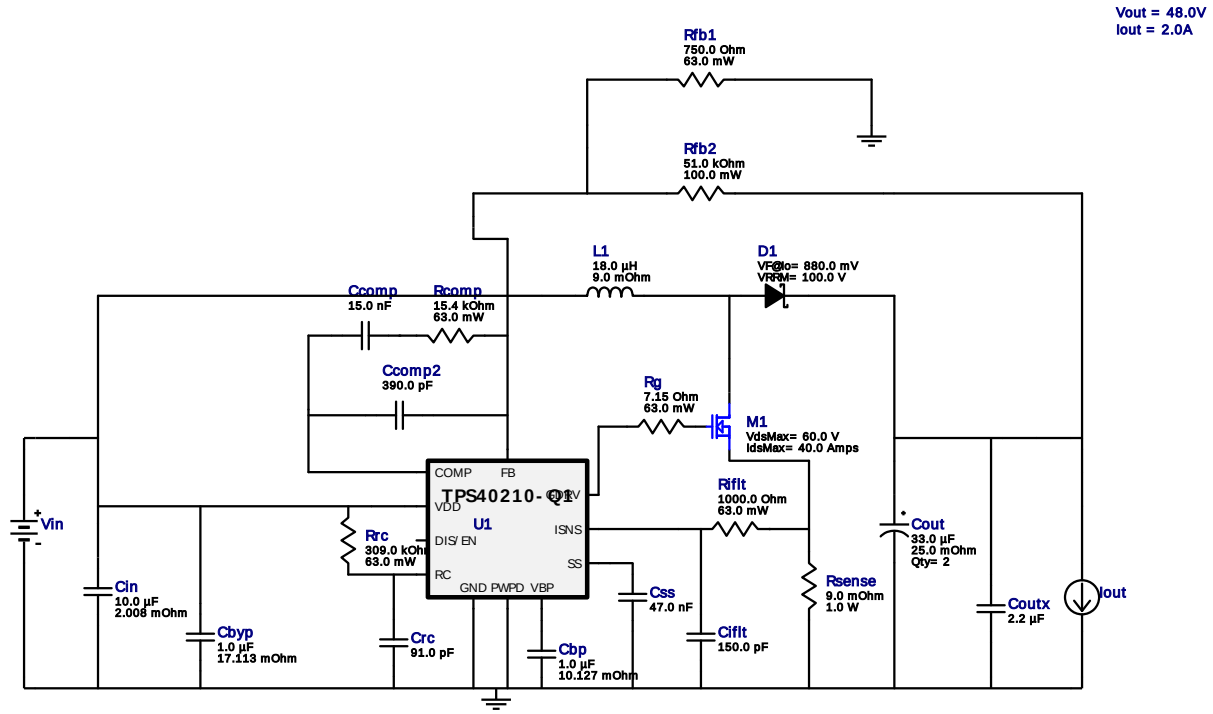
WEBENCH® Design Report

VinMin = 14.0V
VinMax = 22.0V
Vout = 48.0V
Iout = 2.0A

Device = TPS40210QDGQRQ1
Topology = Boost
Created = 7/25/16 7:12:22 AM
BOM Cost = $6.12
BOM Count = 22
Total Pd = 2.93W

Design : 1194016/2205 TPS40210QDGQRQ1
TPS40210QDGQRQ1 14.0V-22.0V to 48.30V @ 2.0A



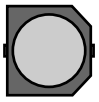
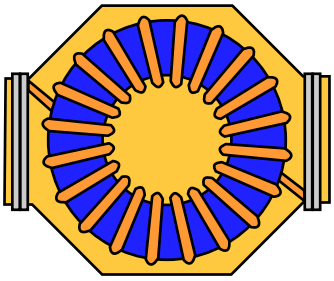
1. This regulator device is qualified for Automotive applications. All passives and other components selected in this design may not be qualified for Automotive applications. The user is required to verify that all components in the design meet the qualification and safety requirements for their specific application.View WEBENCH(R) Disclaimer.

