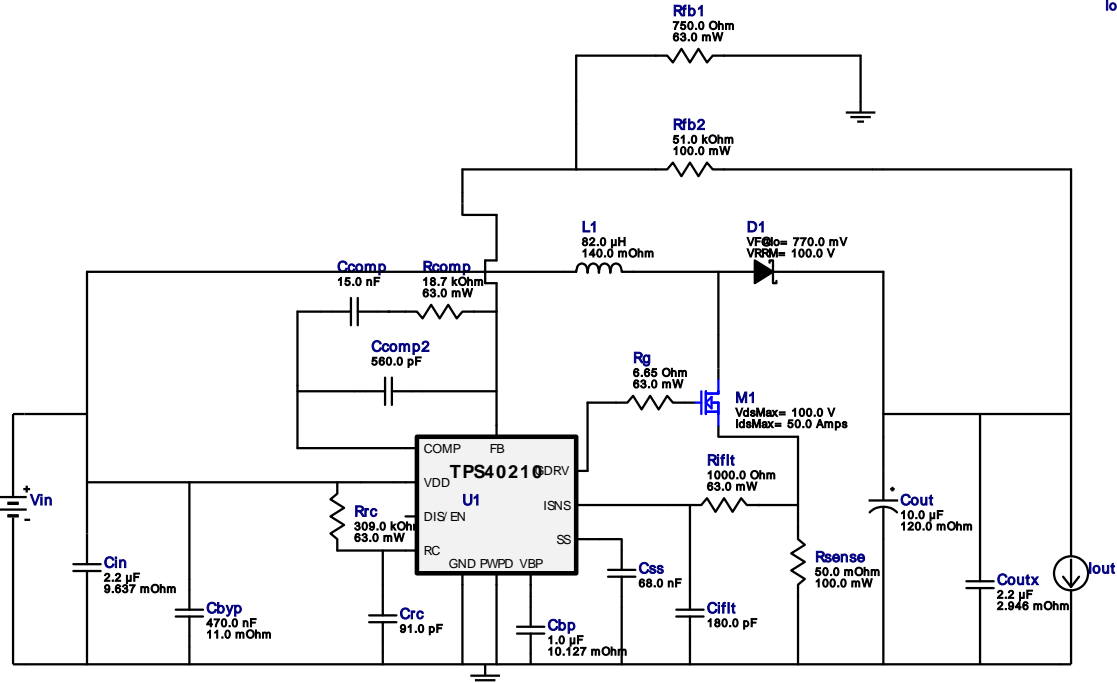


WEBENCH® Design Report

 Design : 3656248/20 TPS40210DGQR
 TPS40210DGQR 8.0V-12.0V to 48.30V @ 0.2A

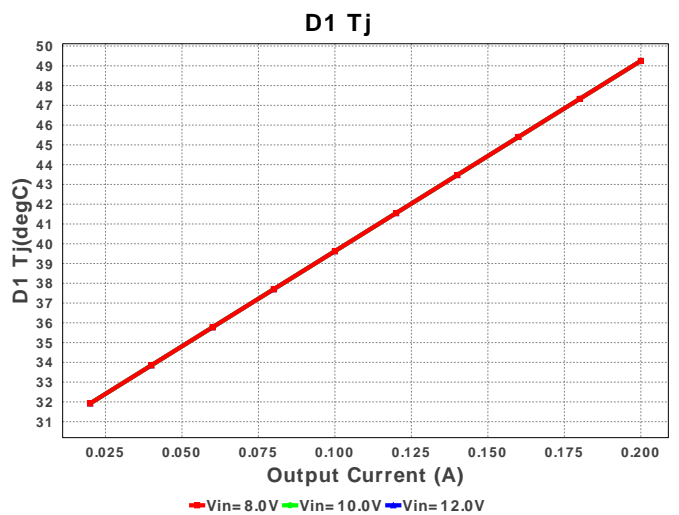
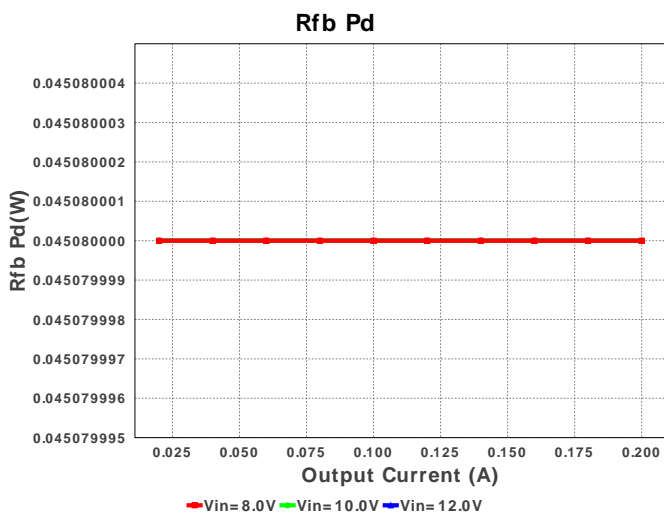
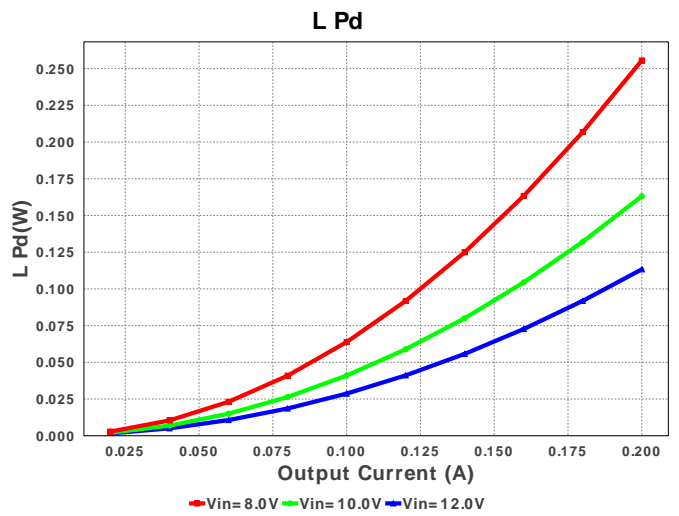
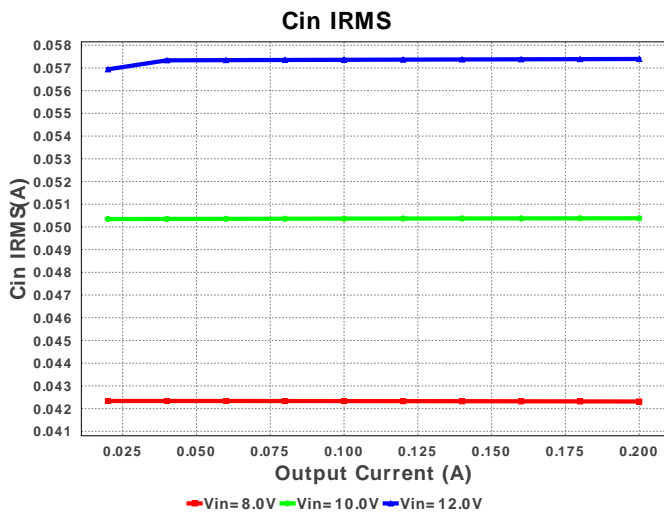
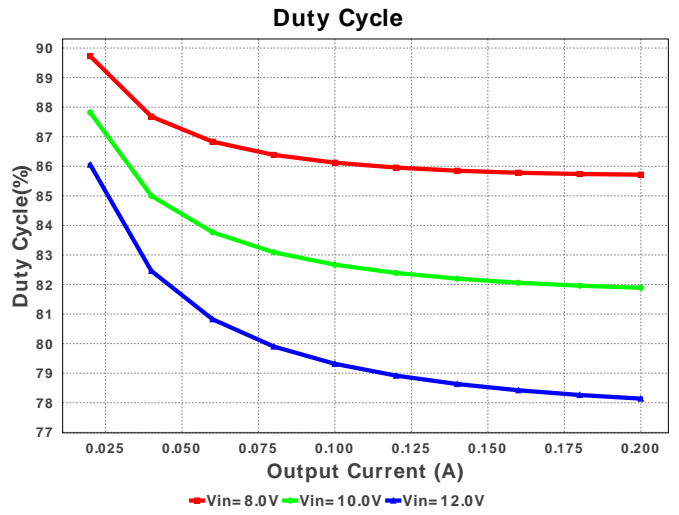
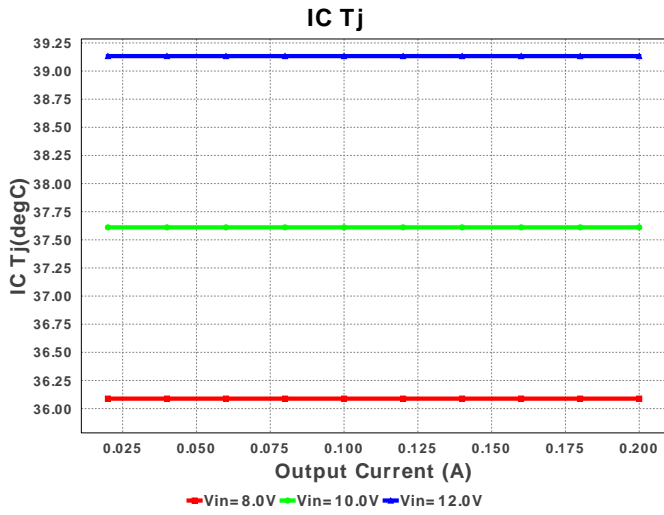
 Vout = 48.0V
 Iout = 0.2A

My Comments

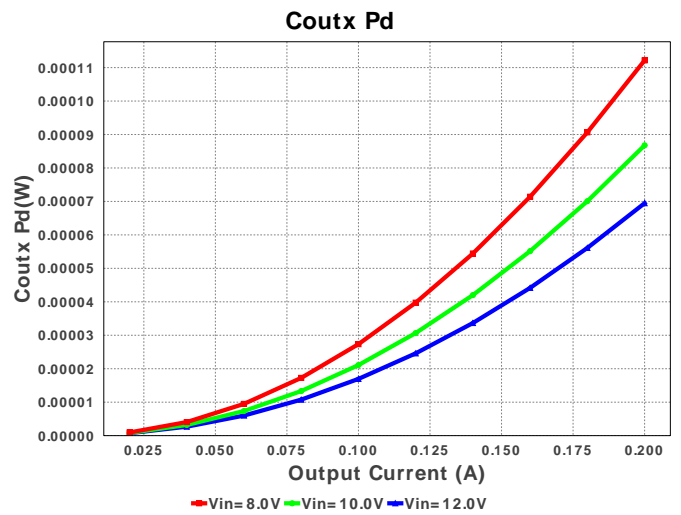
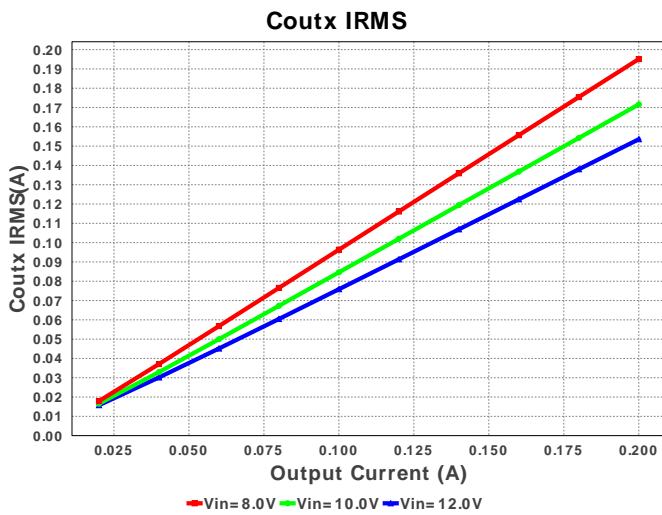
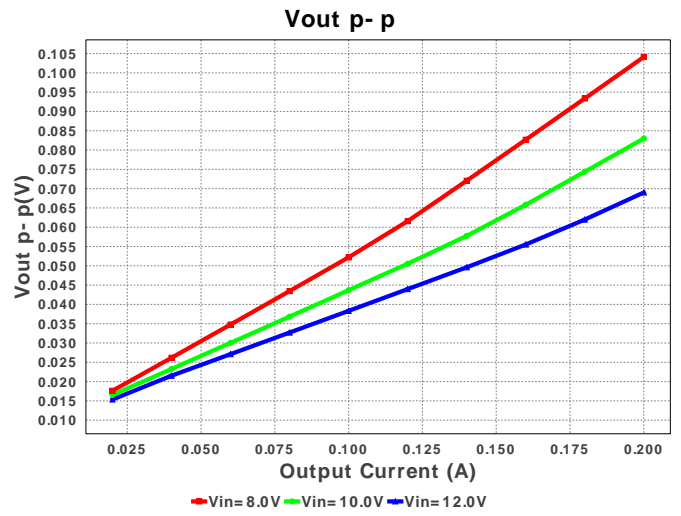
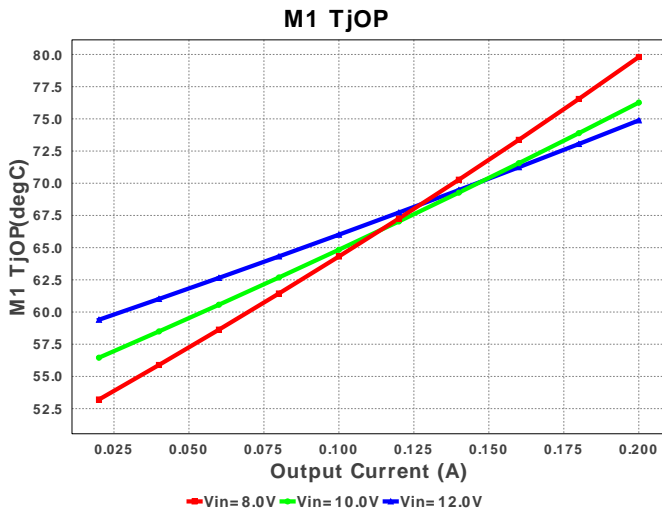
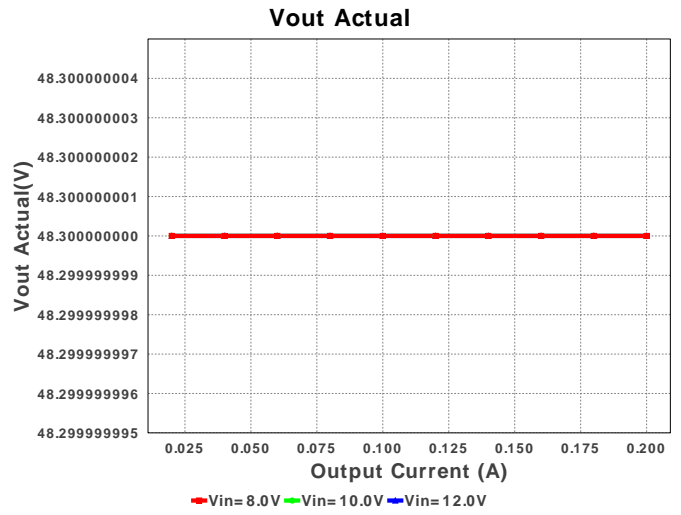
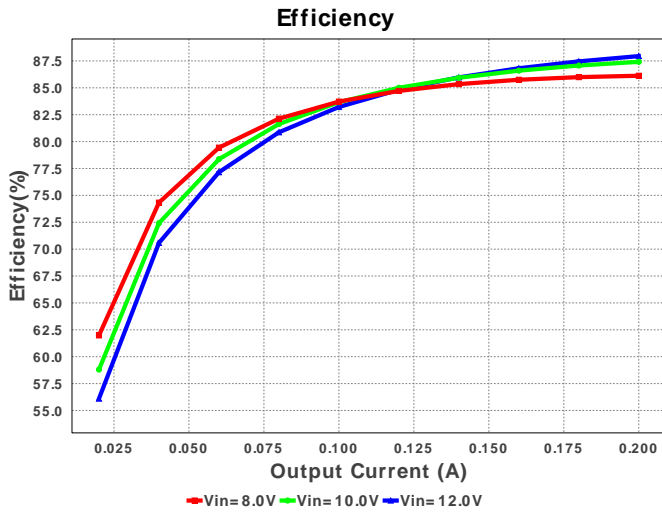
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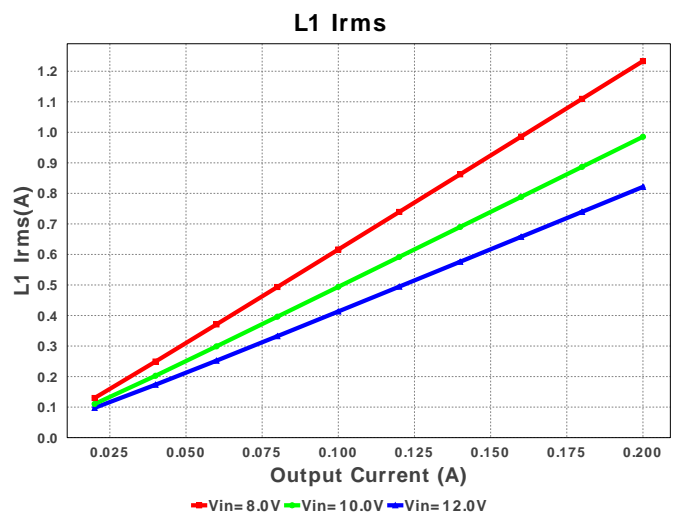
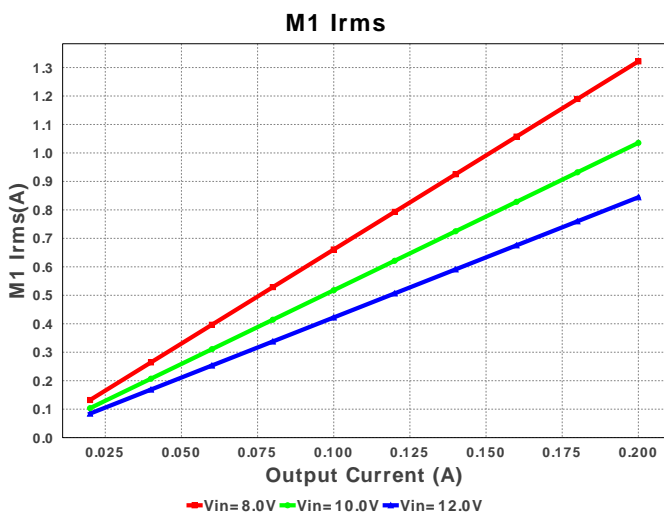
