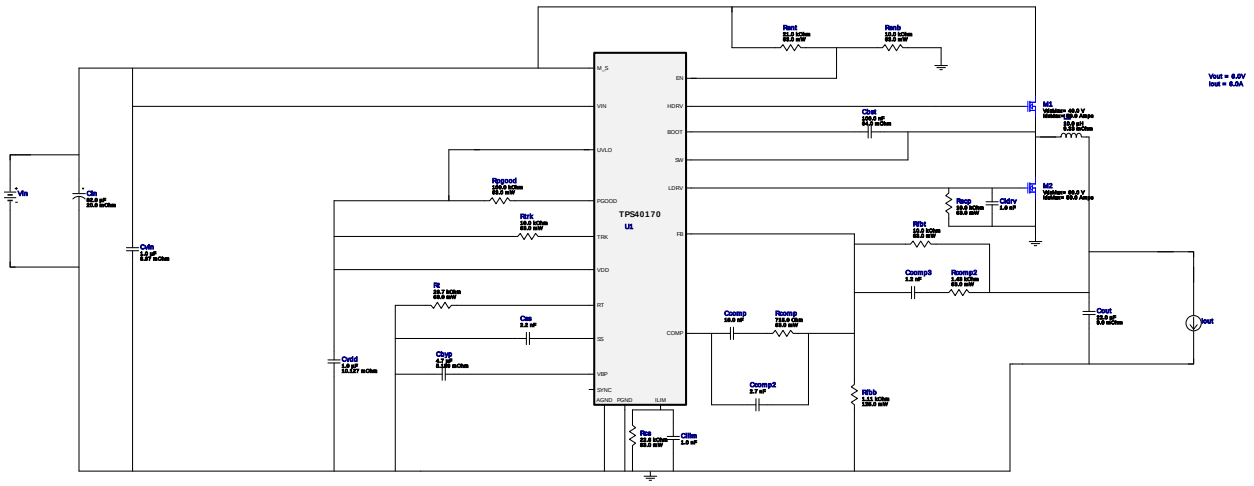
WEBENCH® Design Report

VinMin = 6.9V
VinMax = 25.0V
Vout = 6.0V
Iout = 6.0A

Device = TPS40170RGYR
Topology = Buck
Created = 10/18/16 8:25:15 AM
BOM Cost = $5.57
BOM Count = 27
Total Pd = 1.97W

