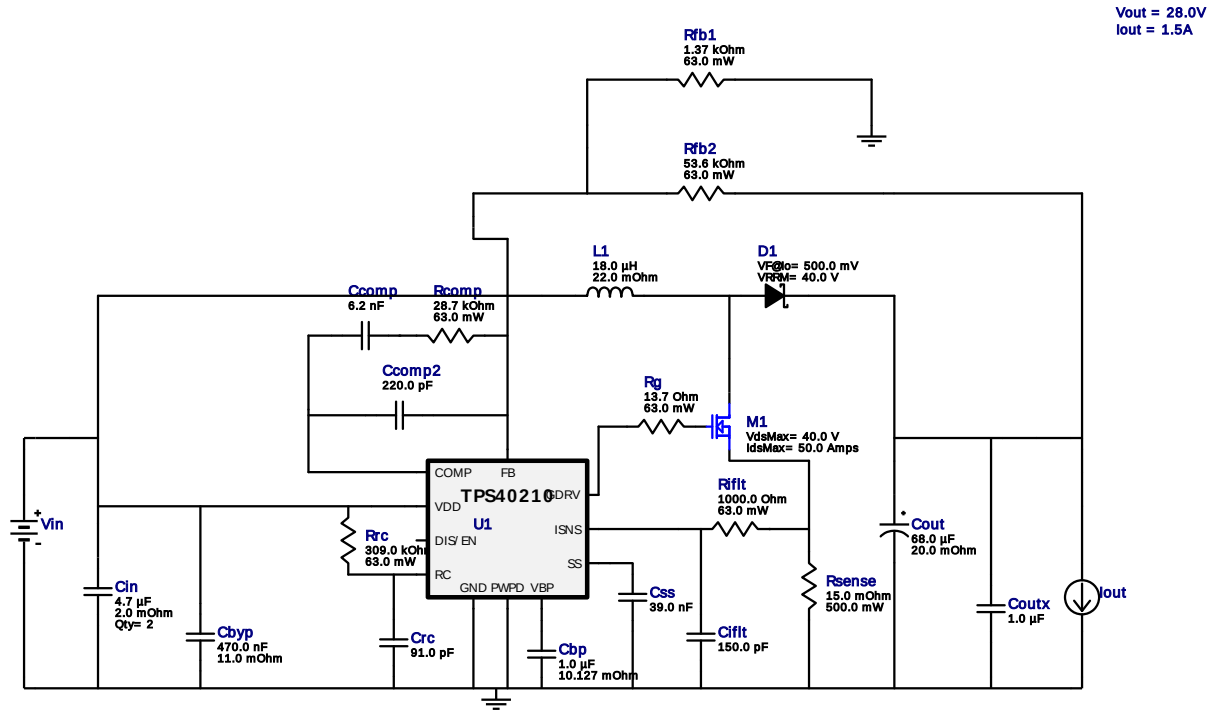
WEBENCH® Design Report

VinMin = 10.0V
VinMax = 14.4V
Vout = 28.0V
Iout = 1.5A

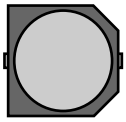
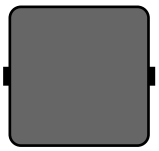
Device = TPS40210DGQR
Topology = Boost
Created = 7/11/16 4:27:40 AM
BOM Cost = $5.08
BOM Count = 22
Total Pd = 1.58W

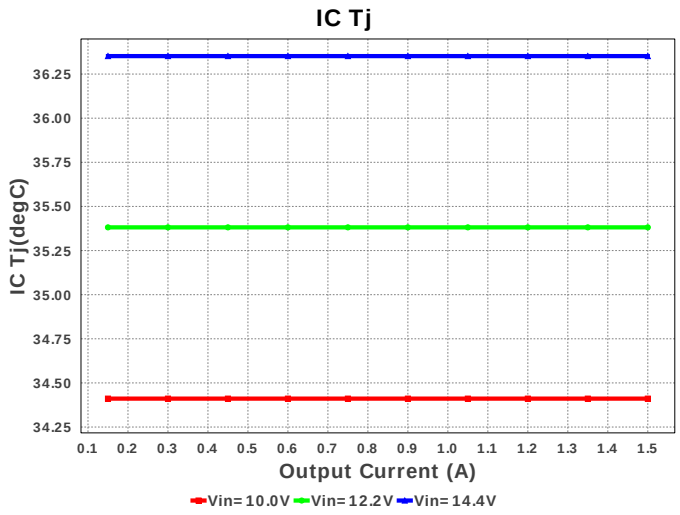
Design : 1641152/104 TPS40210DGQR
TPS40210DGQR 10.0V-14.4V to 28.09V @ 1.5A