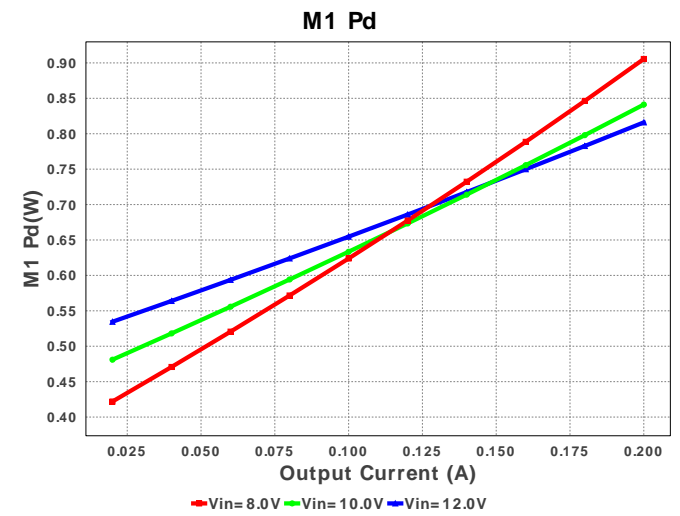
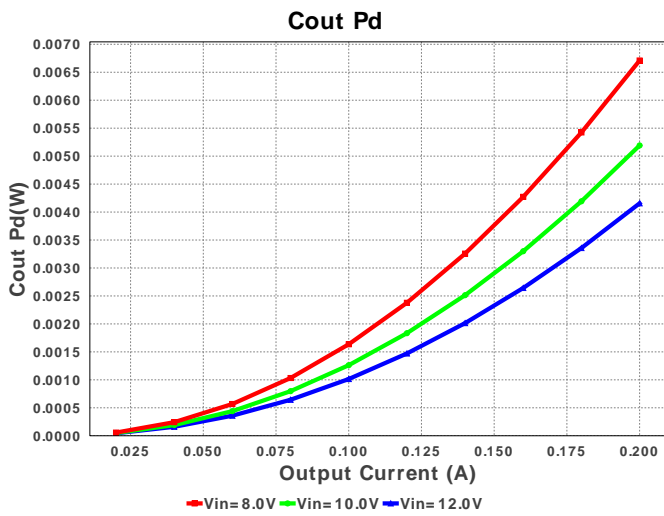
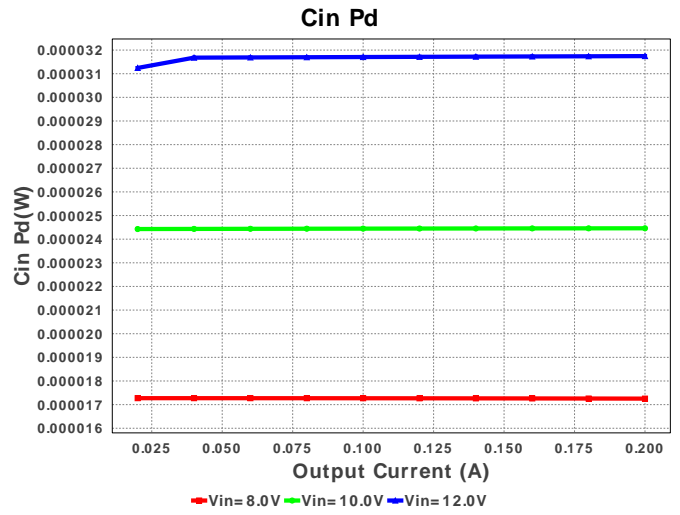
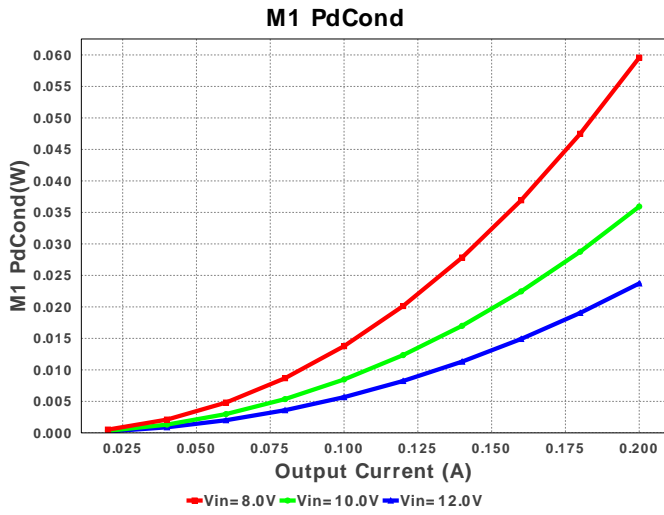
Electrical BOM

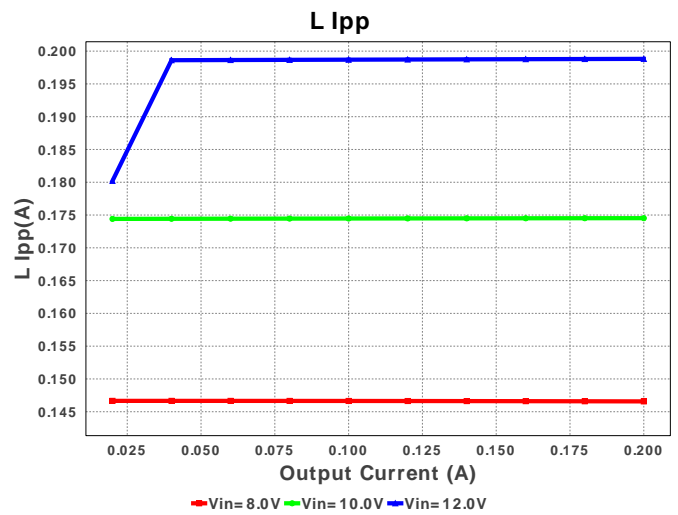
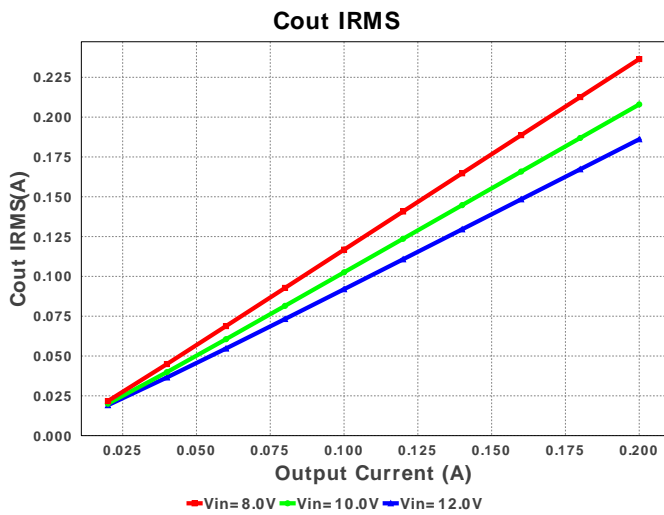
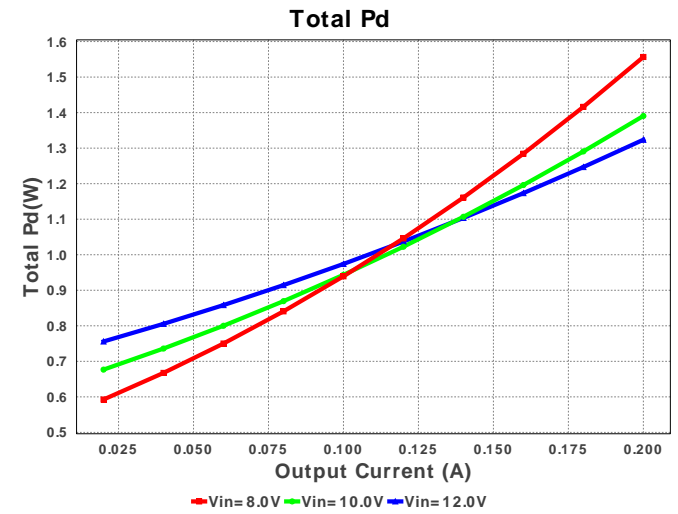
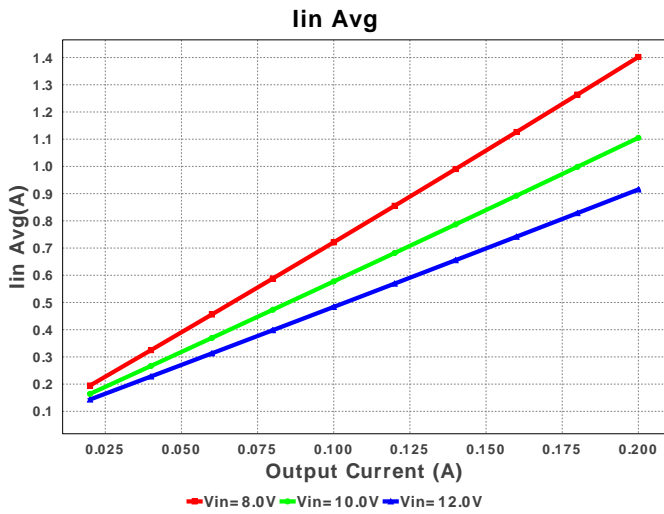
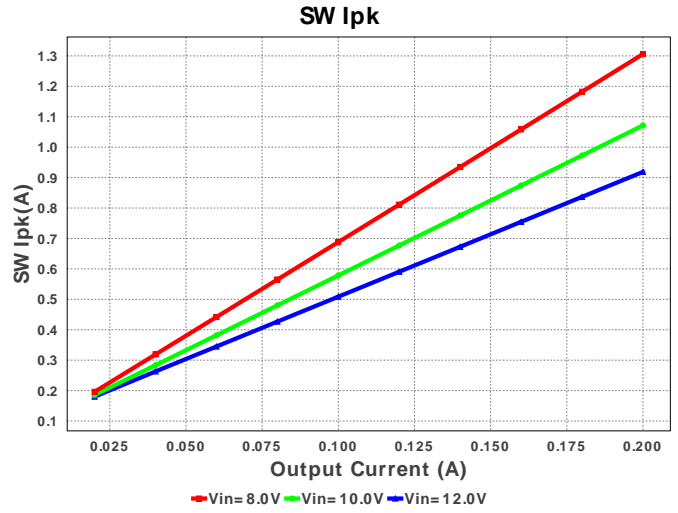
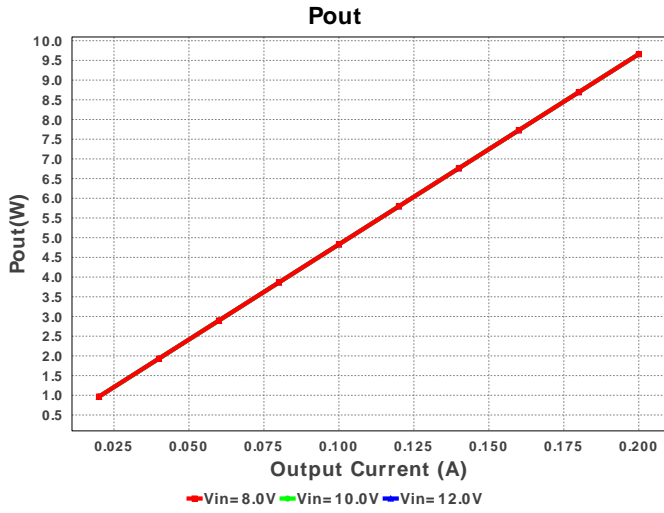
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbp	MuRata	GRM188R61C105KA93D Series= X5R	Cap= 1.0 uF ESR= 10.127 mOhm VDC= 16.0 V IRMS= 994.63 mA	1	\$0.01	0603 5 mm ²
2.	Cbyp	AVX	0805YC474KAT2A Series= X7R	Cap= 470.0 nF ESR= 11.0 mOhm VDC= 16.0 V IRMS= 0.0 A	1	\$0.02	0805 7 mm ²
3.	Ccomp	Yageo America	CC0805KRX7R9BB153 Series= X7R	Cap= 15.0 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