My Comments

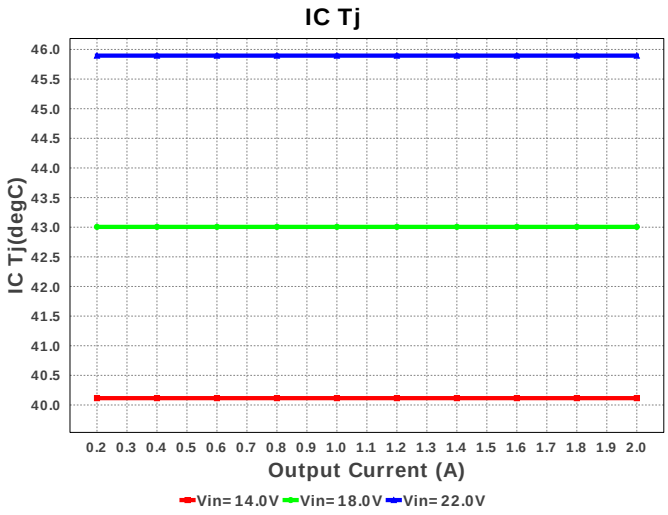
No comments

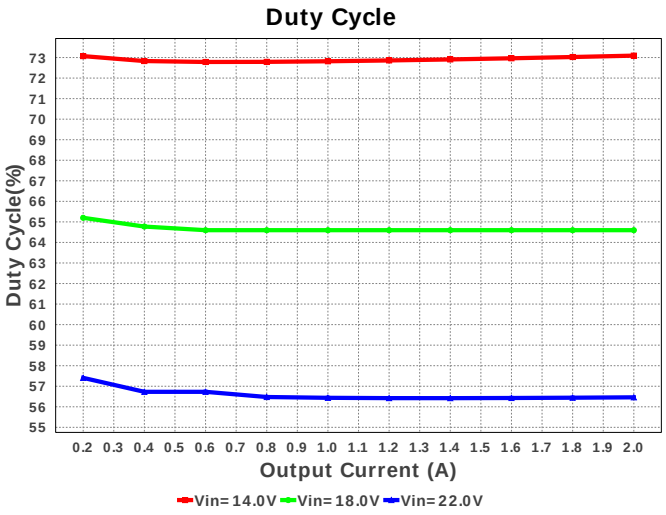
Electrical BOM

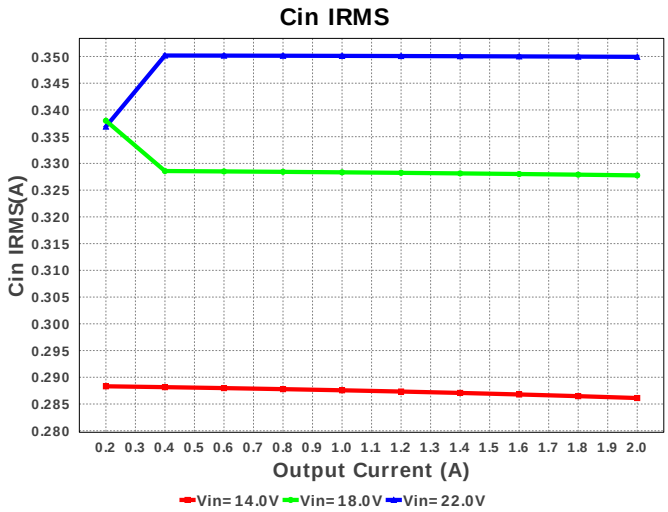
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbp	MuRata	GRM188R61C105KA93D Series= X5R	Cap= 1.0 uF ESR= 10.127 mOhm VDC= 16.0 V IRMS= 994.63 mA	1	$0.01	0603 5 mm²
2.	Cbyp	MuRata	GRM188R61E105KA12D Series= X5R	Cap= 1.0 uF ESR= 17.113 mOhm VDC= 25.0 V IRMS= 979.39 mA	1	$0.01	0603 5 mm²
3.	Ccomp	Yageo America	CC0805KRX7R9BB153 Series= X7R	Cap= 15.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
4.	Ccomp2	Yageo America	CC0805KRX7R9BB391 Series= X7R	Cap= 390.0 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

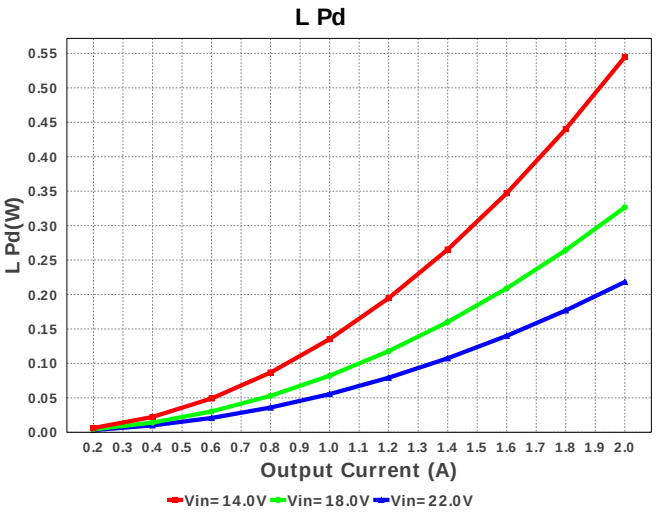
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
6.	Cin	MuRata	GRM32ER7YA106KA12L Series= X7R	Cap= 10.0 uF ESR= 2.008 mOhm VDC= 35.0 V IRMS= 4.6772 A	1	$0.22	 1210_280 15 mm²
7.	Cout	Panasonic	63SXV33M Series= ?	Cap= 33.0 uF ESR= 25.0 mOhm VDC= 63.0 V IRMS= 2.95 A	2	$1.25	 CAPSMT_62_E12 106 mm²
8.	Coutx	Taiyo Yuden	HMK325B7225KN-T Series= X7R	Cap= 2.2 uF VDC= 100.0 V IRMS= 0.0 A	1	$0.13	 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	GRM155R61A473KA01D Series= X5R	Cap= 47.0 nF VDC= 10.0 V IRMS= 0.0 A	1	$0.01	 0402 3 mm²
11.	D1	Vishay-Semiconductor	SS10PH10-M3/86A	VF@Io= 880.0 mV VRRM= 100.0 V	1	$0.29	 TO-277A 56 mm²
12.	L1	Bourns	PM2120-180K-RC	L= 18.0 µH DCR= 9.0 mOhm	1	$1.33	 PM2120 890 mm²
13.	M1	Infineon Technologies	BSZ100N06LS3 G	VdsMax= 60.0 V IdsMax= 40.0 Amps	1	$0.39	 PG-TSDSON-8 19 mm²
14.	Rcomp	Vishay-Dale	CRCW040215K4FKED Series= CRCW..e3	Res= 15.4 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	CRCW04027R15FKED Series= CRCW..e3	Res= 7.15 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
18.	Riflt	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	Susumu Co Ltd	PRL1632-R009-F-T1 Series= PRL1632	Res= 9.0 mOhm Power= 1.0 W Tolerance= 1.0%	1	$0.19	 0612 11 mm²