Design : 4797751/41 TPS40170RGYR
TPS40170RGYR 6.9V-25.0V to 6.00V @ 6.0A



My Comments

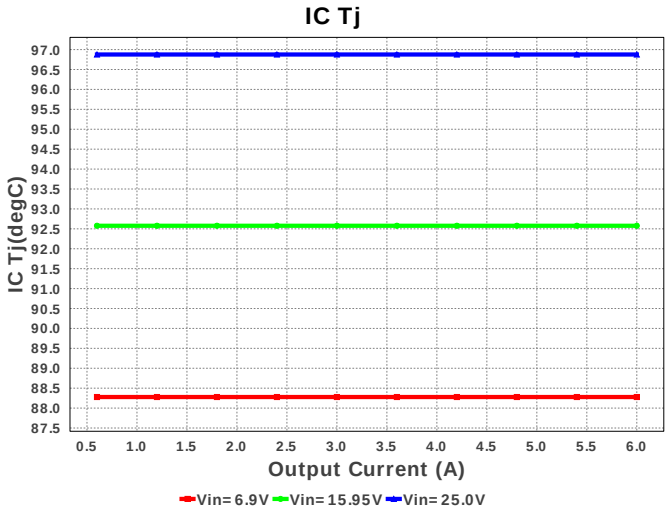
No comments

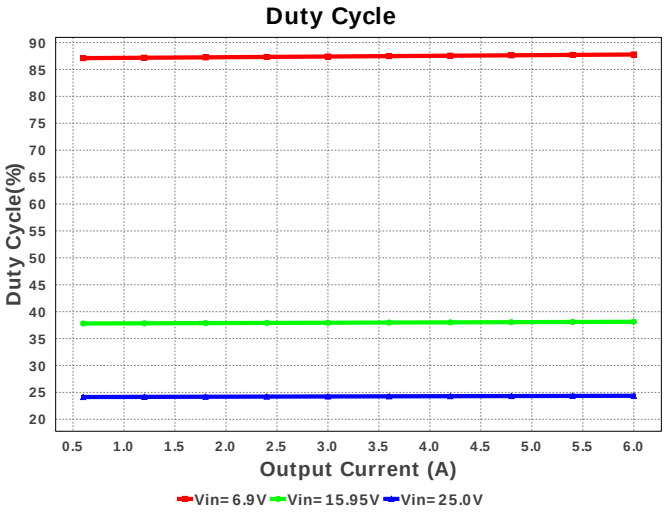
Electrical BOM

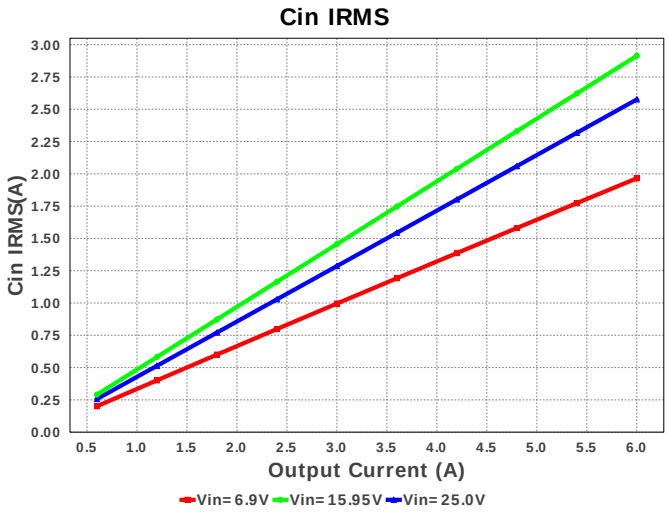
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbst	Kemet	C0805C104K5RACTU Series= X7R	Cap= 100.0 nF ESR= 64.0 mOhm VDC= 50.0 V IRMS= 1.64 A	1	$0.01	0805 7 mm²
2.	Cbyp	MuRata	GRM21BR61E475KA12L Series= X5R	Cap= 4.7 uF ESR= 5.189 mOhm VDC= 25.0 V IRMS= 2.03531 A	1	$0.02	0805 7 mm²
3.	Ccomp	Yageo America	CC0805KRX7R9BB183 Series= X7R	Cap= 18.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
4.	Ccomp2	Yageo America	CC0805KRX7R9BB272 Series= X7R	Cap= 2.7 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
5.	Ccomp3	Samsung Electro-Mechanics	CL21C122JBFNNWE Series= C0G/NP0	Cap= 1.2 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	Panasonic	35SVPF82M Series= ?	Cap= 82.0 uF ESR= 20.0 mOhm VDC= 35.0 V IRMS= 4.0 A	1	$0.61	CAPSMT_62_E12 106 mm²
8.	Cldrv	MuRata	GRM216R71E102KA01D Series= X7R	Cap= 1.0 nF VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
9.	Cout	MuRata	GRM21BR60J226ME39L Series= X5R	Cap= 22.0 uF ESR= 9.0 mOhm VDC= 6.3 V IRMS= 3.5 A	1	$0.04	0805 7 mm²

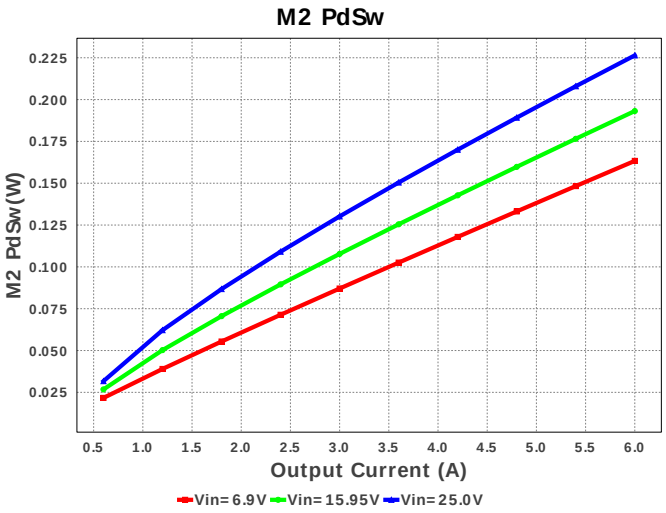
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	Css	MuRata	GRM033R70J222KA01D Series= X7R	Cap= 2.2 nF VDC= 6.3 V IRMS= 0.0 A	1	$0.01	0201 2 mm²
11.	Cvdd	MuRata	GRM188R61C105KA93D Series= X5R	Cap= 1.0 uF ESR= 10.127 mOhm VDC= 16.0 V IRMS= 994.63 mA	1	$0.01	0603 5 mm²