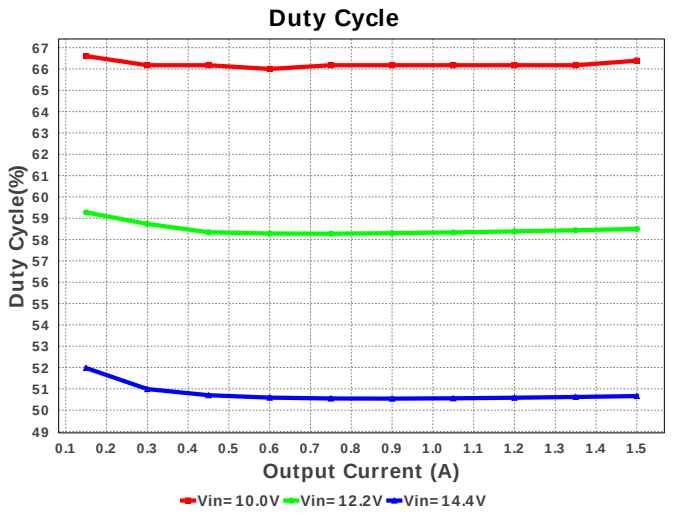


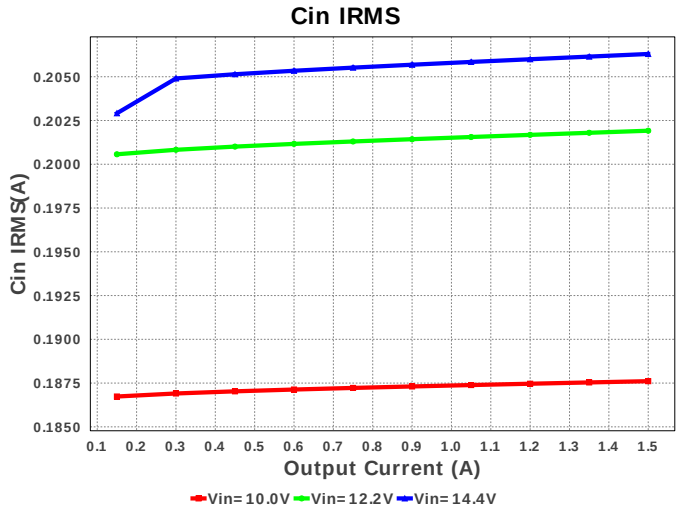
Electrical BOM

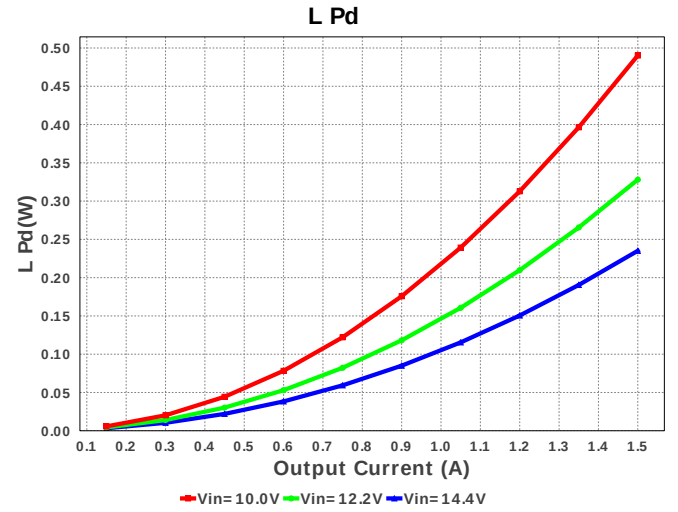
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbp	MuRata	GRM188R61C105KA93D Series= X5R	Cap= 1.0 uF ESR= 10.127 mOhm VDC= 16.0 V IRMS= 994.63 mA	1	$0.01	0603 5 mm²
2.	Cbyp	AVX	0805YC474KAT2A Series= X7R	Cap= 470.0 nF ESR= 11.0 mOhm VDC= 16.0 V IRMS= 0.0 A	1	$0.02	0805 7 mm²
3.	Ccomp	MuRata	GRM2195C1H622JA01D Series= C0G/NP0	Cap= 6.2 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.04	0805 7 mm²
4.	Ccomp2	Yageo America	CC0805JRNPO9BN221 Series= C0G/NP0	Cap= 220.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
5.	Ciflt	TDK	C2012C0G1H151J Series= C0G/NP0	Cap= 150.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
6.	Cin	MuRata	GRM21BR61E475MA12L Series= X5R	Cap= 4.7 uF ESR= 2.0 mOhm VDC= 25.0 V IRMS= 7.29 A	2	$0.02	0805 7 mm²

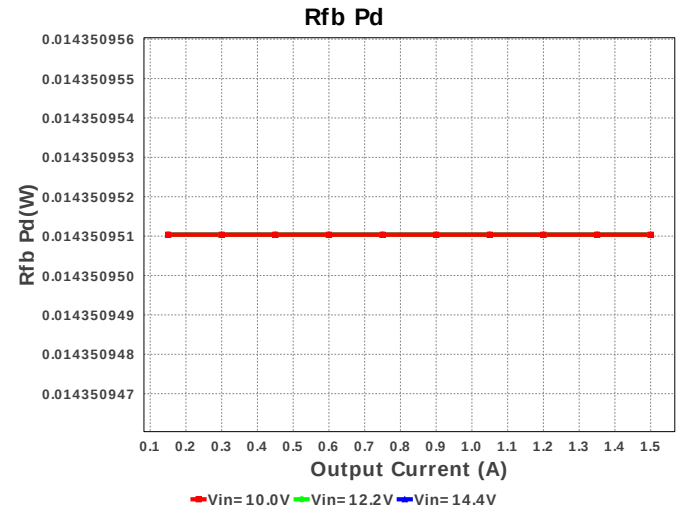
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
7.	Cout	Panasonic	50SVPF68M Series= ?	Cap= 68.0 uF ESR= 20.0 mOhm VDC= 50.0 V IRMS= 4.3 A	1	$0.92	 CAPSMT_62_F12 151 mm^2
8.	Coutx	Taiyo Yuden	GMK212B7105KG-T Series= X7R	Cap= 1.0 uF VDC= 35.0 V IRMS= 0.0 A	1	$0.05	 0805 7 mm^2
9.	Crc	Samsung 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
10.	Css	MuRata	GRM155R61A393KA01D Series= X5R	Cap= 39.0 nF VDC= 10.0 V IRMS= 0.0 A	1	$0.01	 0402 3 mm^2
11.	D1	Diodes Inc.	B240A-13-F	VF@Io= 500.0 mV VRRM= 40.0 V	1	$0.09	 SMA 37 mm^2
12.	L1	Wurth Elektronik	7443551181	L= 18.0 µH DCR= 22.0 mOhm	1	$2.34	 WE-HCA2 237 mm^2
13.	M1	Texas Instruments	CSD18504Q5A	VdsMax= 40.0 V IdsMax= 50.0 Amps	1	$0.56	 TRANS_NexFET_Q5A 55 mm^2
14.	Rcomp	Vishay-Dale	CRCW040228K7FKED Series= CRCW..e3	Res= 28.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
15.	Rfb1	Vishay-Dale	CRCW04021K37FKED Series= CRCW..e3	Res= 1.37 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
16.	Rfb2	Vishay-Dale	CRCW040253K6FKED Series= CRCW..e3	Res= 53.6 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
17.	Rg	Vishay-Dale	CRCW040213R7FKED Series= CRCW..e3	Res= 13.7 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
18.	Riflt	Vishay-Dale	CRCW04021K00FKED Series= CRCW..e3	Res= 1000.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
19.	Rrc	Vishay-Dale	CRCW0402309KFKED Series= CRCW..e3	Res= 309.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
20.	Rsense	Stackpole Electronics Inc	CSR1206FK15L0 Series= ?	Res= 15.0 mOhm Power= 500.0 mW Tolerance= 1.0%	1	$0.11	 1206 11 mm^2
21.	U1	Texas Instruments	TPS40210DGQR	Switcher	1	$0.80	 S-PDSO-G10 24 mm^2