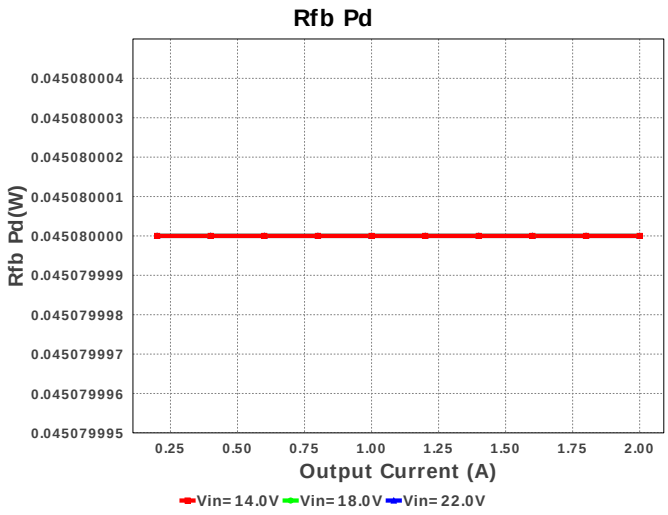
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
21.	U1	Texas Instruments	TPS40210QDGQRQ1	Switcher	1	$0.94	S-PDSO-G10 24 mm²