12.	Cvin	TDK	C3216X5R1H105K Series= X5R	Cap= 1.0 uF ESR= 8.97 mOhm VDC= 50.0 V IRMS= 0.0 A	1	$0.02	1206 11 mm²
13.	L1	Vishay-Dale	IHLP6767DZER100M11	L= 10.0 µH DCR= 9.33 mOhm	1	$2.54	 IHLP-6767DZ 369 mm²
14.	M1	Texas Instruments	CSD18504Q5A	VdsMax= 40.0 V IdsMax= 50.0 Amps	1	$0.33	 TRANS_NexFET_Q5A 55 mm²
15.	M2	Texas Instruments	CSD18537NQ5A	VdsMax= 60.0 V IdsMax= 50.0 Amps	1	$0.28	 TRANS_NexFET_Q5A 55 mm²
16.	Rcomp	Vishay-Dale	CRCW0402715RFKED Series= CRCW..e3	Res= 715.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
17.	Rcomp2	Vishay-Dale	CRCW04021K43FKED Series= CRCW..e3	Res= 1.43 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
18.	Rcs	Vishay-Dale	CRCW040222K6FKED Series= CRCW..e3	Res= 22.6 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
19.	Renb	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
20.	Rent	Vishay-Dale	CRCW040221K0FKED Series= CRCW..e3	Res= 21.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
21.	Rfbb	Yageo America	RT0805BRD071K11L Series= RT0805	Res= 1.11 kOhm Power= 125.0 mW Tolerance= 0.1%	1	$0.05	0805 7 mm²
22.	Rfbt	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
23.	Rpgood	Vishay-Dale	CRCW0402100KFKED Series= CRCW..e3	Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
24.	Rscp	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
25.	Rt	Vishay-Dale	CRCW040226K7FKED Series= CRCW..e3	Res= 26.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
26.	Rtrk	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
27.	U1	Texas Instruments	TPS40170RGYR	Switcher	1	$1.50	 RGY0020A 25 mm^2