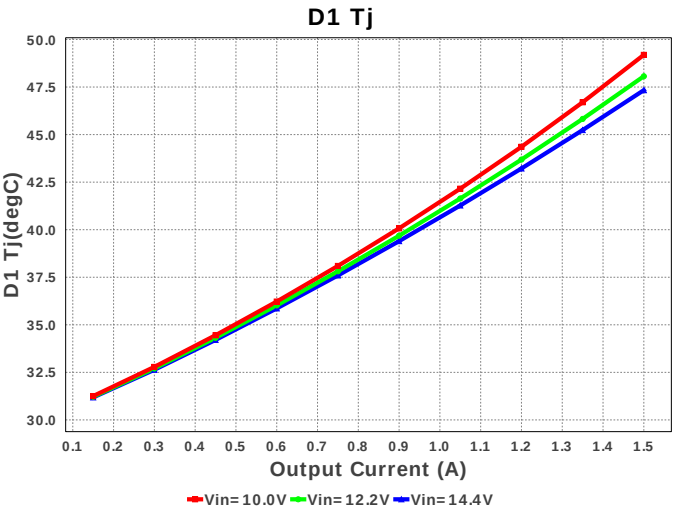


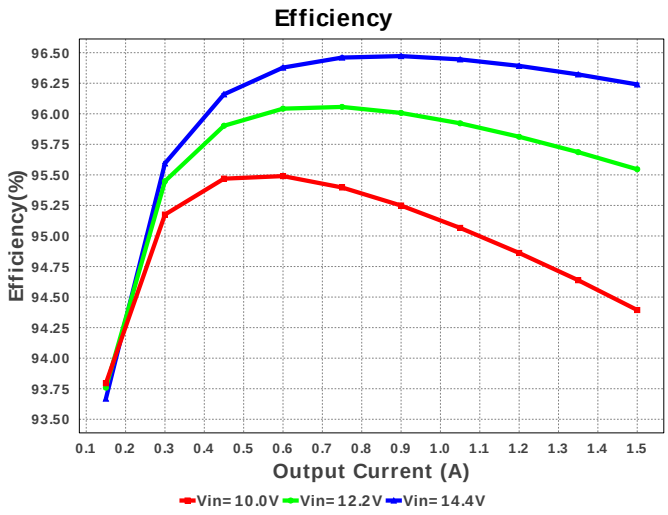


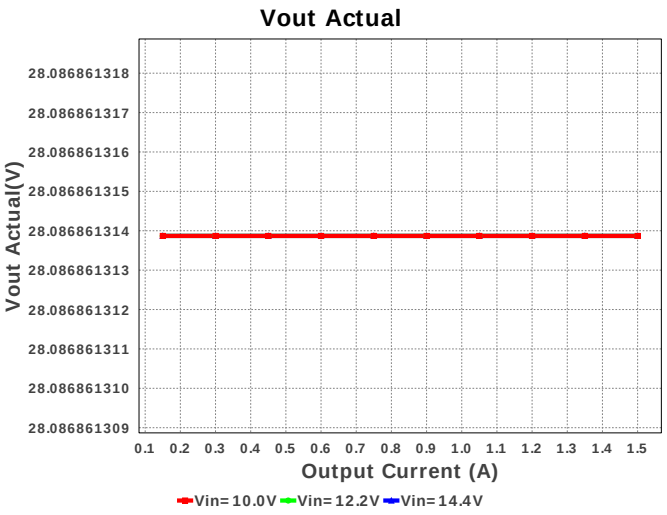


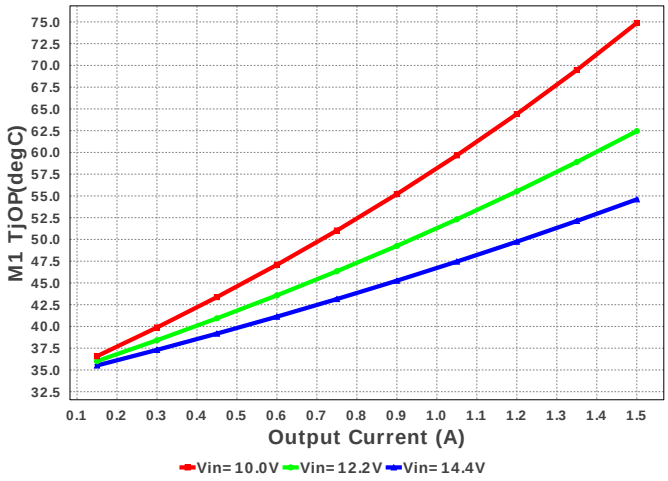


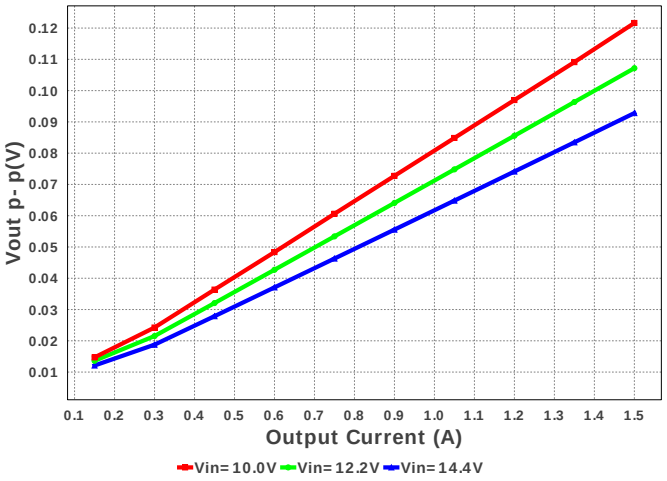


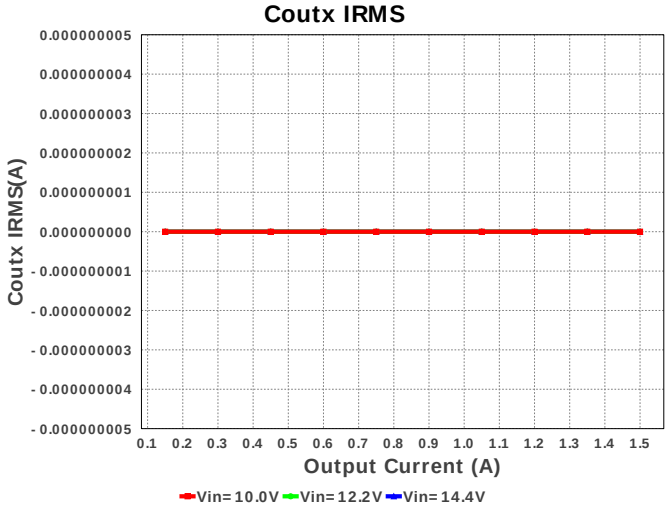


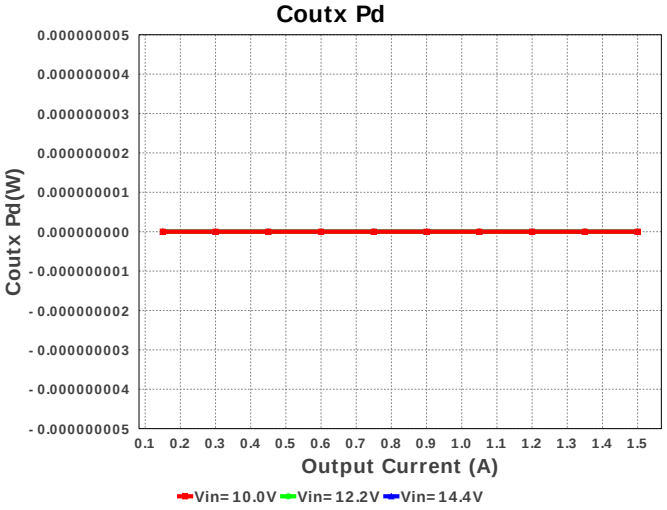


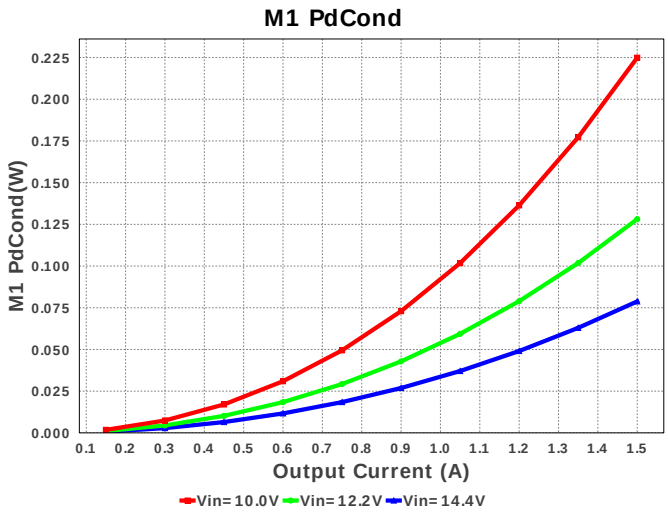


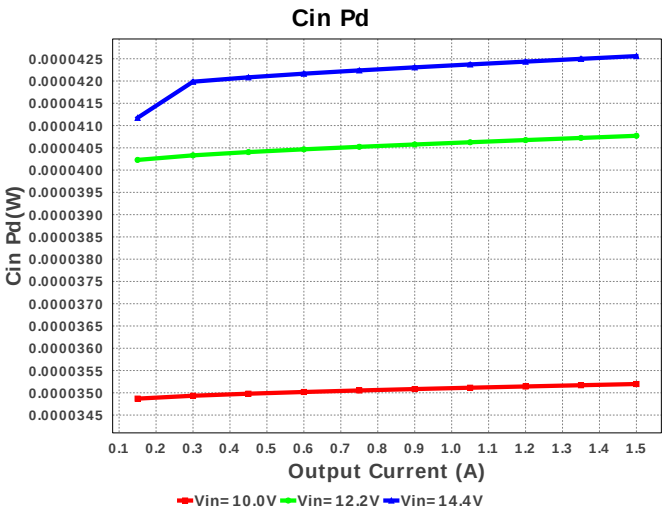


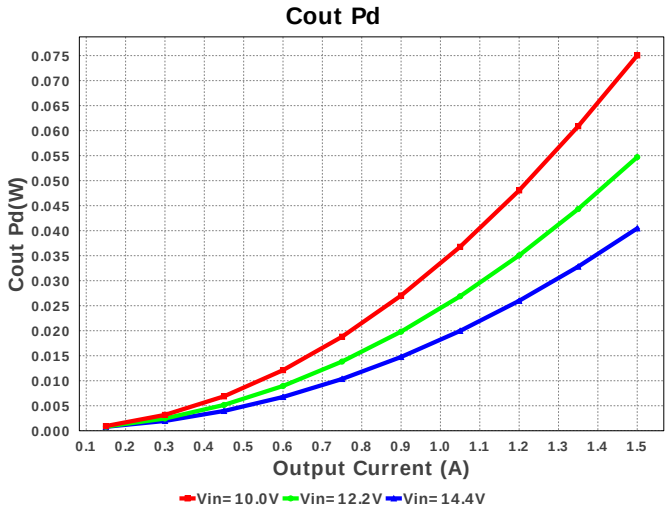


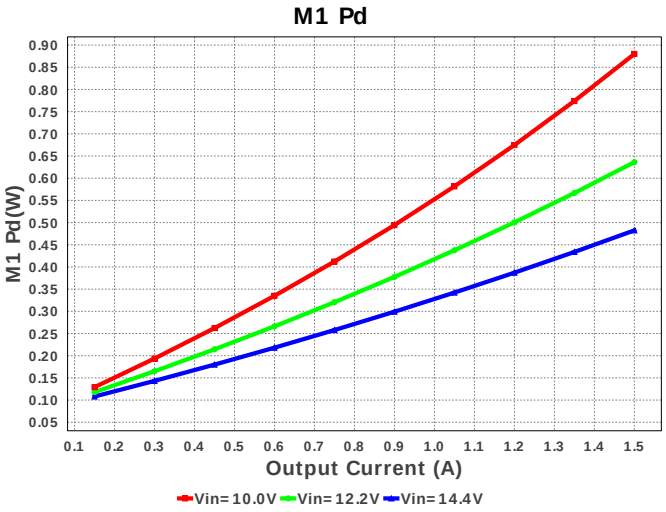


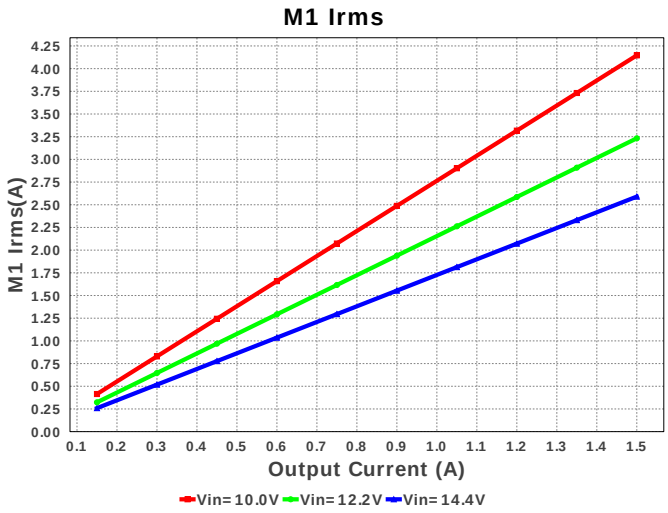


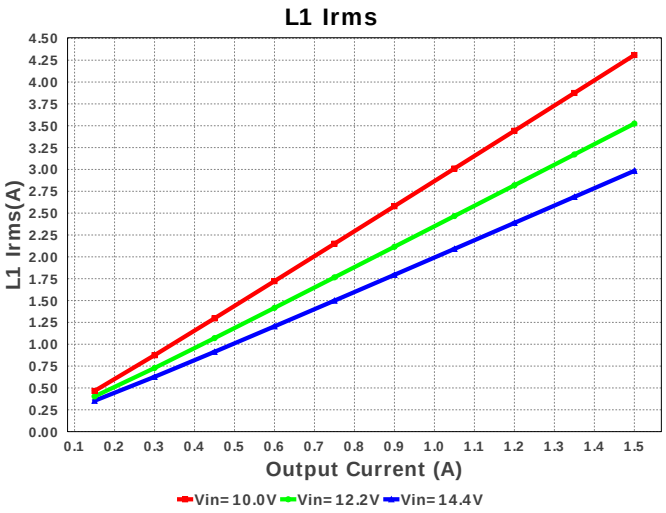


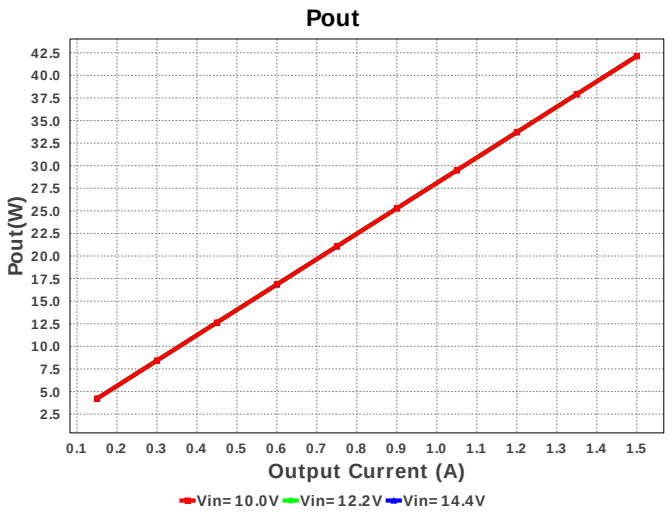


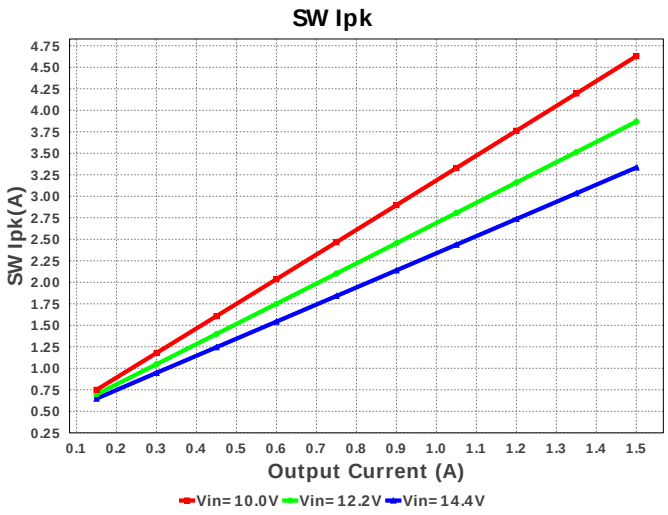


