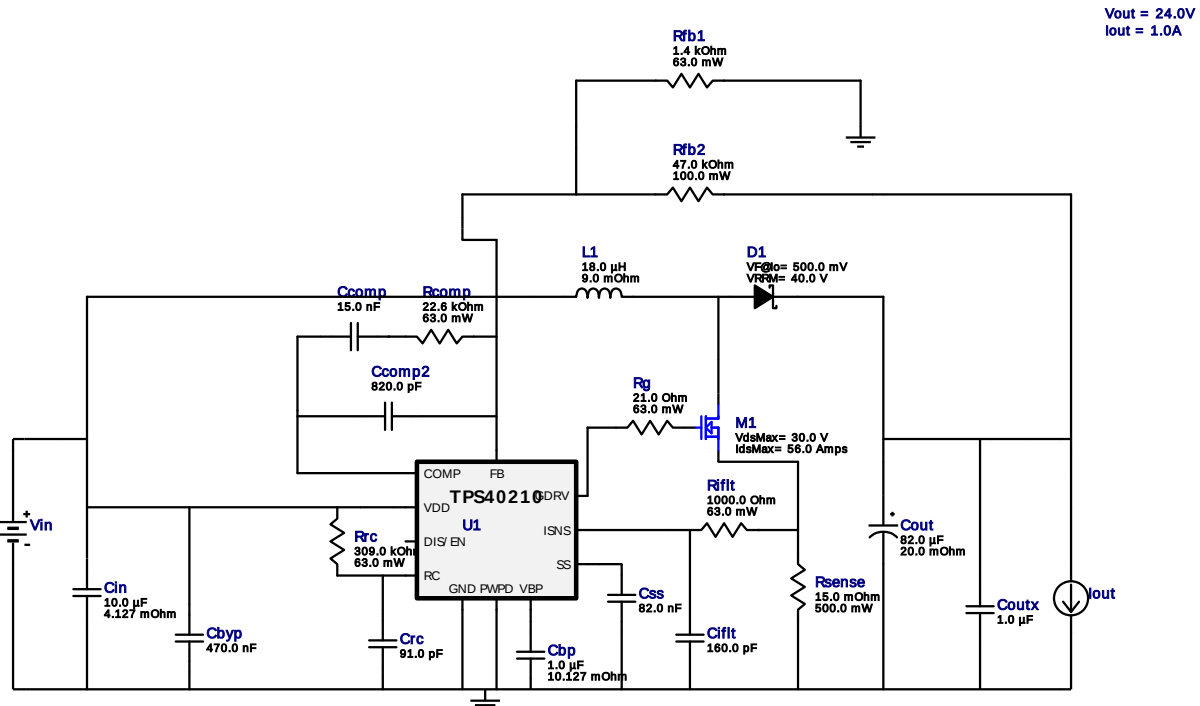


WEBENCH® Design Report

Design : 1194016/2194 TPS40210DGQR
TPS40210DGQR 5.0V-10.0V to 24.20V @ 1.0A

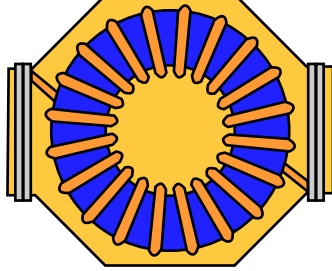


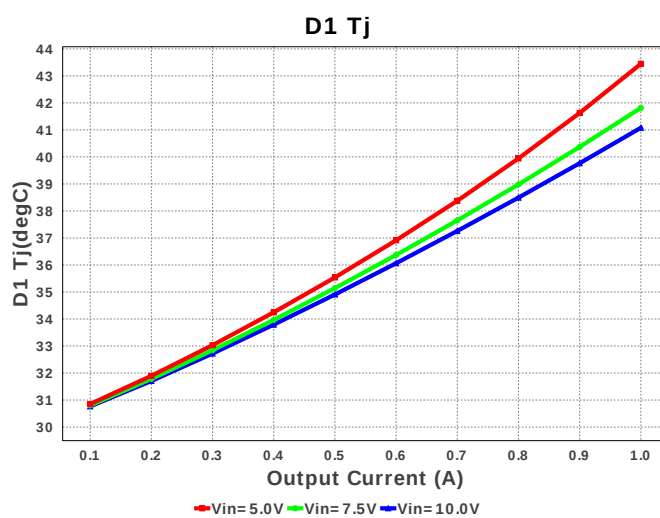
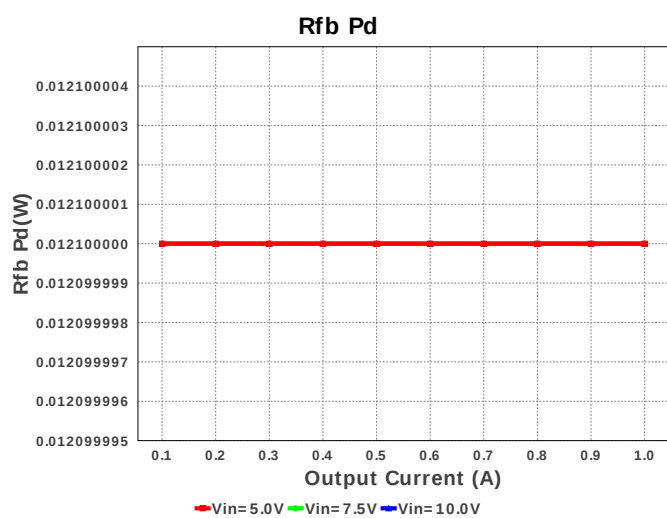
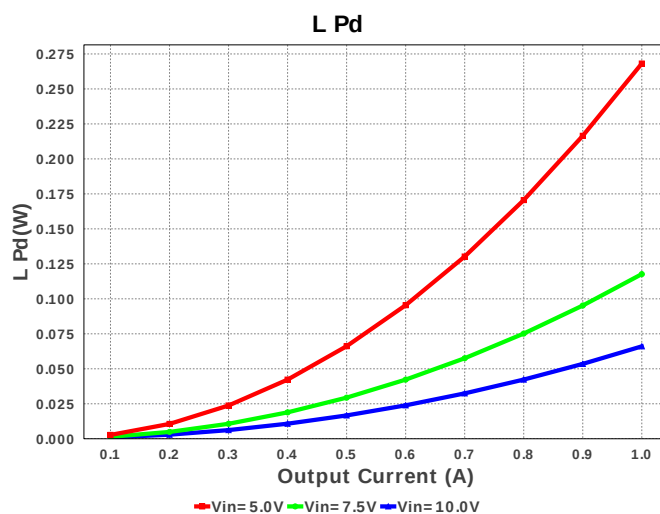
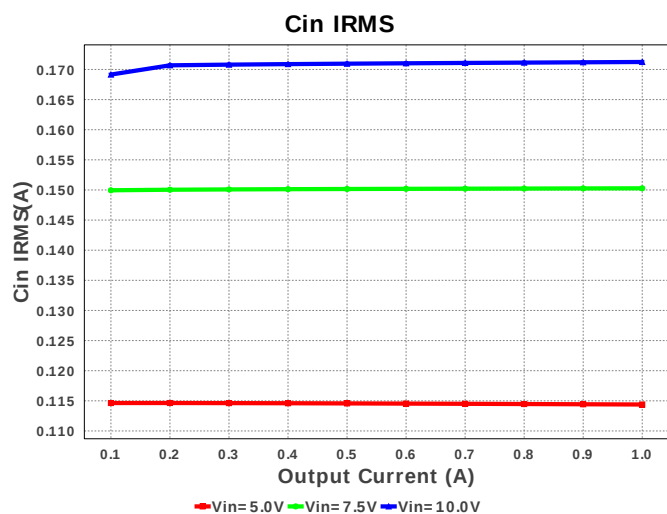
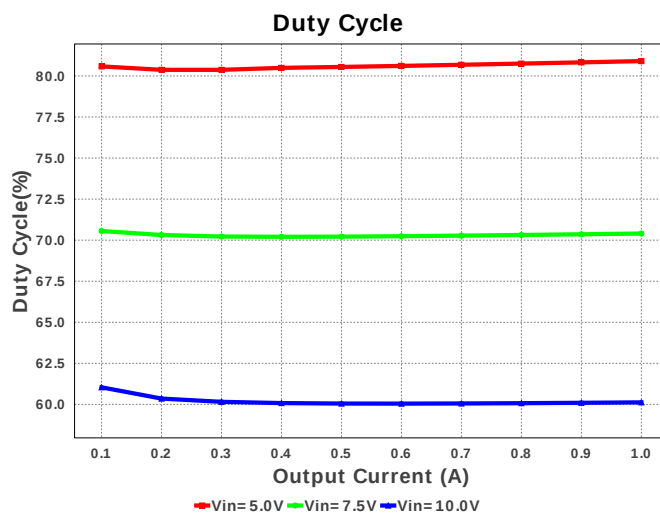
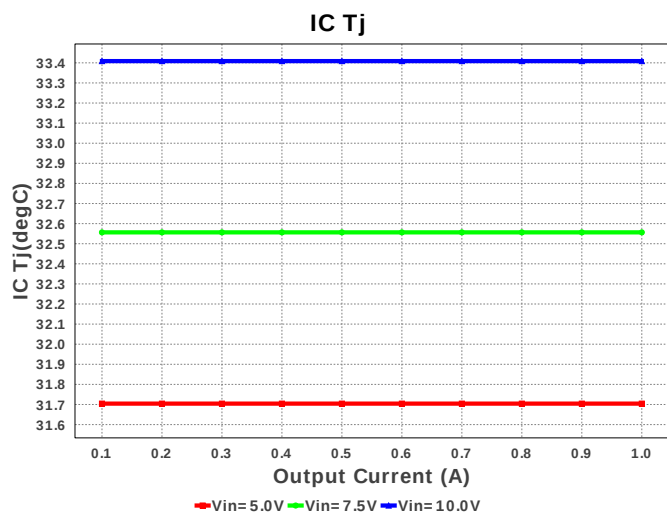
My Comments

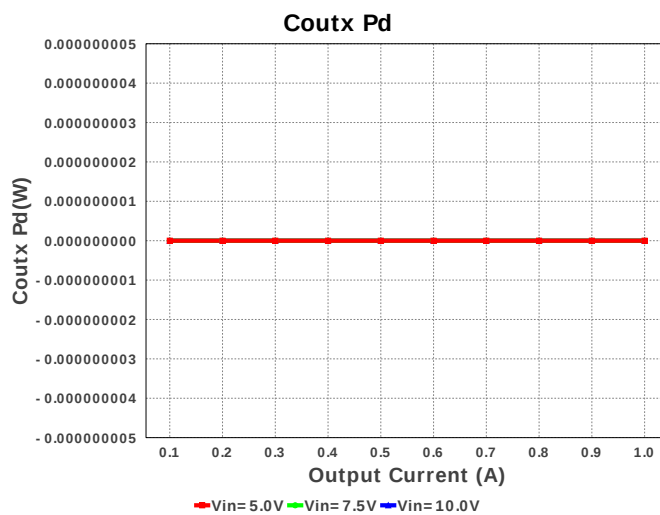
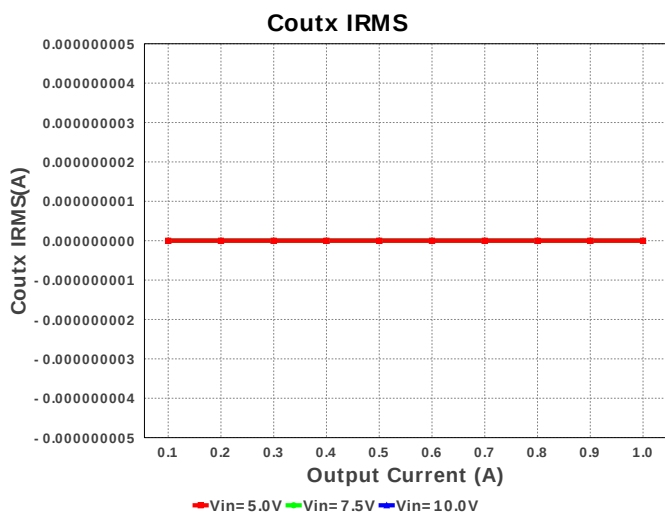
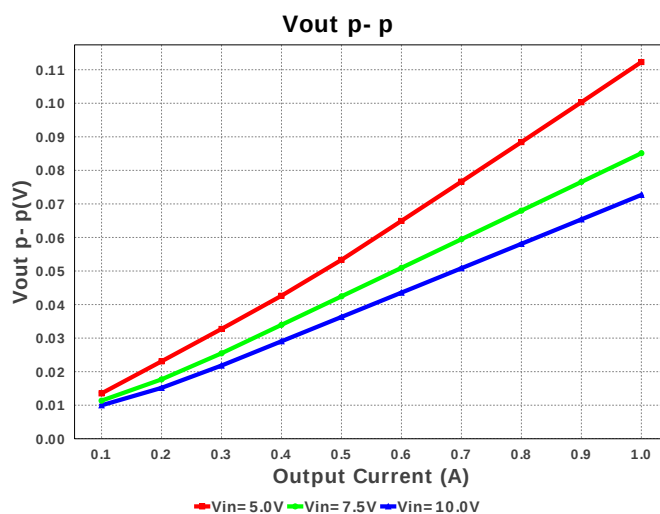
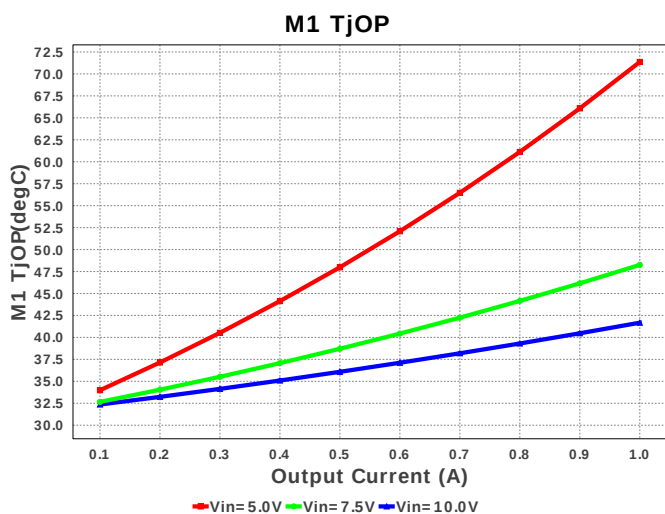
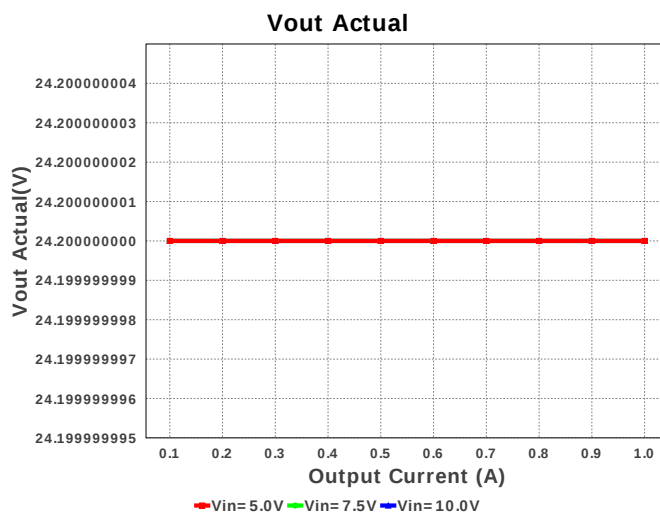
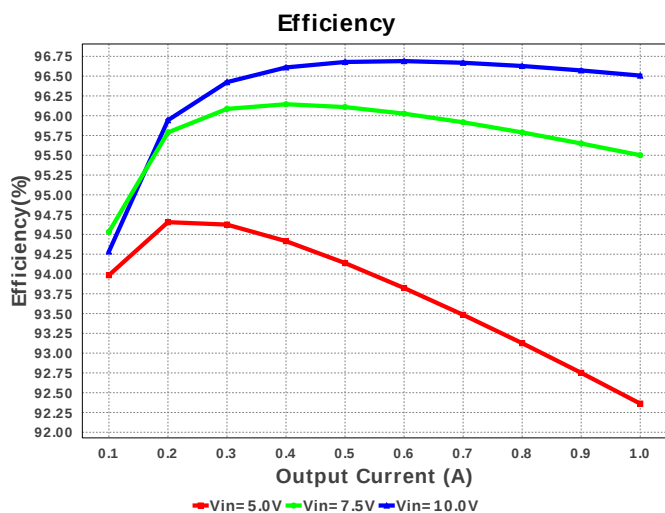
No comments

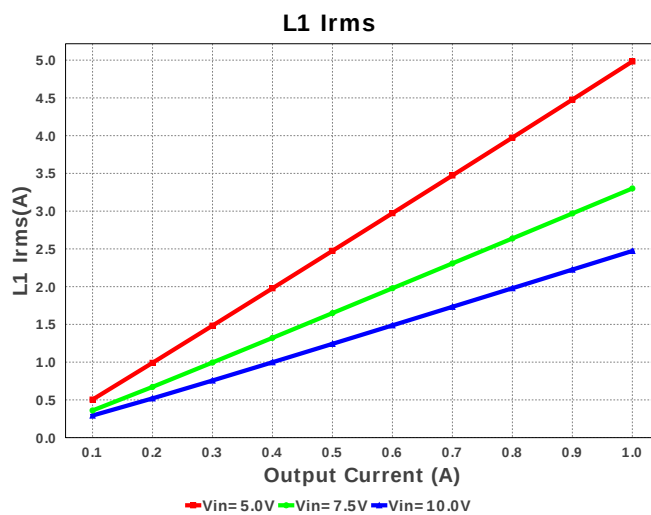