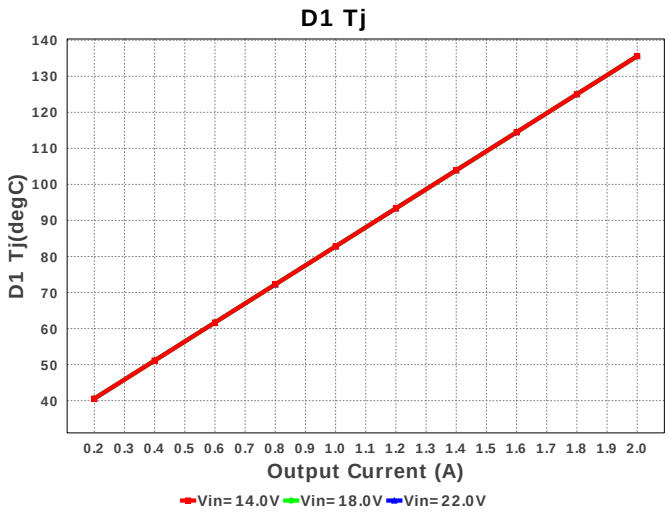


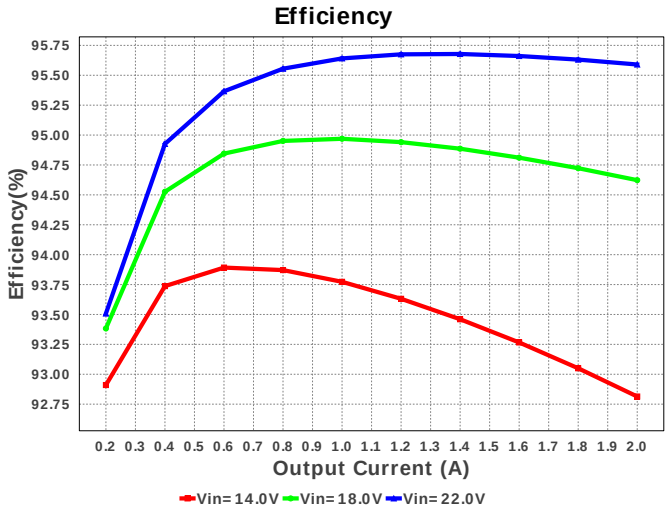


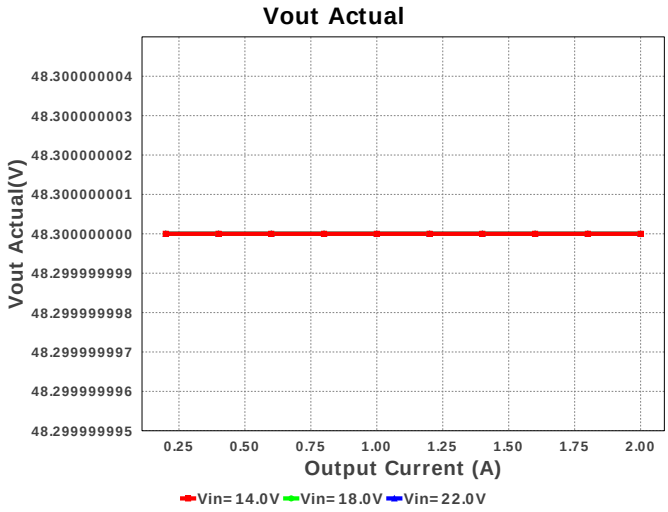


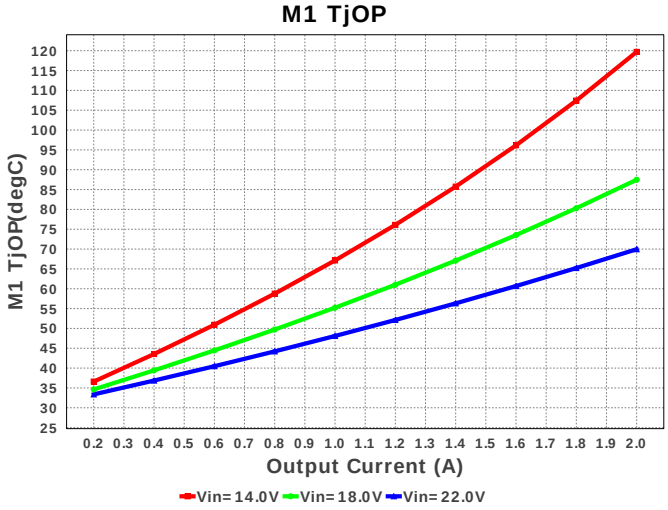


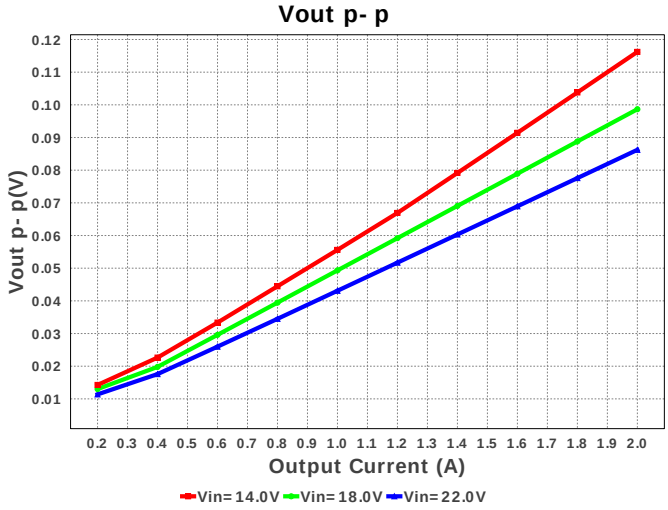


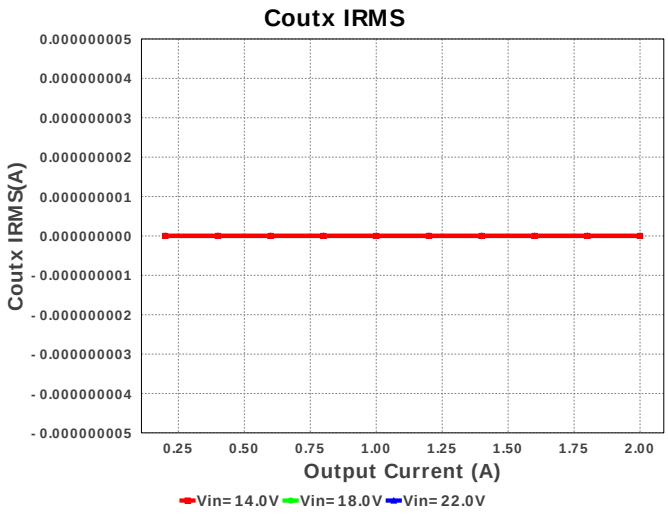


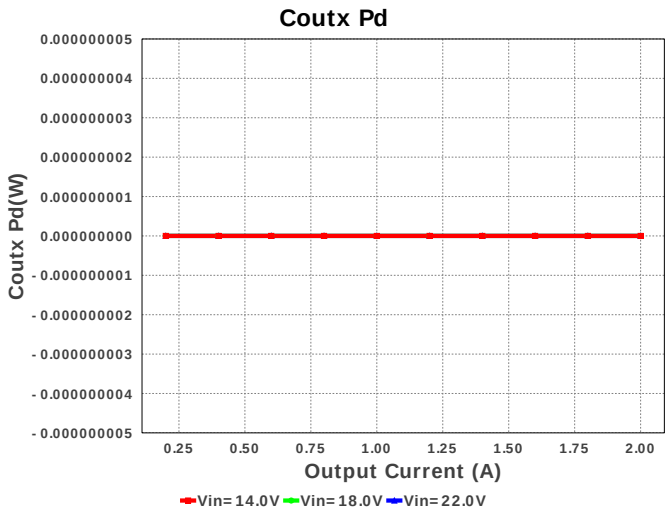


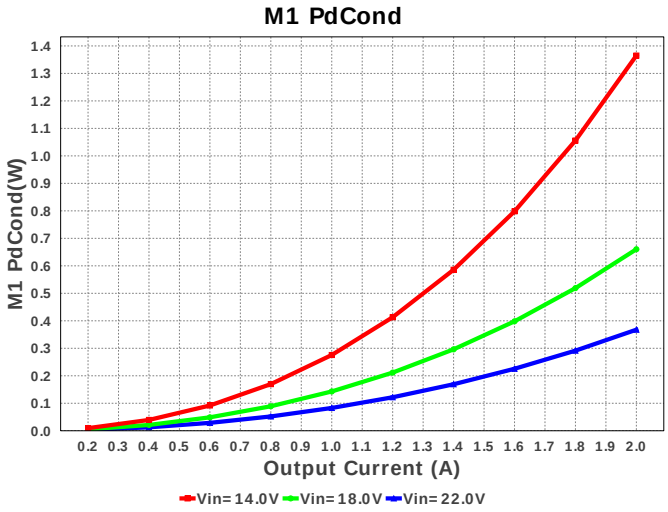


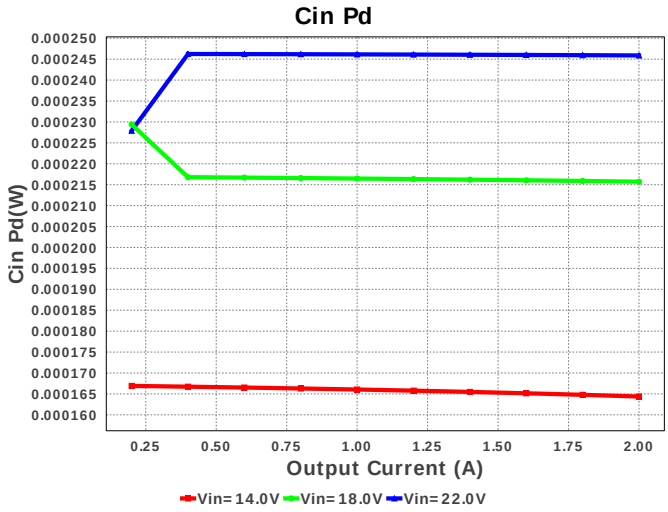


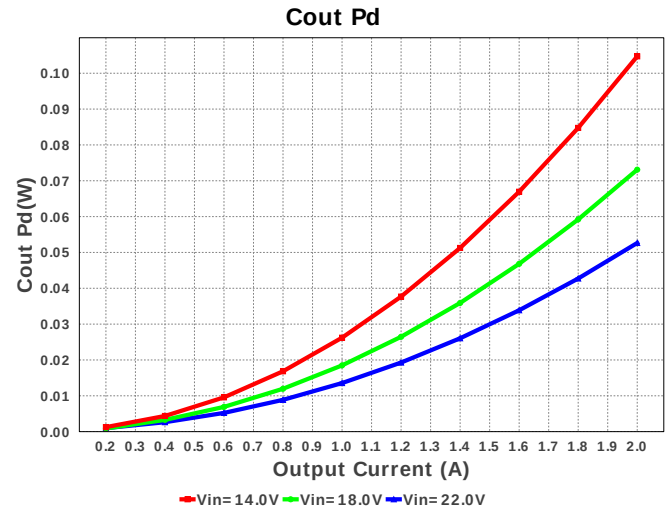


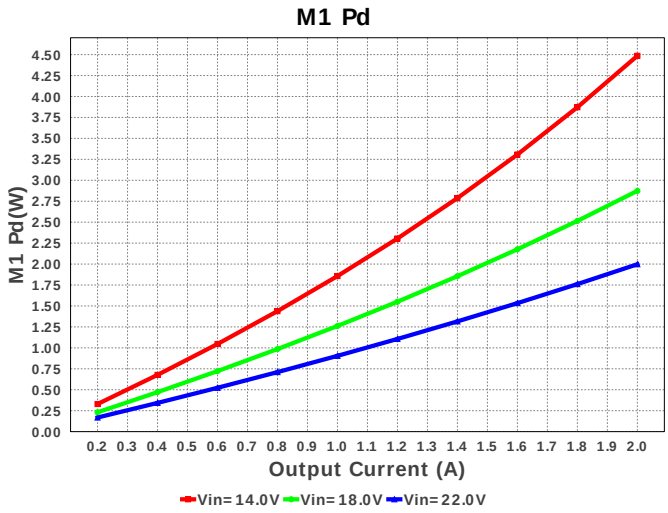


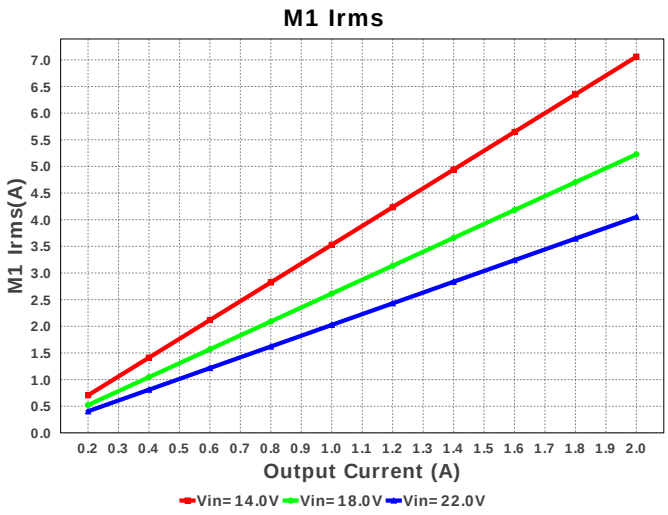


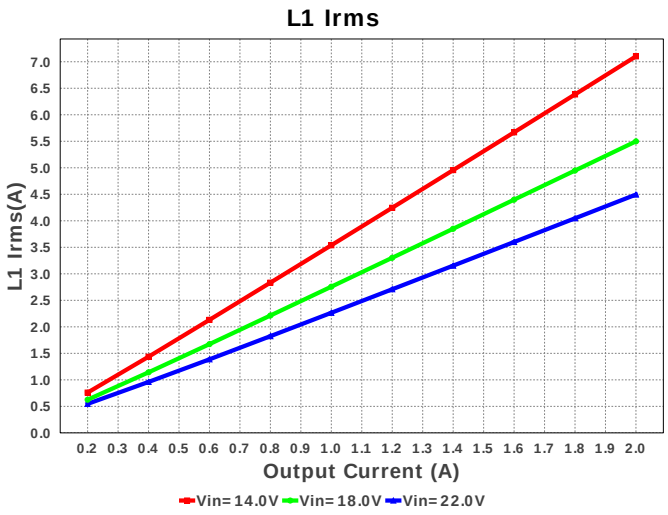


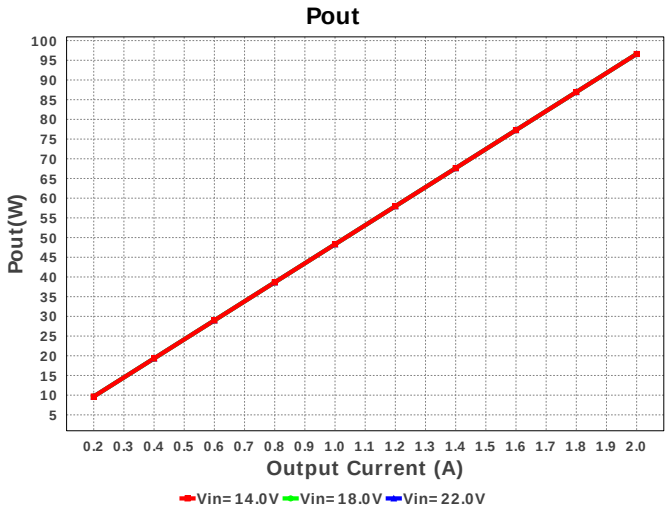


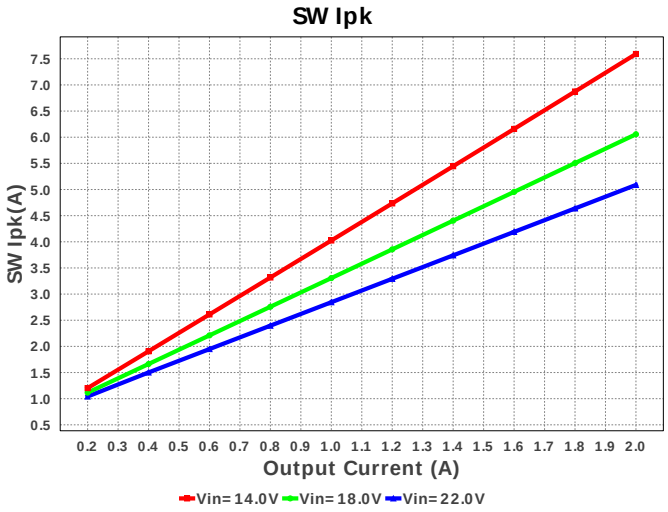


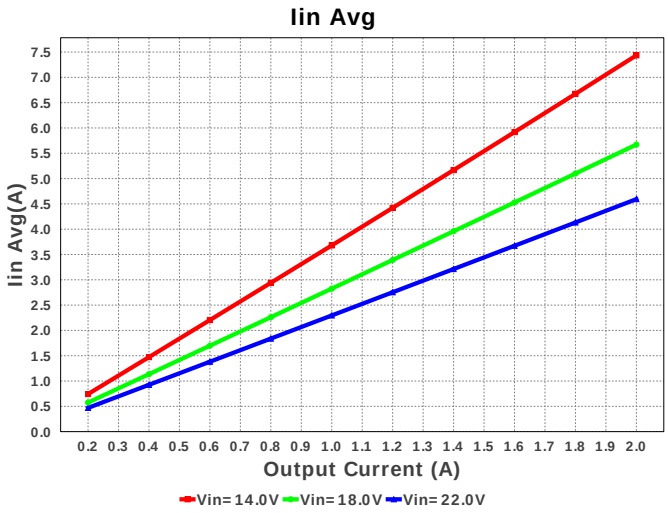


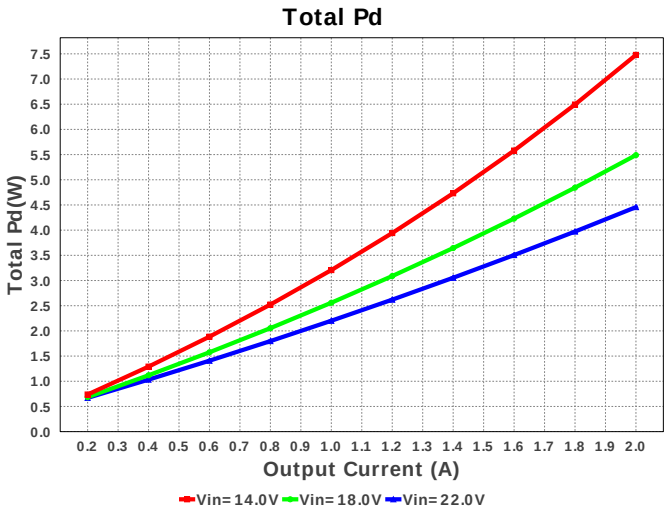


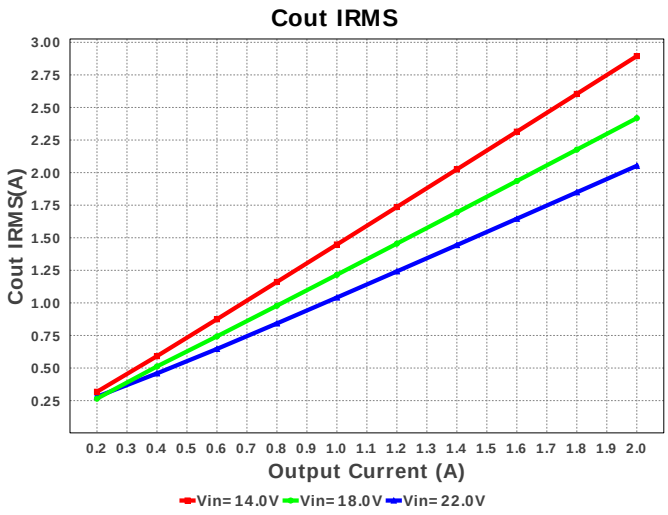


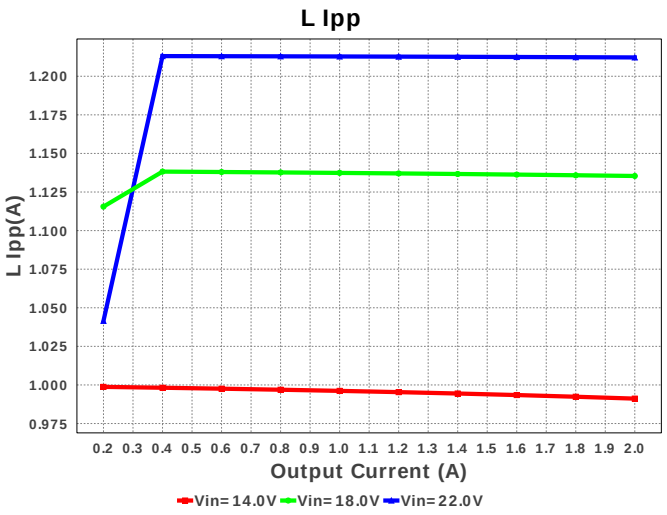


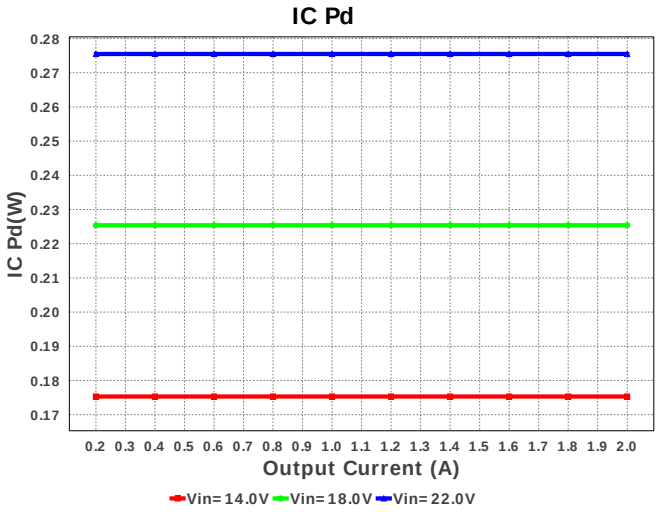