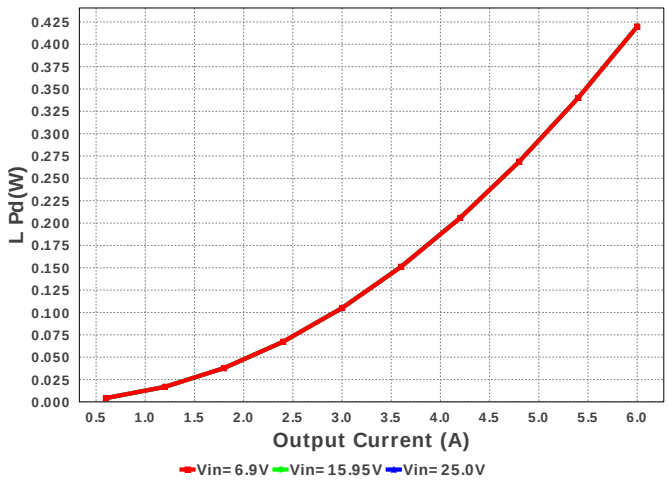




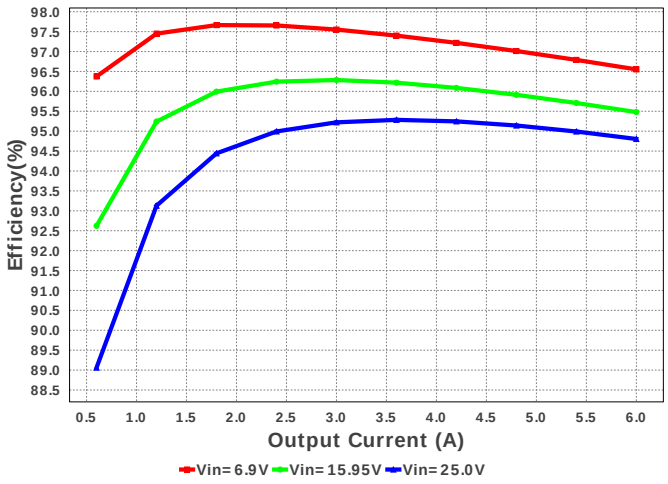




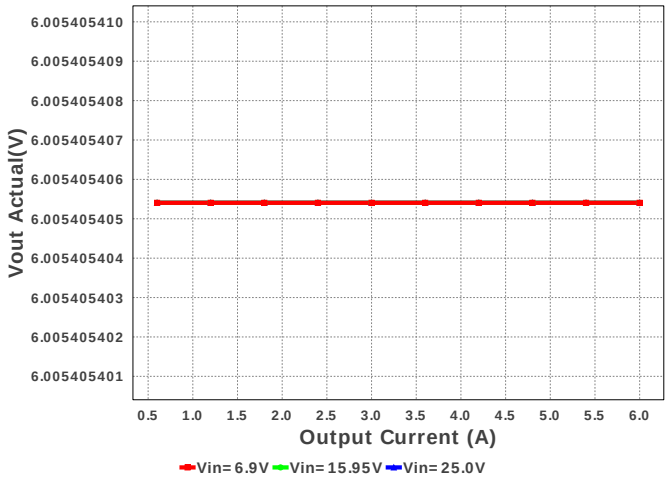
L Pd



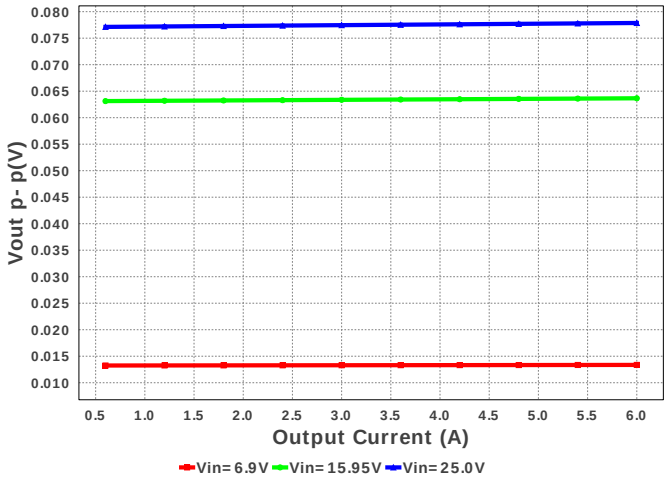
Efficiency



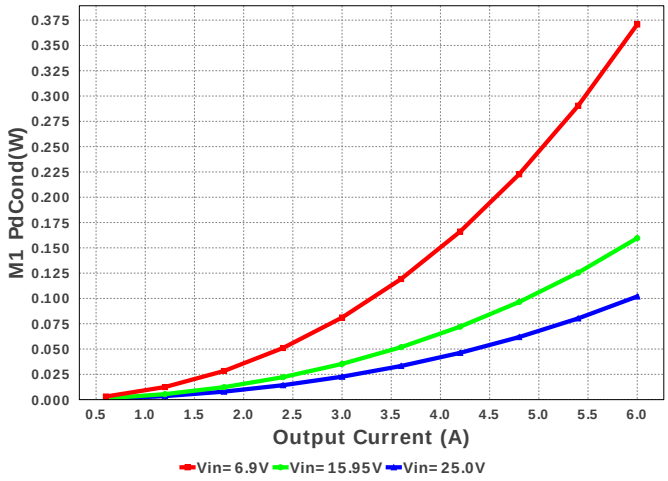
Vout Actual



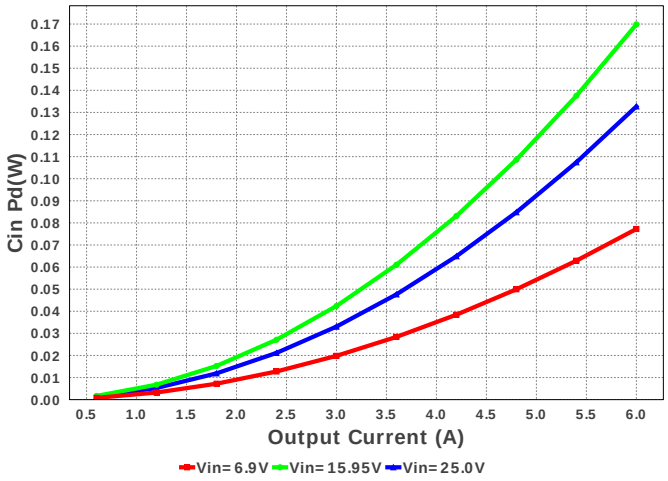
Vout p- p

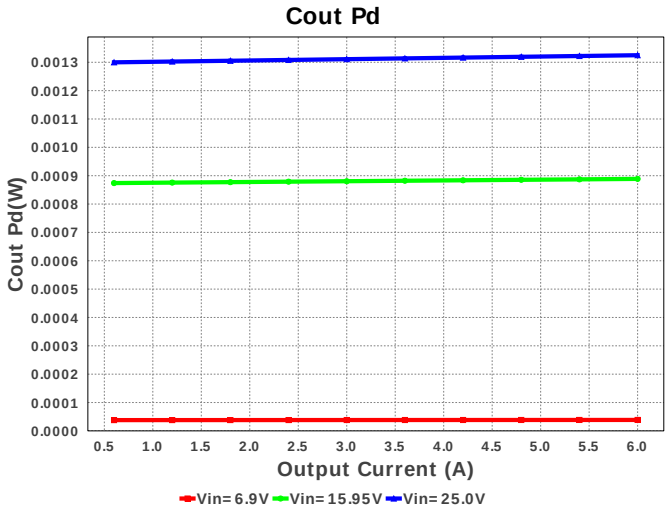


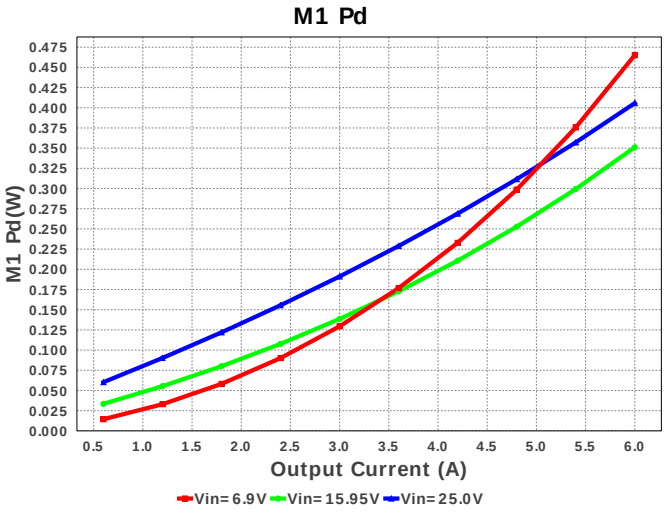
M1 PdCond

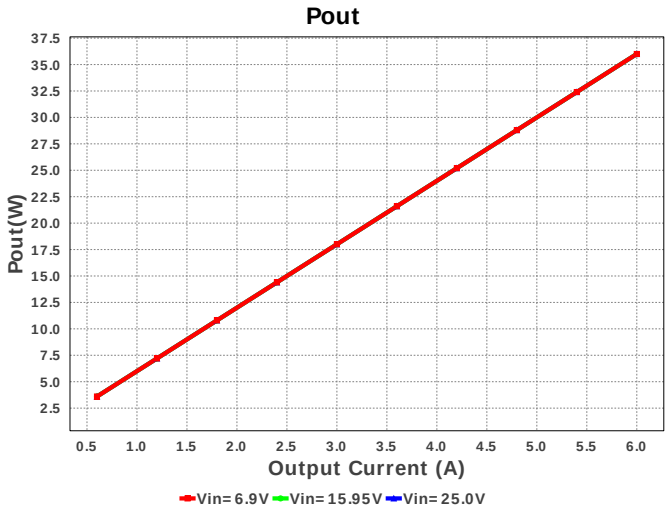


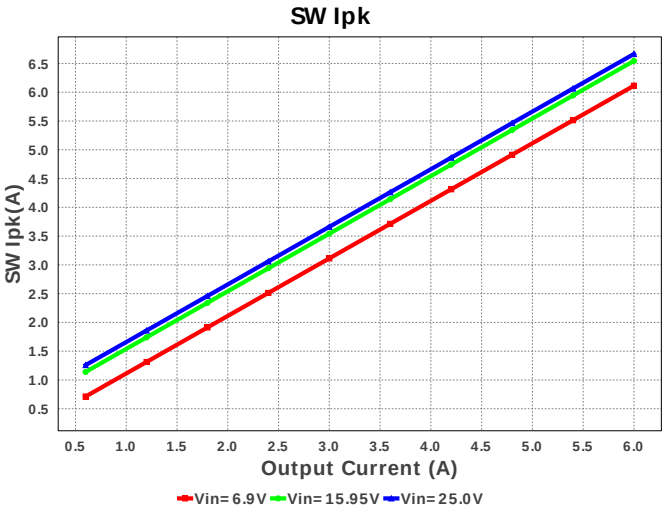
Cin Pd

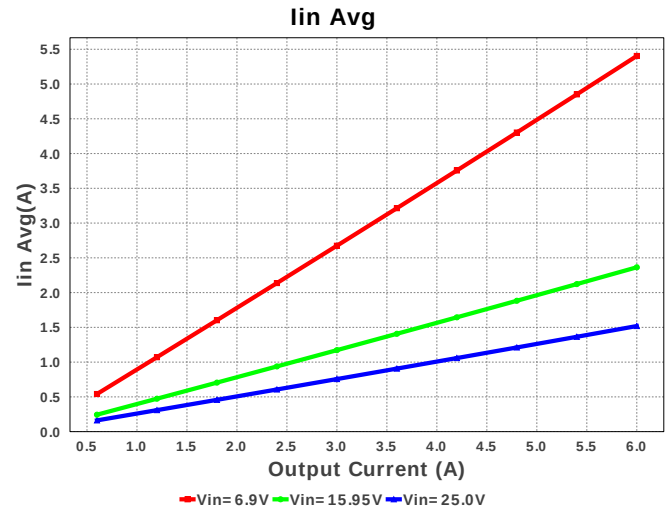


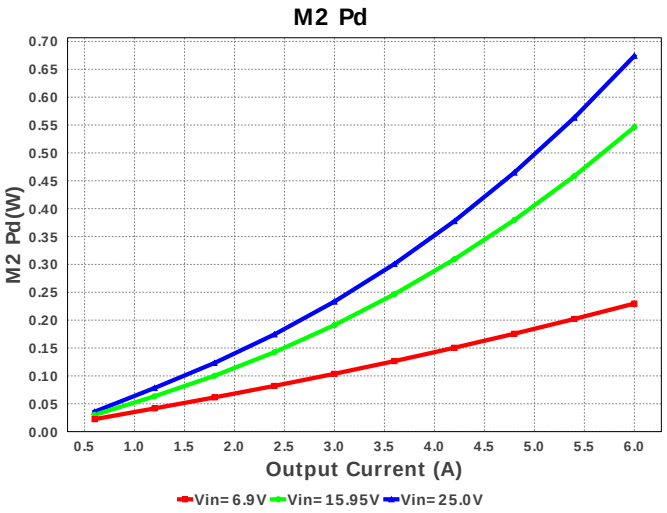


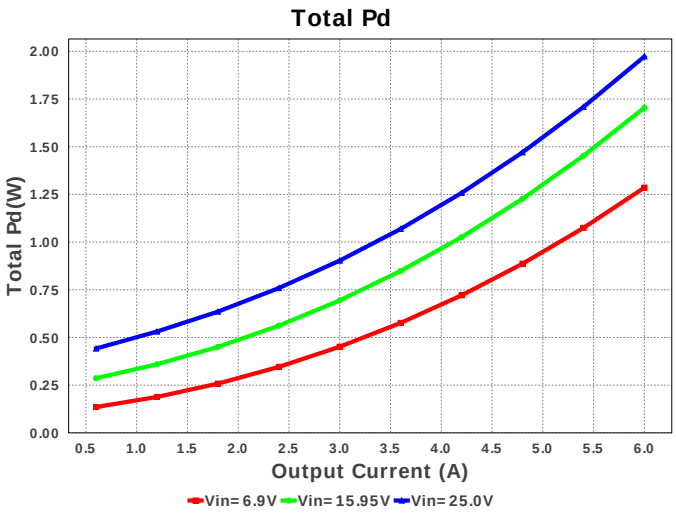


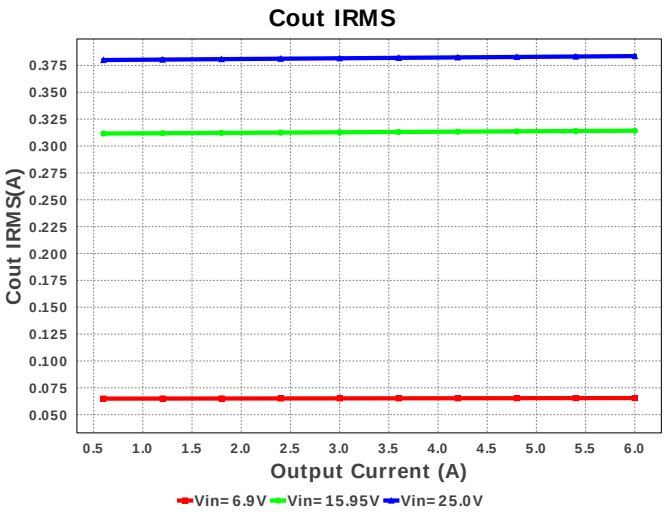


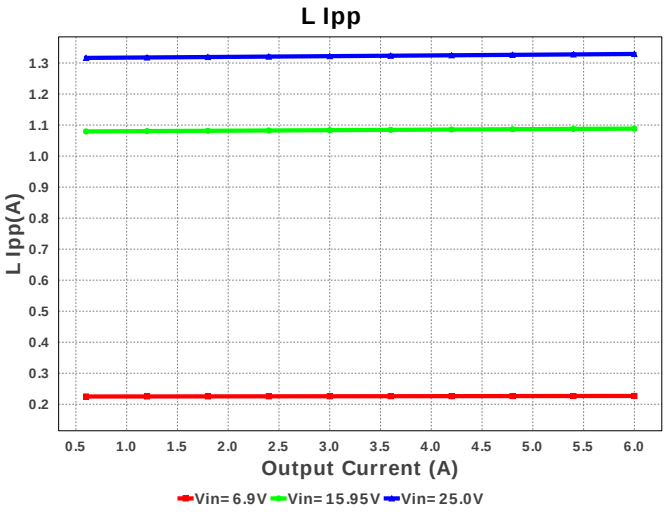