4.	Ccomp2	Samsung Electro-Mechanics	CL21C561JBANFNC Series= C0G/NP0	Cap= 560.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
5.	Ciftt	Kemet	C0805C181K5GACTU Series= C0G/NP0	Cap= 180.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
6.	Cin	MuRata	GRM188R61C225KE15D Series= X5R	Cap= 2.2 uF ESR= 9.637 mOhm VDC= 16.0 V IRMS= 1.20373 A	1	\$0.02	0603 5 mm ²

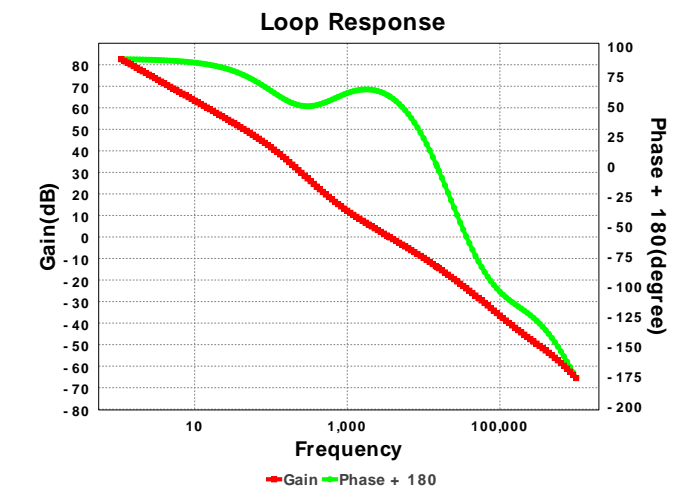
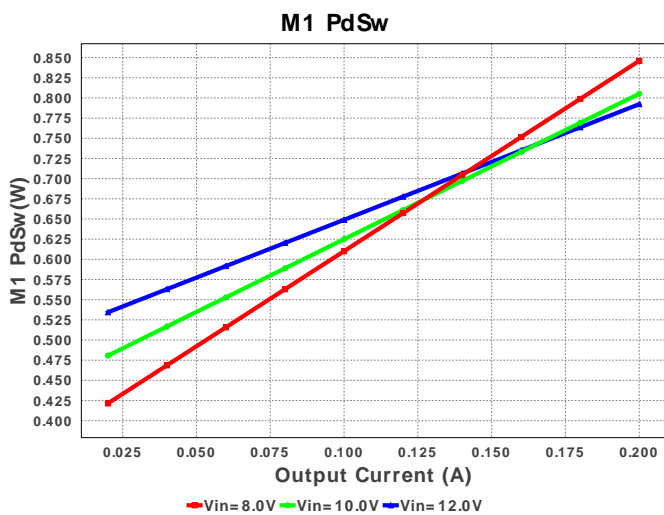
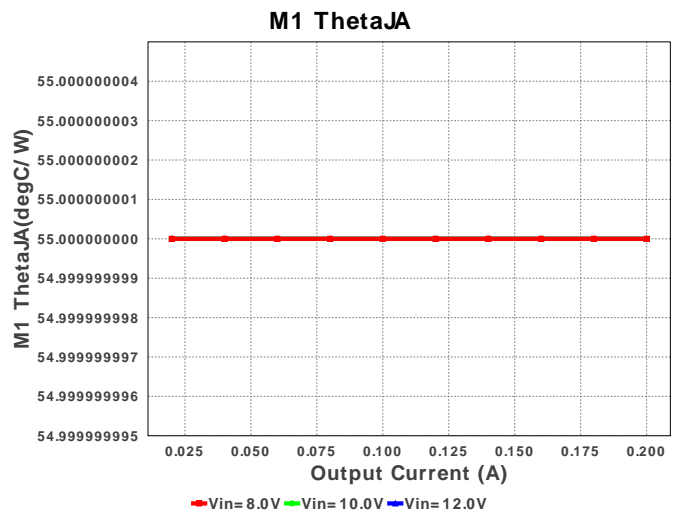
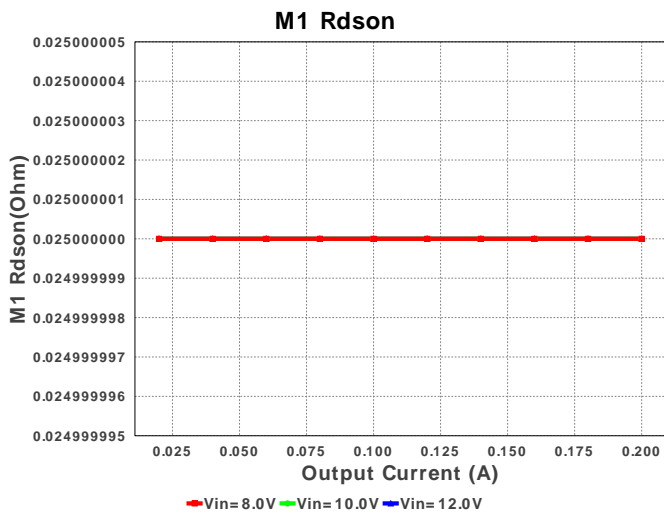
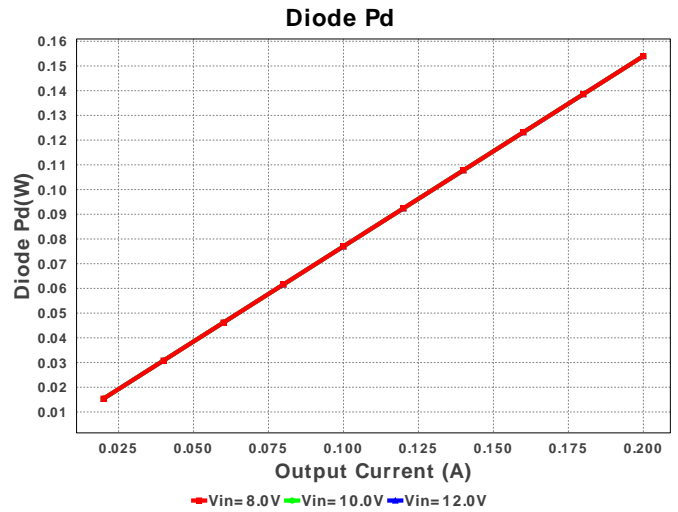
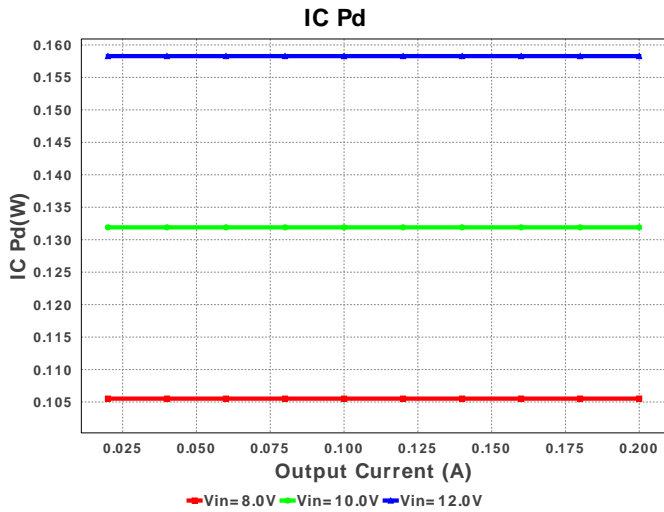
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
7.	Cout	Panasonic	EEHZA1J100P Series= ?	Cap= 10.0 uF ESR= 120.0 mOhm VDC= 63.0 V IRMS= 1.0 A	1	\$0.66	 SM_RADIAL_6.3AMM 80 mm²