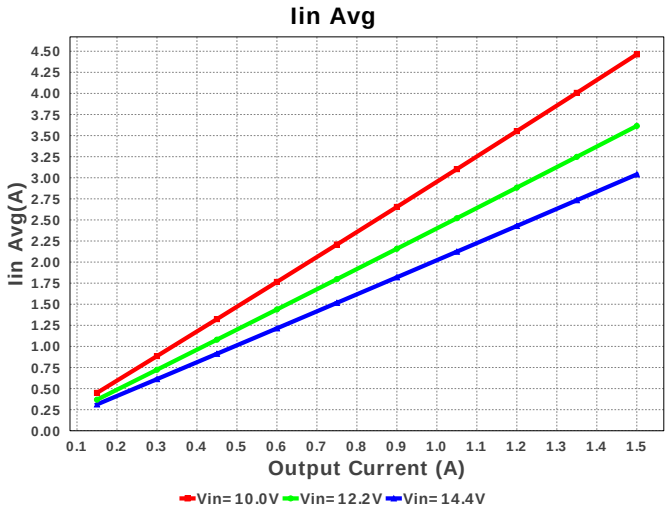


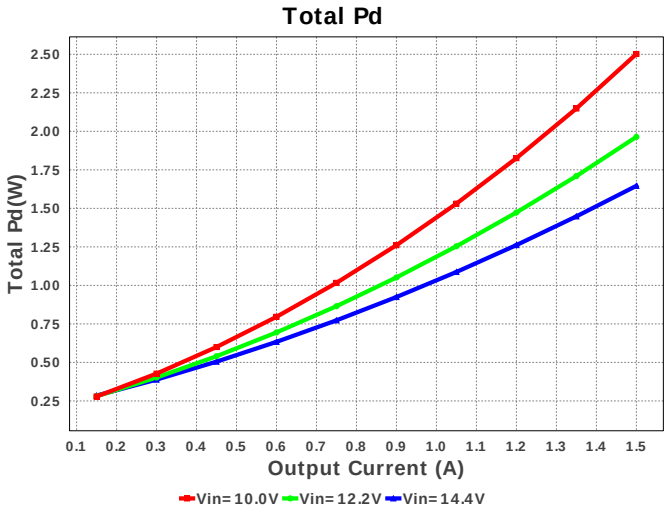


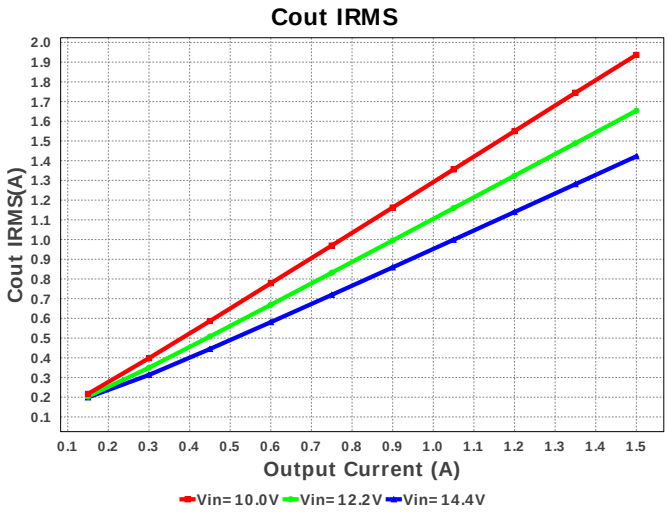


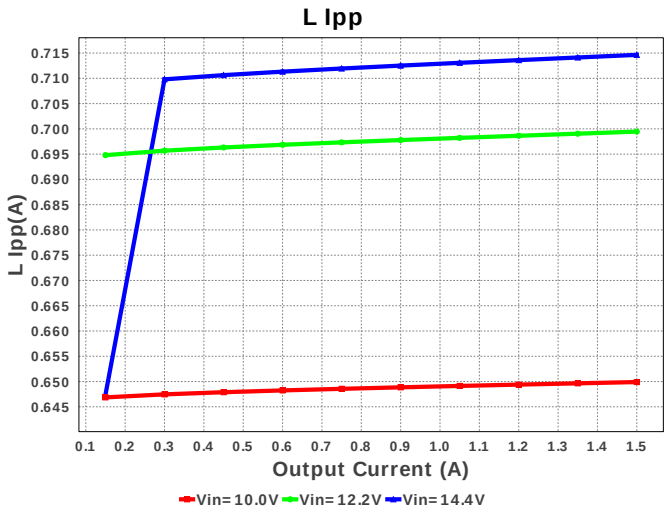


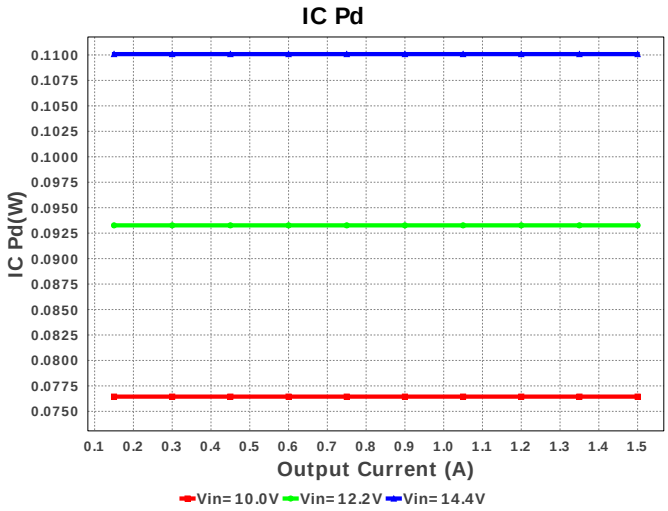


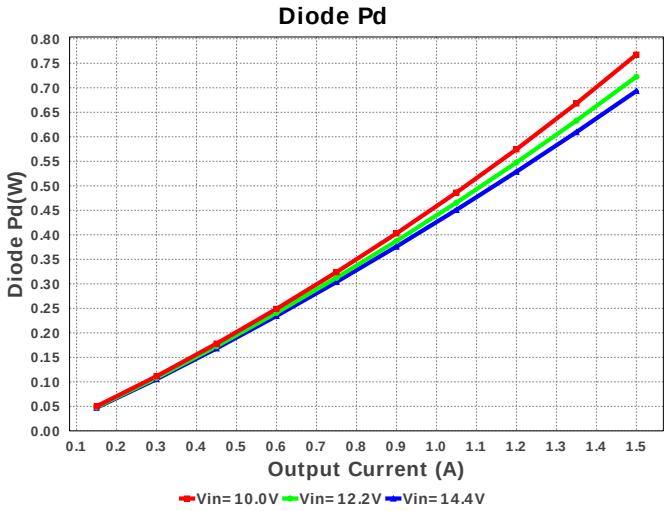


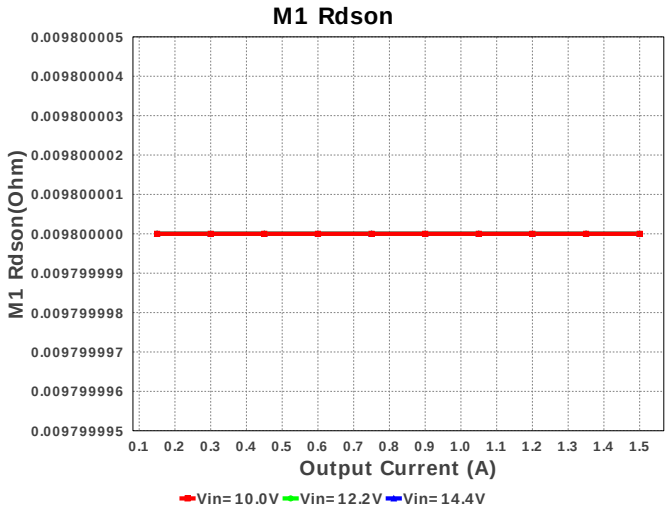


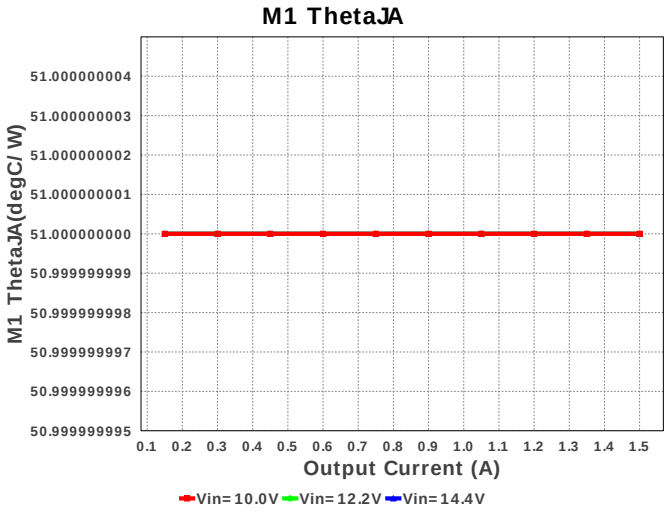


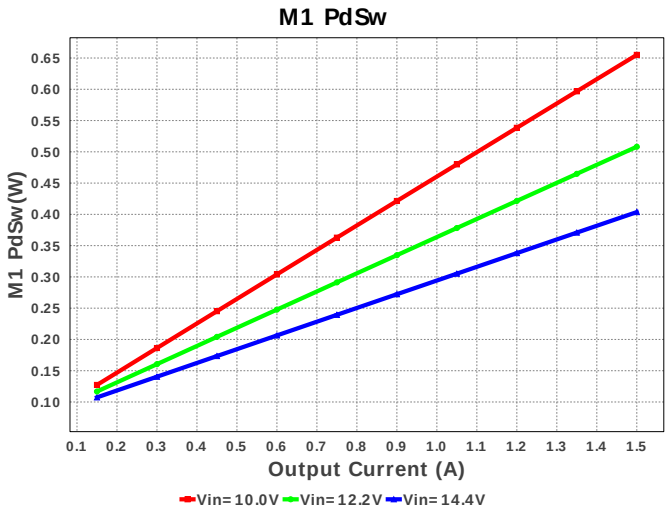


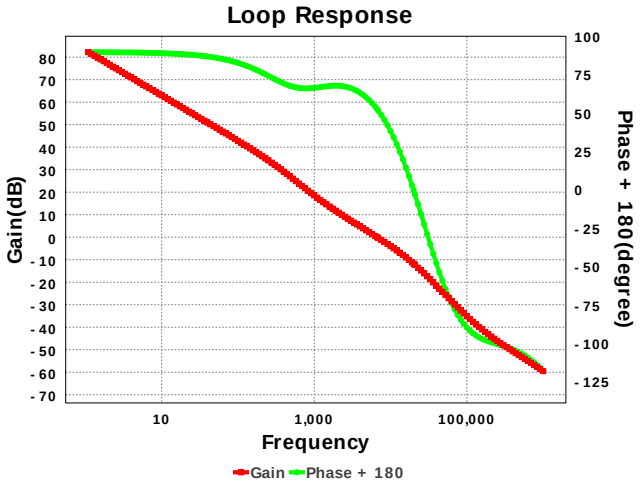












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	204.051 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	1.942 A	Current	Output capacitor RMS ripple current
3.	Coutx IRMS	0.0 A	Current	Output capacitor_x RMS ripple current