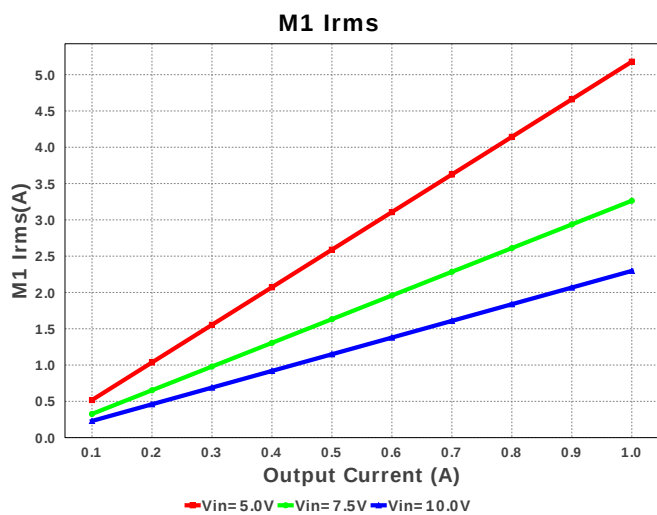
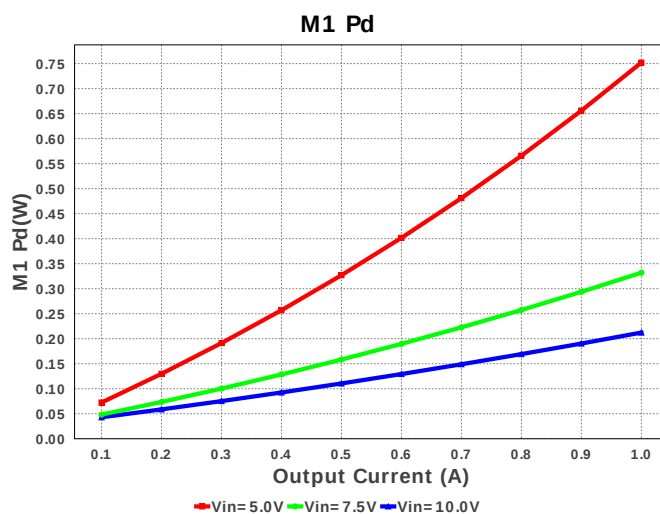
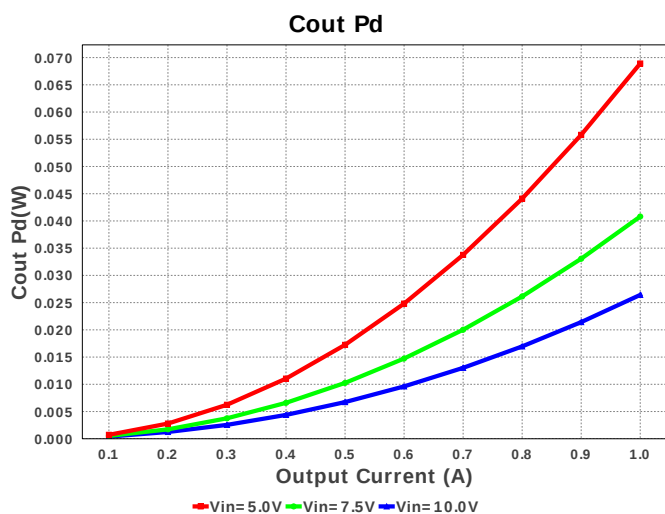
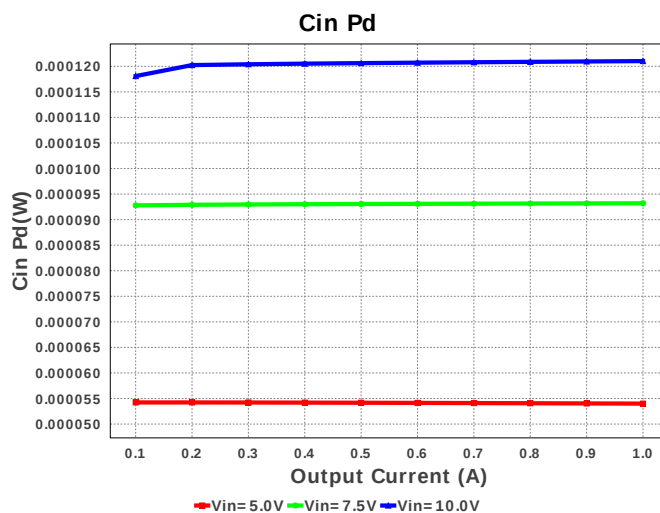
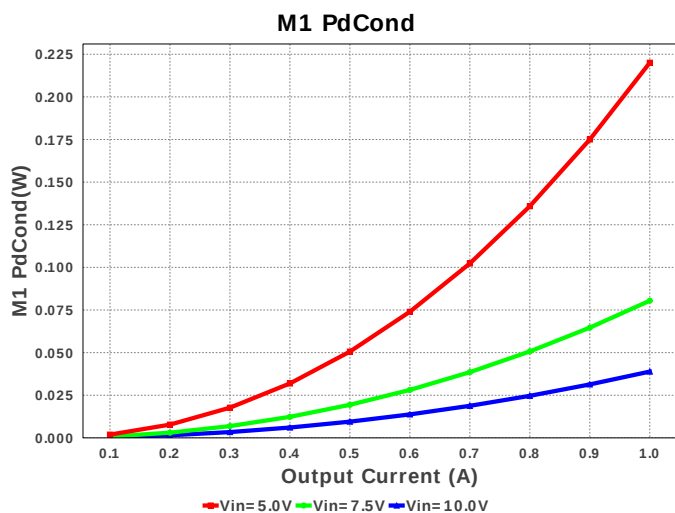
Electrical BOM

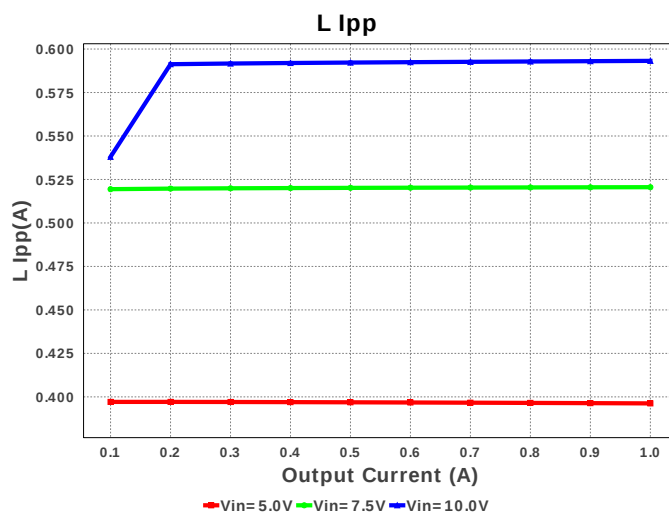
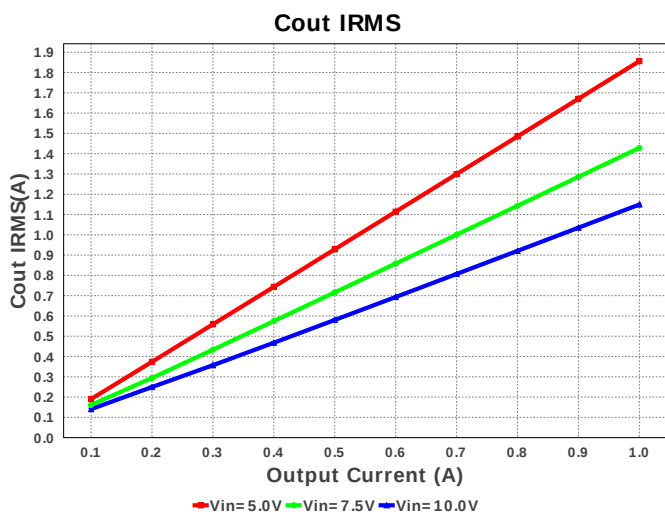
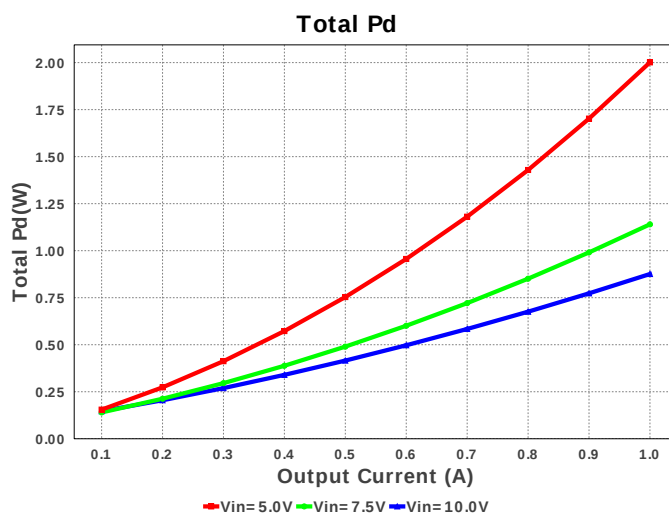
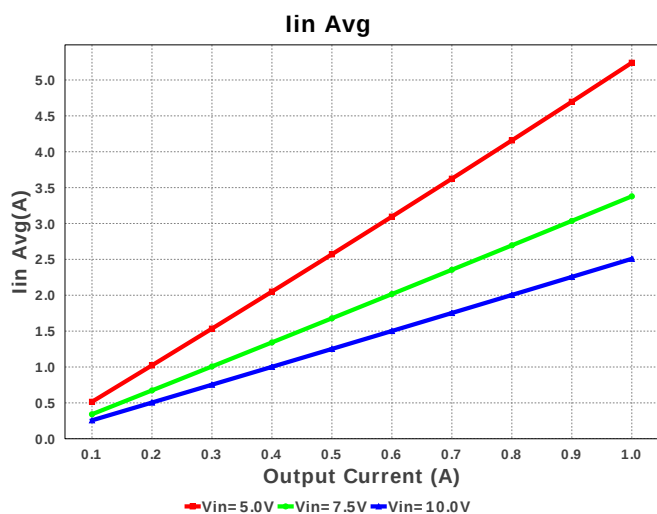
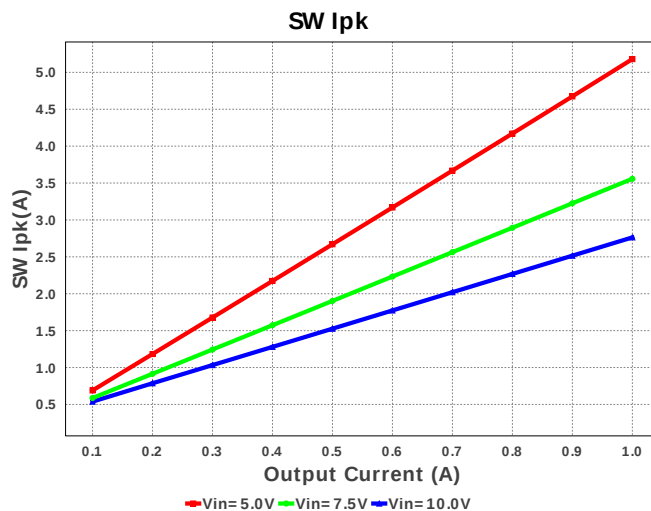
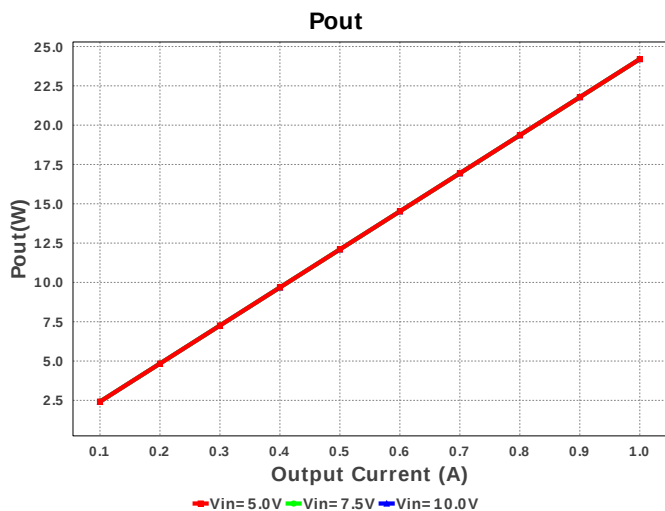
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbp	MuRata	GRM188R61C105KA93D Series= X5R	Cap= 1.0 uF ESR= 10.127 mOhm VDC= 16.0 V IRMS= 994.63 mA	1	\$0.01	0603 5 mm ²
2.	Cbyp	MuRata	GRM155R61A474KE15D Series= X5R	Cap= 470.0 nF VDC= 10.0 V IRMS= 0.0 A	1	\$0.01	0402 3 mm ²
