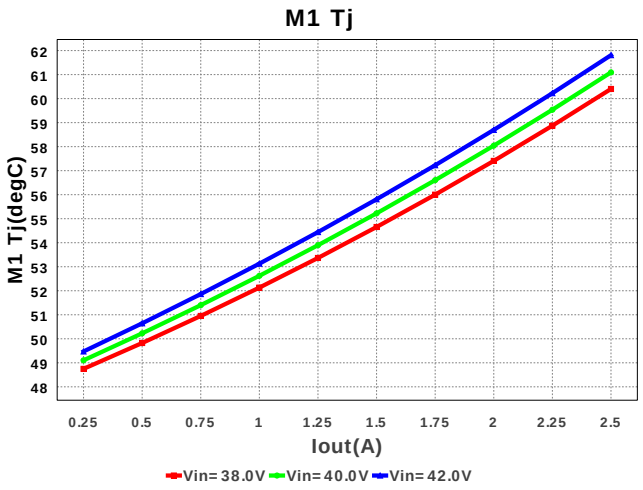


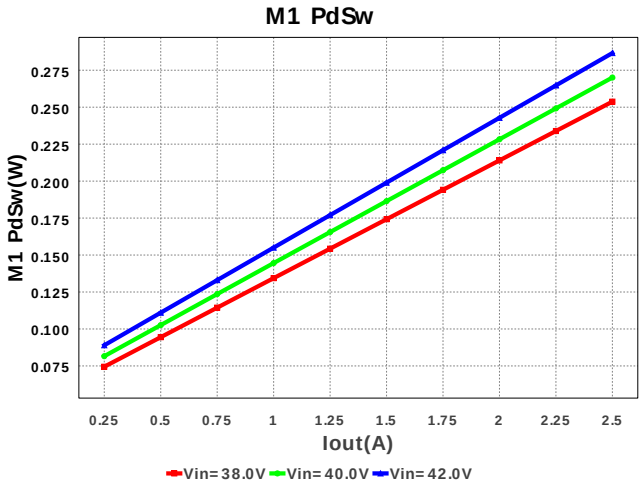


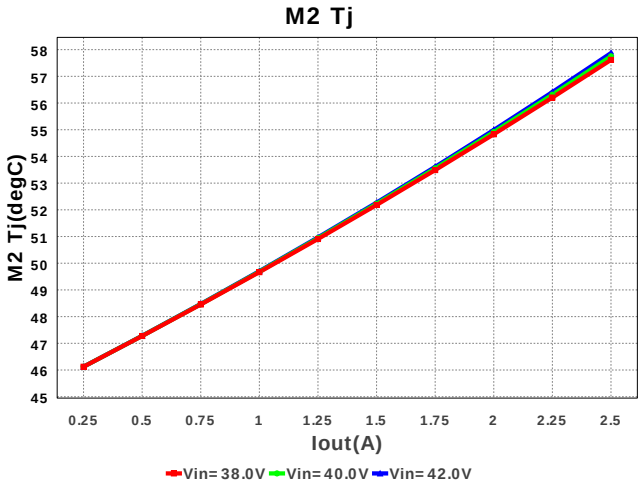


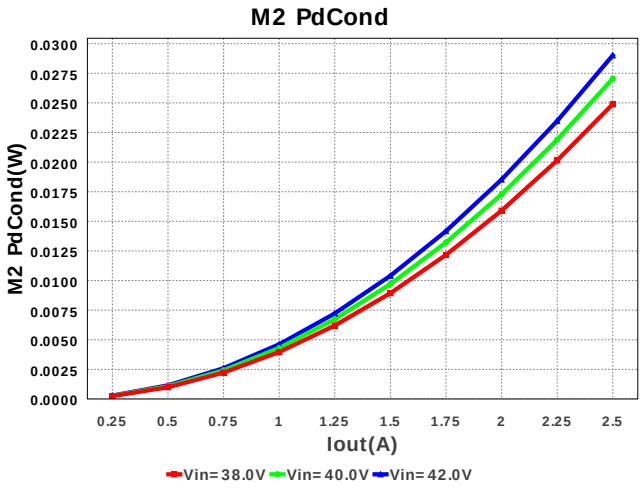


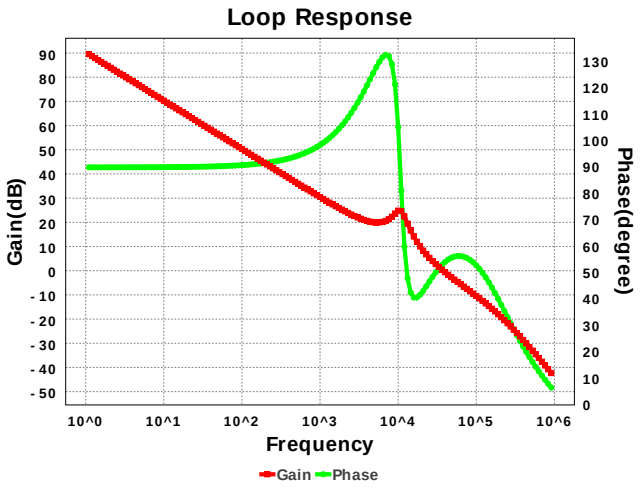












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	1.236 A	Current	Input capacitor RMS ripple current
2.	Cout IRMS	182.019 mA	Current	Output capacitor RMS ripple current
3.	Iin Avg	1.469 A	Current	Average input current
4.	L Ipp	630.533 mA	Current	Peak-to-peak inductor ripple current
5.	SW Ipk	2.815 A	Current	Peak switch current
6.	BOM Count	27	General	Total Design BOM count
7.	FootPrint	480.0 mm2	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	60.0 W	General	Total output power
11.	Total BOM	$4.91	General	Total BOM Cost

#	Name	Value	Category	Description
12.	Cross Freq	37.773 kHz	Op_point	Bode plot crossover frequency
13.	Duty Cycle	57.366 %	Op_point	Duty cycle
14.	Efficiency	97.24 %	Op_point	Steady state efficiency
15.	IC Tj	70.054 degC	Op_point	IC junction temperature
16.	IOUT_OP	2.5 A	Op_point	Iout operating point
17.	M1 Tj	61.808 degC	Op_point	M1 MOSFET junction temperature
18.	M2 Tj	57.872 degC	Op_point	M2 MOSFET junction temperature
19.	Phase Marg	53.55 deg	Op_point	Bode Plot Phase Margin