4.	Iin Avg	4.358 A	Current	Average input current
5.	L Ipp	706.85 mA	Current	Peak-to-peak inductor ripple current
6.	L1 Irms	4.28 A	Current	Inductor ripple current
7.	M1 Irms	4.13 A	Current	M1 MOSFET Irms
8.	SW Ipk	4.628 A	Current	Peak switch current
9.	BOM Count	22	General	Total Design BOM count
10.	FootPrint	595.0 mm^2	General	Total Foot Print Area of BOM components
11.	Frequency	512.777 kHz	General	Switching frequency

#	Name	Value	Category	Description
12.	IC Tolerance	10.0 mV	General	IC Feedback Tolerance
13.	M1 Rdson	9.8 mOhm	General	Drain-Source On-resistance
14.	M1 ThetaJA	51.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
15.	Pout	42.0 W	General	Total output power
16.	Total BOM	$5.08	General	Total BOM Cost
17.	D1 Tj	48.75 degC	Op_Point	D1 junction temperature
18.	Low Freq Gain	82.005 dB	Op_Point	Gain at 10Hz
19.	Vout Actual	28.087 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
20.	Vout OP	28.087 V	Op_Point	Operational Output Voltage
21.	Cross Freq	4.904 kHz	Op_point	Bode plot crossover frequency
22.	Duty Cycle	65.587 %	Op_point	Duty cycle
23.	Efficiency	96.369 %	Op_point	Steady state efficiency
24.	Gain Marg	-10.784 dB	Op_point	Bode Plot Gain Margin
25.	IC Tj	34.164 degC	Op_point	IC junction temperature
26.	ICThetaJA	57.7 degC/W	Op_point	IC junction-to-ambient thermal resistance