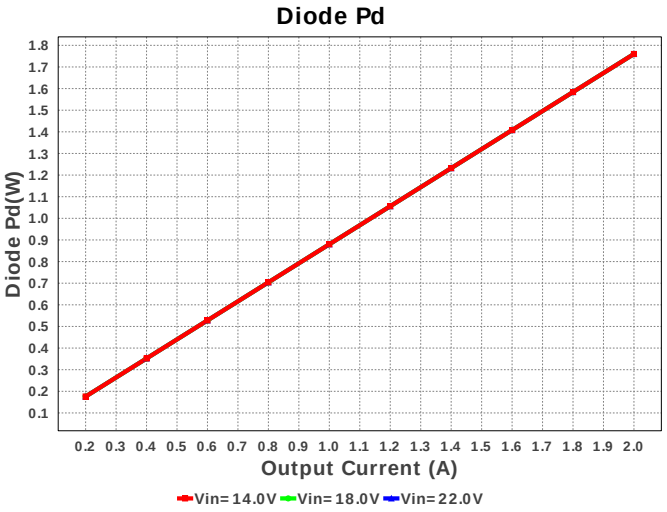


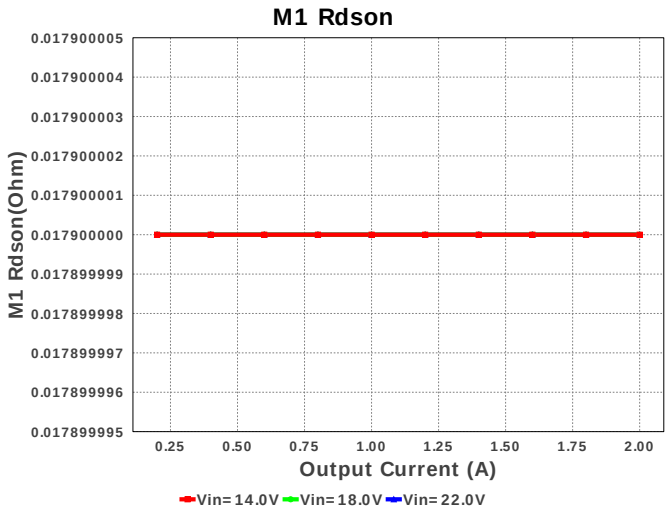


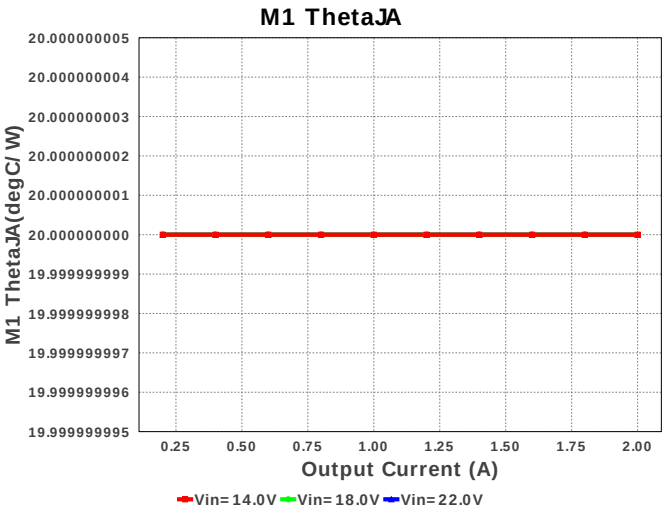


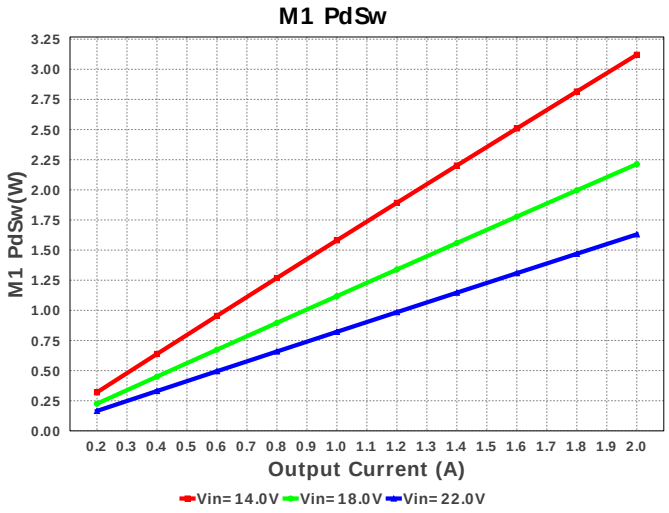


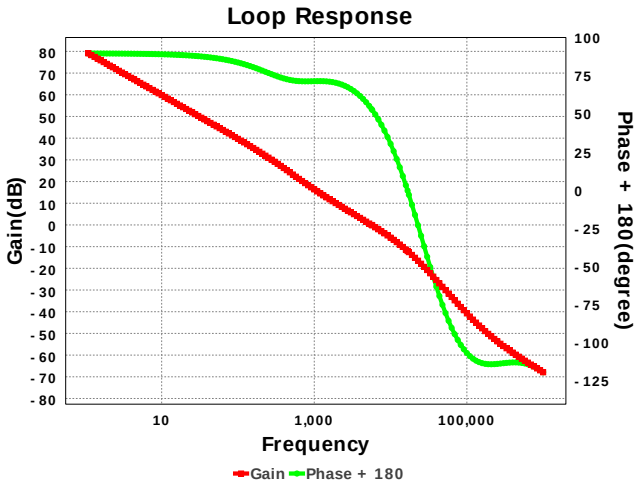












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	313.014 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	2.91 A	Current	Output capacitor RMS ripple current
3.	Coutx IRMS	0.0 A	Current	Output capacitor_x RMS ripple current
4.	Iin Avg	7.066 A	Current	Average input current
5.	L Ipp	1.084 A	Current	Peak-to-peak inductor ripple current
6.	L1 Irms	6.99 A	Current	Inductor ripple current
7.	M1 Irms	7.008 A	Current	M1 MOSFET Irms
8.	SW Ipk	7.525 A	Current	Peak switch current
9.	BOM Count	22	General	Total Design BOM count
10.	FootPrint	1.301 k mm^2	General	Total Foot Print Area of BOM components
11.	Frequency	512.777 kHz	General	Switching frequency