3.	Ccomp	Yageo 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	Yageo America	CC0805KRX7R9BB821 Series= X7R	Cap= 820.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
5.	Ciflt	Samsung Electro-Mechanics	CL21C161JBANNNC Series= C0G/NP0	Cap= 160.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
6.	Cin	MuRata	GRM21BR61C106KE15L Series= X5R	Cap= 10.0 uF ESR= 4.127 mOhm VDC= 16.0 V IRMS= 2.46634 A	1	\$0.03	0805 7 mm ²

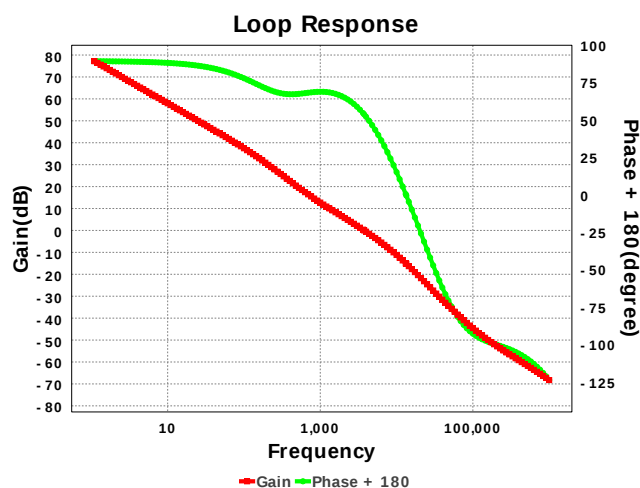
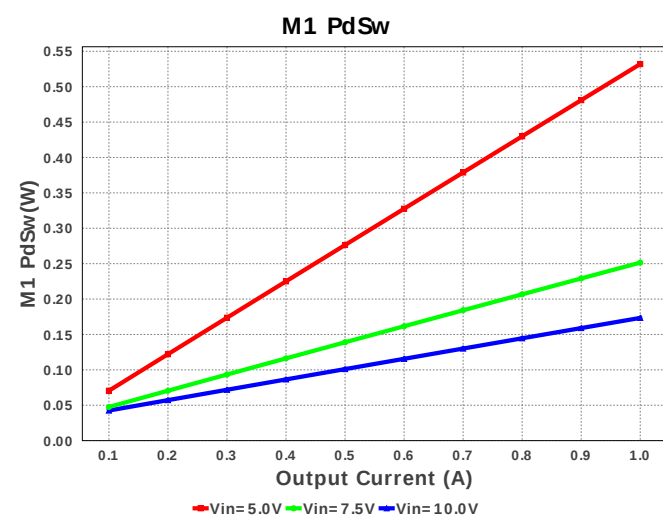
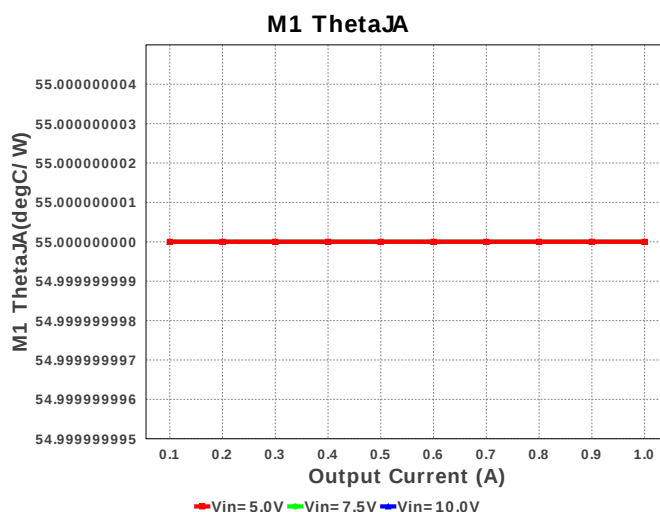
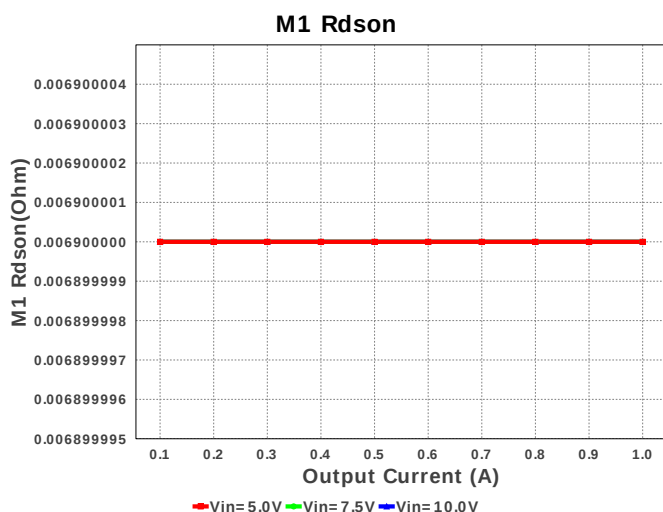
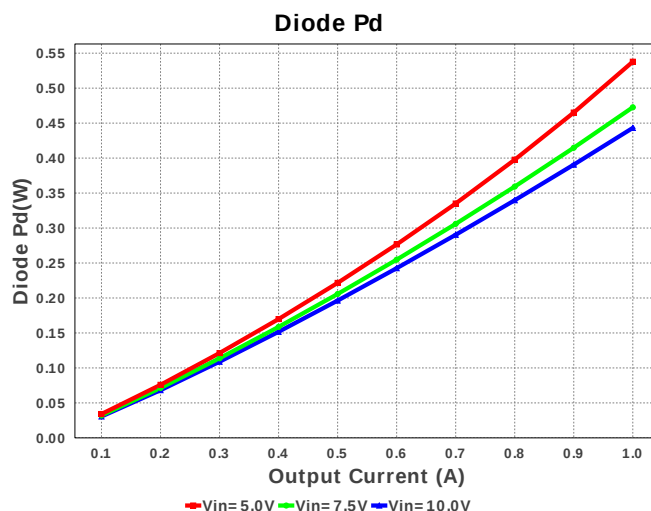
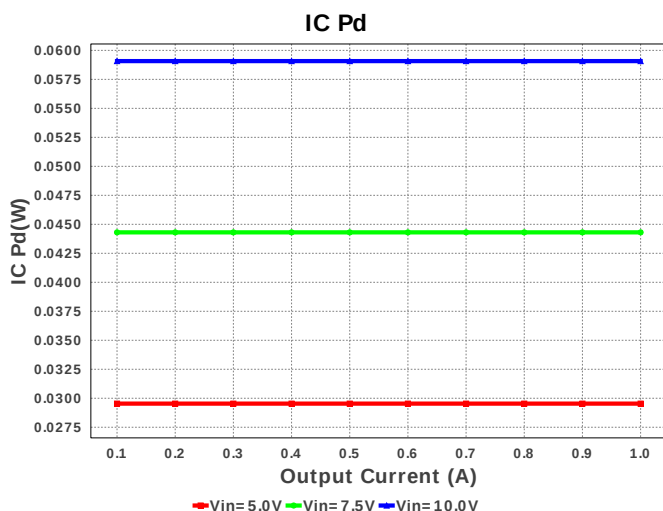
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