20.	VIN_OP	42.0 V	Op_point	Vin operating point
21.	Vout p-p	48.166 mV	Op_point	Peak-to-peak output ripple voltage
22.	Cin Pd	8.346 mW	Power	Input capacitor power dissipation
23.	Cout Pd	99.393 µW	Power	Output capacitor power dissipation
24.	IC Pd	715.829 mW	Power	IC power dissipation
25.	L Pd	398.438 mW	Power	Inductor power dissipation
26.	M1 Pd	329.678 mW	Power	M1 MOSFET total power dissipation
27.	M1 PdCond	43.067 mW	Power	M1 MOSFET conduction losses
28.	M1 PdSw	286.611 mW	Power	M1 MOSFET switching losses
29.	M2 Pd	250.52 mW	Power	M2 MOSFET total power dissipation
30.	M2 PdCond	29.054 mW	Power	M2 MOSFET conduction losses
31.	M2 PdSw	221.465 mW	Power	M2 MOSFET switching losses
32.	Total Pd	1.703 W	Power	Total Power Dissipation

Design Inputs

#	Name	Value	Description
1.	Iout	2.5 A	Maximum Output Current
2.	Iout1	2.5 Amps	Output Current #1
3.	VinMax	42.0 V	Maximum input voltage
4.	VinMin	38.0 V	Minimum input voltage
5.	Vout	24.0 V	Output Voltage
6.	Vout1	24.0 Volt	Output Voltage #1
7.	base_pn	TPS40170	Base Product Number
8.	source	DC	Input Source Type
9.	Ta	45.0 degC	Ambient temperature

Design Assistance

1. **TPS40170** Product Folder : http://www.ti.com/product/tps40170 : contains the data sheet and other resources.