27.	IOUT_OP	1.5 A	Op_point	Iout operating point
28.	M1 TjOP	71.602 degC	Op_point	M1 MOSFET junction temperature
29.	Phase Marg	54.936 deg	Op_point	Bode Plot Phase Margin
30.	VIN_OP	10.0 V	Op_point	Vin operating point
31.	Vout p-p	121.047 mV	Op_point	Peak-to-peak output ripple voltage
32.	Cin Pd	41.637 µW	Power	Input capacitor power dissipation
33.	Cout Pd	75.433 mW	Power	Output capacitor power dissipation
34.	Coutx Pd	0.0 W	Power	Output capacitor_x power loss
35.	Diode Pd	750.0 mW	Power	Diode power dissipation
36.	IC Pd	72.166 mW	Power	IC power dissipation
37.	L Pd	483.576 mW	Power	Inductor power dissipation
38.	M1 Pd	815.722 mW	Power	M1 MOSFET total power dissipation
39.	M1 PdCond	219.547 mW	Power	M1 MOSFET conduction losses
40.	M1 PdSw	596.175 mW	Power	M1 MOSFET switching losses
41.	Rfb Pd	14.262 mW	Power	Rfb Power Dissipation
42.	Total Pd	1.582 W	Power	Total Power Dissipation
43.	Vout Tolerance	3.427 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	1.5	Maximum Output Current
2.	VinMax	14.4	Maximum input voltage
3.	VinMin	10.0	Minimum input voltage
4.	Vout	28.0	Output Voltage
5.	base_pn	TPS40210	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	30.0	Ambient temperature

Design Assistance

1. **TPS40210** Product Folder : http://www.ti.com/product/TPS40210 : contains the data sheet and other resources.