7.	Cout	Panasonic	35SVPF82M Series= ?	Cap= 82.0 uF ESR= 20.0 mOhm VDC= 35.0 V IRMS= 4.0 A	1	\$0.61	 CAPSMT_62_E12 106 mm ²
8.	Coutx	Taiyo Yuden	GMK212B7105KG-T Series= X7R	Cap= 1.0 uF VDC= 35.0 V IRMS= 0.0 A	1	\$0.05	 0805 7 mm ²
9.	Crc	Samsung 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	GRM155R71A823KA01D Series= X7R	Cap= 82.0 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	Bourns	PM2110-180K-RC	L= 18.0 uH DCR= 9.0 mOhm	1	\$1.21	 PM2110 890 mm ²
13.	M1	Texas Instruments	CSD17304Q3	VdsMax= 30.0 V IdsMax= 56.0 Amps	1	\$0.36	 TRANS_NexFET_Q3 18 mm ²
14.	Rcomp	Vishay-Dale	CRCW040222K6FKED Series= CRCW..e3	Res= 22.6 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
15.	Rfb1	Vishay-Dale	CRCW04021K40FKED Series= CRCW..e3	Res= 1.4 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
16.	Rfb2	Yageo America	RC0603FR-0747KL Series= ?	Res= 47.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	 0603 5 mm ²
17.	Rg	Vishay-Dale	CRCW040221R0FKED Series= CRCW..e3	Res= 21.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
18.	Rift	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	124.746 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	1.858 A	Current	Output capacitor RMS ripple current
3.	Coutx IRMS	0.0 A	Current	Output capacitor_x RMS ripple current
4.	Iin Avg	5.035 A	Current	Average input current
5.	L Ipp	432.13 mA	Current	Peak-to-peak inductor ripple current
6.	L1 Irms	4.902 A	Current	Inductor ripple current