8.	Coutx	TDK	C3225JB2A225K Series= JB	Cap= 2.2 uF ESR= 2.946 mOhm VDC= 100.0 V IRMS= 0.0 A	1	\$0.14	 1210 15 mm²
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 mm²
10.	Css	MuRata	GRM155R61A683KA01D Series= X5R	Cap= 68.0 nF VDC= 10.0 V IRMS= 0.0 A	1	\$0.01	 0402 3 mm²
11.	D1	Diodes Inc.	DFLS1100-7	VF@Io= 770.0 mV VRRM= 100.0 V	1	\$0.14	 PowerDI123 13 mm²
12.	L1	Bourns	SDR1307-820KL	L= 82.0 uH DCR= 140.0 mOhm	1	\$0.35	 SDR1307 227 mm²
13.	M1	Texas Instruments	CSD19537Q3	VdsMax= 100.0 V IdsMax= 50.0 Amps	1	\$0.41	 DQG0008A 18 mm²
14.	Rcomp	Vishay-Dale	CRCW040218K7FKED Series= CRCW..e3	Res= 18.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
15.	Rfb1	Vishay-Dale	CRCW0402750RFKED Series= CRCW..e3	Res= 750.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
16.	Rfb2	Yageo America	RC0603FR-0751KL Series= ?	Res= 51.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	 0603 5 mm²
17.	Rg	Vishay-Dale	CRCW04026R65FKED Series= CRCW..e3	Res= 6.65 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
18.	Rifft	Vishay-Dale	CRCW04021K00FKED Series= CRCW..e3	Res= 1000.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
19.	Rrc	Vishay-Dale	CRCW0402309KFKED Series= CRCW..e3	Res= 309.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
20.	Rsense	Panasonic	ERJ-L03KF50MV Series= ERJ-L03	Res= 50.0 mOhm Power= 100.0 mW Tolerance= 1.0%	1	\$0.09	 0603 5 mm²
21.	U1	Texas Instruments	TPS40210DGQR	Switcher	1	\$0.75	 S-PDSO-G10 24 mm²











Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	46.106 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	251.261 mA	Current	Output capacitor RMS ripple current