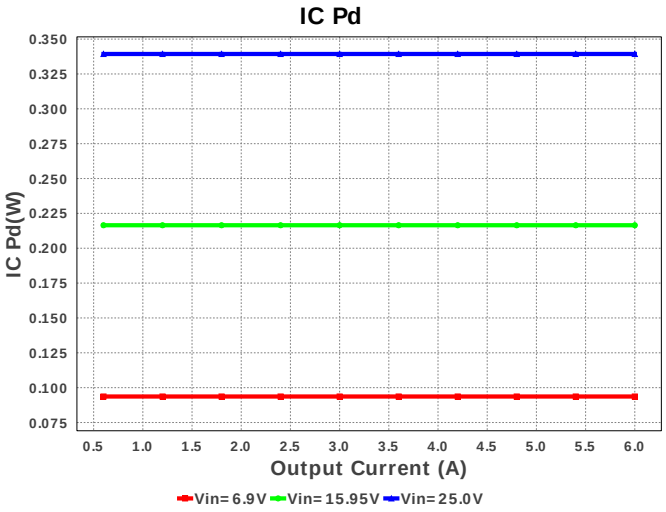


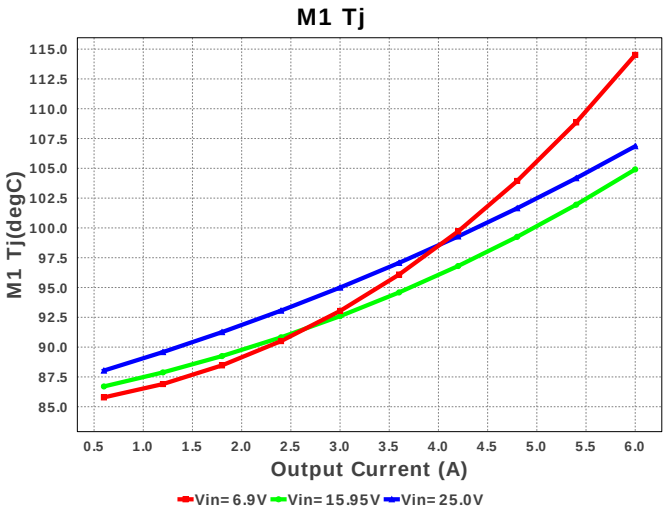


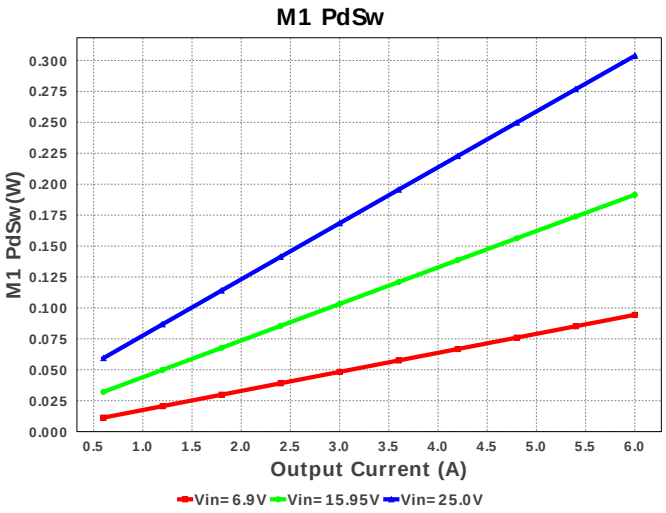


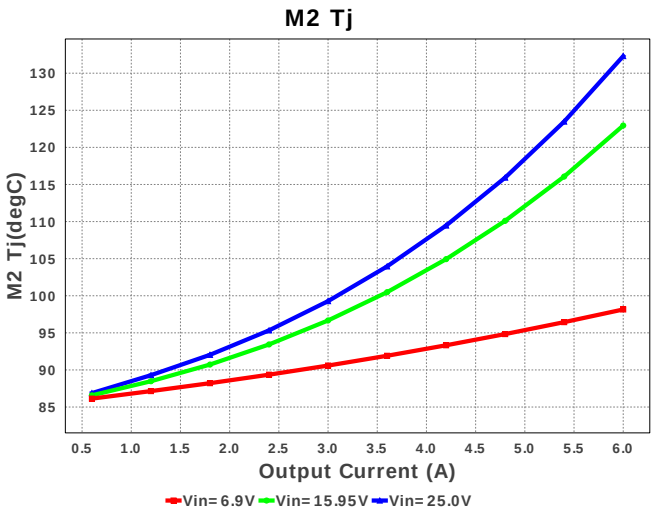


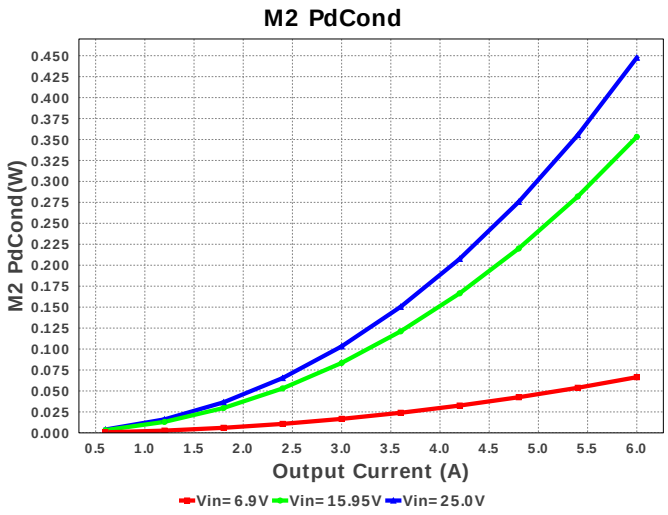


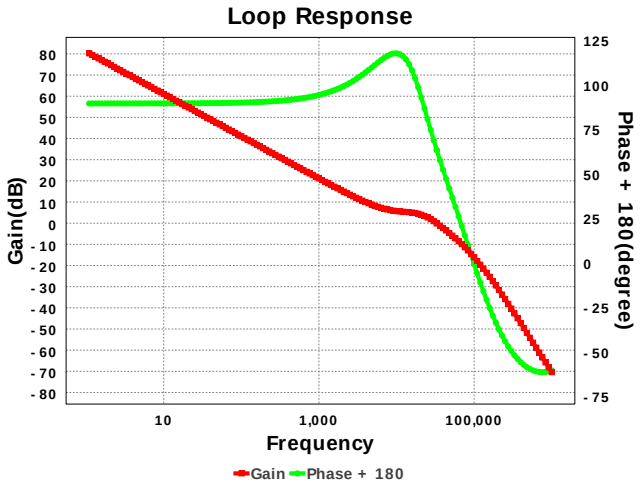












Operating Values

#	Name	Value	Category	Description
1.	BOM Count	27		Total Design BOM count
2.	Total BOM	$5.57		Total BOM Cost
3.	Cin IRMS	2.576 A	Current	Input capacitor RMS ripple current
4.	Cout IRMS	383.683 mA	Current	Output capacitor RMS ripple current
5.	Iin Avg	1.519 A	Current	Average input current
6.	L Ipp	1.329 A	Current	Peak-to-peak inductor ripple current
7.	SW Ipk	6.665 A	Current	Peak switch current