7.	M1 Irms	5.131 A	Current	M1 MOSFET Irms
8.	SW Ipk	5.116 A	Current	Peak switch current
9.	BOM Count	21	General	Total Design BOM count
10.	FootPrint	1.158 k 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	6.9 mOhm	General	Drain-Source On-resistance
14.	M1 ThetaJA	55.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
15.	Pout	24.0 W	General	Total output power
16.	Total BOM	\$3.39	General	Total BOM Cost
17.	D1 Tj	42.5 degC	Op_Point	D1 junction temperature
18.	Low Freq Gain	74.237 dB	Op_Point	Gain at 10Hz
19.	Vout Actual	24.2 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
20.	Vout OP	24.2 V	Op_Point	Operational Output Voltage
21.	Cross Freq	2.067 kHz	Op_point	Bode plot crossover frequency
22.	Duty Cycle	80.208 %	Op_point	Duty cycle
23.	Efficiency	95.329 %	Op_point	Steady state efficiency
24.	Gain Marg	-12.096 dB	Op_point	Bode Plot Gain Margin
25.	IC Tj	31.635 degC	Op_point	IC junction temperature
26.	ICThetaJA	57.7 degC/W	Op_point	IC junction-to-ambient thermal resistance
27.	IOUT_OP	1.0 A	Op_point	Iout operating point
28.	M1 TjOP	68.472 degC	Op_point	M1 MOSFET junction temperature
29.	Phase Marg	55.165 deg	Op_point	Bode Plot Phase Margin
30.	VIN_OP	5.0 V	Op_point	Vin operating point
31.	Vout p-p	110.174 mV	Op_point	Peak-to-peak output ripple voltage
32.	Cin Pd	64.223 μW	Power	Input capacitor power dissipation
33.	Cout Pd	69.05 mW	Power	Output capacitor power dissipation
34.	Coutx Pd	0.0 W	Power	Output capacitor_x power loss
35.	Diode Pd	500.0 mW	Power	Diode power dissipation
36.	IC Pd	28.336 mW	Power	IC power dissipation
37.	L Pd	259.476 mW	Power	Inductor power dissipation
38.	M1 Pd	699.491 mW	Power	M1 MOSFET total power dissipation
39.	M1 PdCond	213.898 mW	Power	M1 MOSFET conduction losses
40.	M1 PdSw	485.593 mW	Power	M1 MOSFET switching losses
41.	Rfb Pd	11.901 mW	Power	Rfb Power Dissipation
42.	Total Pd	1.176 W	Power	Total Power Dissipation
43.	Vout Tolerance	3.418 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	1.0	Maximum Output Current
2.	VinMax	10.0	Maximum input voltage
3.	VinMin	5.0	Minimum input voltage
4.	Vout	24.0	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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