3.	Coutx IRMS	192.114 mA	Current	Output capacitor_x RMS ripple current
4.	Iin Avg	1.278 A	Current	Average input current
5.	L Ipp	159.72 mA	Current	Peak-to-peak inductor ripple current
6.	L1 Irms	1.22 A	Current	Inductor ripple current
7.	M1 Irms	1.31 A	Current	M1 MOSFET Irms
8.	SW Ipk	1.299 A	Current	Peak switch current
9.	BOM Count	21	General	Total Design BOM count
10.	FootPrint	447.0 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	25.0 mOhm	General	Drain-Source On-resistance
14.	M1 ThetaJA	55.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
15.	Mode	CCM	General	Conduction Mode
16.	Pout	9.6 W	General	Total output power
17.	Total BOM	\$2.7	General	Total BOM Cost
18.	D1 Tj	49.25 degC	Op_Point	D1 junction temperature
19.	Low Freq Gain	80.953 dB	Op_Point	Gain at 10Hz
20.	Vout Actual	48.3 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
21.	Vout OP	48.3 V	Op_Point	Operational Output Voltage
22.	Cross Freq	2.652 kHz	Op_point	Bode plot crossover frequency
23.	Duty Cycle	84.349 %	Op_point	Duty cycle
24.	Efficiency	93.89 %	Op_point	Steady state efficiency
25.	Gain Marg	-12.38 dB	Op_point	Bode Plot Gain Margin
26.	IC Tj	35.74 degC	Op_point	IC junction temperature
27.	ICThetaJA	57.7 degC/W	Op_point	IC junction-to-ambient thermal resistance
28.	IOUT_OP	200.0 mA	Op_point	Iout operating point
29.	M1 TjOP	76.679 degC	Op_point	M1 MOSFET junction temperature
30.	Phase Marg	57.28 deg	Op_point	Bode Plot Phase Margin
31.	VIN_OP	8.0 V	Op_point	Vin operating point
32.	Vout p-p	100.114 mV	Op_point	Peak-to-peak output ripple voltage
33.	Cin Pd	20.486 μW	Power	Input capacitor power dissipation
34.	Cout Pd	7.576 mW	Power	Output capacitor power dissipation
35.	Coutx Pd	108.73 μW	Power	Output capacitor_x power loss
36.	Diode Pd	154.0 mW	Power	Diode power dissipation
37.	IC Pd	99.488 mW	Power	IC power dissipation
38.	L Pd	250.101 mW	Power	Inductor power dissipation
39.	M1 Pd	848.709 mW	Power	M1 MOSFET total power dissipation
40.	M1 PdCond	57.635 mW	Power	M1 MOSFET conduction losses
41.	M1 PdSw	791.074 mW	Power	M1 MOSFET switching losses
42.	Rfb Pd	44.522 mW	Power	Rfb Power Dissipation
43.	Total Pd	624.735 mW	Power	Total Power Dissipation
44.	Vout Tolerance	3.448 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	200.0 m	Maximum Output Current
2.	VinMax	12.0	Maximum input voltage
3.	VinMin	8.0	Minimum input voltage
4.	Vout	48.0	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.

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