12.	IC Tolerance	10.0 mV	General	IC Feedback Tolerance
13.	M1 Rdson	17.9 mOhm	General	Drain-Source On-resistance
14.	M1 ThetaJA	20.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
15.	Pout	96.0 W	General	Total output power
16.	Total BOM	$6.12	General	Total BOM Cost
17.	D1 Tj	135.6 degC	Op_Point	D1 junction temperature
18.	Low Freq Gain	79.525 dB	Op_Point	Gain at 10Hz
19.	Vout Actual	48.3 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
20.	Vout OP	48.3 V	Op_Point	Operational Output Voltage
21.	Cross Freq	3.875 kHz	Op_point	Bode plot crossover frequency
22.	Duty Cycle	71.7 %	Op_point	Duty cycle
23.	Efficiency	97.042 %	Op_point	Steady state efficiency
24.	Gain Marg	-11.197 dB	Op_point	Bode Plot Gain Margin
25.	IC Tj	39.544 degC	Op_point	IC junction temperature
26.	ICThetaJA	57.7 degC/W	Op_point	IC junction-to-ambient thermal resistance
27.	IOUT_OP	2.0 A	Op_point	Iout operating point
28.	M1 TjOP	113.471 degC	Op_point	M1 MOSFET junction temperature
29.	Phase Marg	57.424 deg	Op_point	Bode Plot Phase Margin
30.	VIN_OP	14.0 V	Op_point	Vin operating point
31.	Vout p-p	114.501 mV	Op_point	Peak-to-peak output ripple voltage
32.	Cin Pd	196.739 µW	Power	Input capacitor power dissipation
33.	Cout Pd	105.857 mW	Power	Output capacitor power dissipation
34.	Coutx Pd	0.0 W	Power	Output capacitor_x power loss
35.	Diode Pd	1.76 W	Power	Diode power dissipation
36.	IC Pd	165.41 mW	Power	IC power dissipation
37.	L Pd	527.669 mW	Power	Inductor power dissipation
38.	M1 Pd	4.174 W	Power	M1 MOSFET total power dissipation
39.	M1 PdCond	1.315 W	Power	M1 MOSFET conduction losses
40.	M1 PdSw	2.859 W	Power	M1 MOSFET switching losses
41.	Rfb Pd	44.522 mW	Power	Rfb Power Dissipation
42.	Total Pd	2.926 W	Power	Total Power Dissipation
43.	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	2.0	Maximum Output Current
2.	Iout1	2.0	Output Current #1
3.	VinMax	22.0	Maximum input voltage
4.	VinMin	14.0	Minimum input voltage

#	Name	Value	Description
5.	Vout	48.0	Output Voltage
6.	Vout1	48.0	Output Voltage #1
7.	Vout2	24.0	Output Voltage #2
8.	base_pn	TPS40210-Q1	Base Product Number
9.	source	DC	Input Source Type
10.	Ta	30.0	Ambient temperature

Design Assistance

1. The TPS40210-Q1 is qualified for Automotive applications. All passives and other components selected in this design may not be qualified for Automotive applications. The user is required to verify that all components in the design meet the qualification and safety requirements for their specific application

2. **TPS40210-Q1** Product Folder : http://www.ti.com/product/TPS40210%2DQ1 : contains the data sheet and other resources.