8.	FootPrint	719.0 mm^2	General	Total Foot Print Area of BOM components
9.	Frequency	348.432 kHz	General	Switching frequency
10.	IC Tolerance	6.0 µV	General	IC Feedback Tolerance
11.	Mode	CCM	General	Conduction Mode
12.	Pout	36.0 W	General	Total output power
13.	Low Freq Gain	80.274 dB	Op_Point	Gain at 10Hz
14.	Vout Actual	6.005 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
15.	Cross Freq	32.889 kHz	Op_point	Bode plot crossover frequency
16.	Duty Cycle	24.374 %	Op_point	Duty cycle
17.	Efficiency	94.804 %	Op_point	Steady state efficiency
18.	Gain Marg	-16.069 dB	Op_point	Bode Plot Gain Margin
19.	IC Tj	96.877 degC	Op_point	IC junction temperature
20.	IOUT_OP	6.0 A	Op_point	Iout operating point
21.	M1 Tj	106.853 degC	Op_point	M1 MOSFET junction temperature
22.	M2 Tj	132.304 degC	Op_point	M2 MOSFET junction temperature
23.	Phase Marg	63.993 deg	Op_point	Bode Plot Phase Margin
24.	VIN_OP	25.0 V	Op_point	Vin operating point
25.	Vout p-p	77.865 mV	Op_point	Peak-to-peak output ripple voltage
26.	Cin Pd	132.718 mW	Power	Input capacitor power dissipation
27.	Cout Pd	1.325 mW	Power	Output capacitor power dissipation
28.	IC Pd	339.329 mW	Power	IC power dissipation
29.	L Pd	419.85 mW	Power	Inductor power dissipation
30.	M1 Pd	405.712 mW	Power	M1 MOSFET total power dissipation
31.	M1 PdCond	101.94 mW	Power	M1 MOSFET conduction losses

#	Name	Value	Category	Description
32.	M1 PdSw	303.773 mW	Power	M1 MOSFET switching losses
33.	M2 Pd	674.003 mW	Power	M2 MOSFET total power dissipation
34.	M2 PdCond	447.585 mW	Power	M2 MOSFET conduction losses
35.	M2 PdSw	226.418 mW	Power	M2 MOSFET switching losses
36.	Total Pd	1.973 W	Power	Total Power Dissipation
37.	Vout Tolerance	992.1 m%		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	6.0	Maximum Output Current
2.	VinMax	25.0	Maximum input voltage
3.	VinMin	6.9	Minimum input voltage
4.	Vout	6.0	Output Voltage
5.	base_pn	TPS40170	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	85.0	Ambient temperature

Design Assistance

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