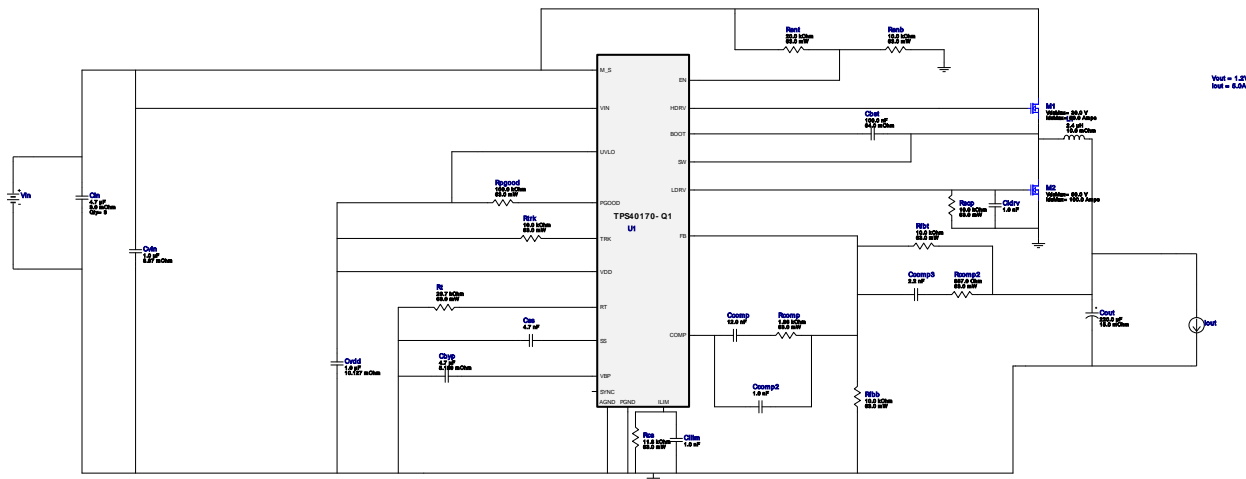


WEBENCH® Design Report

Design : 4466246/68 TPS40170QRGYRQ1
TPS40170QRGYRQ1 5.0V-24.0V to 1.20V @ 5.0A




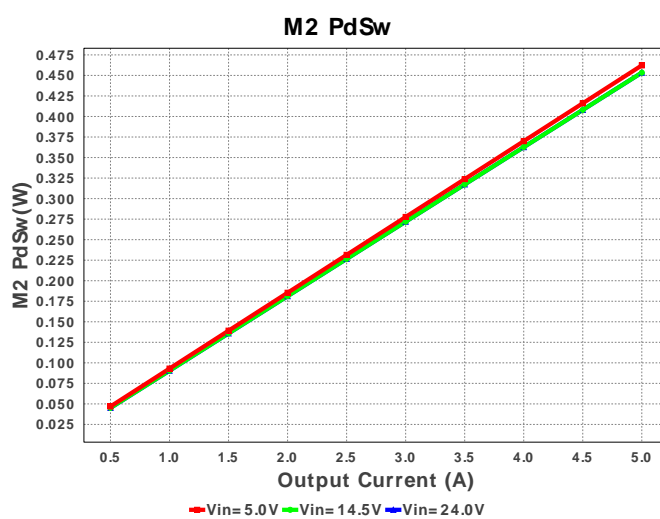
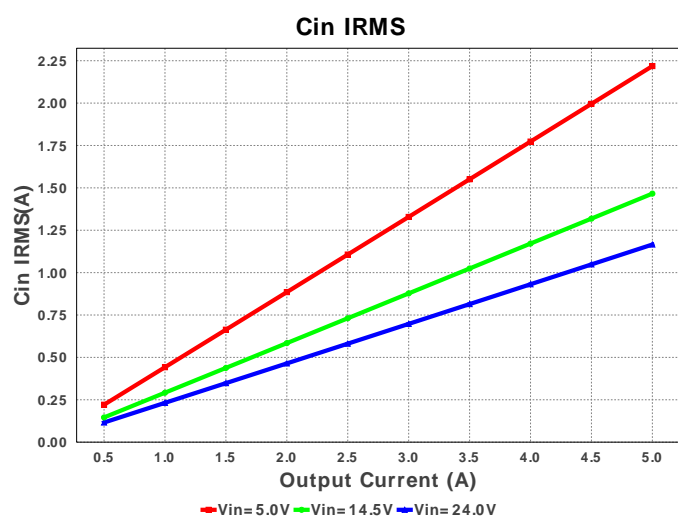
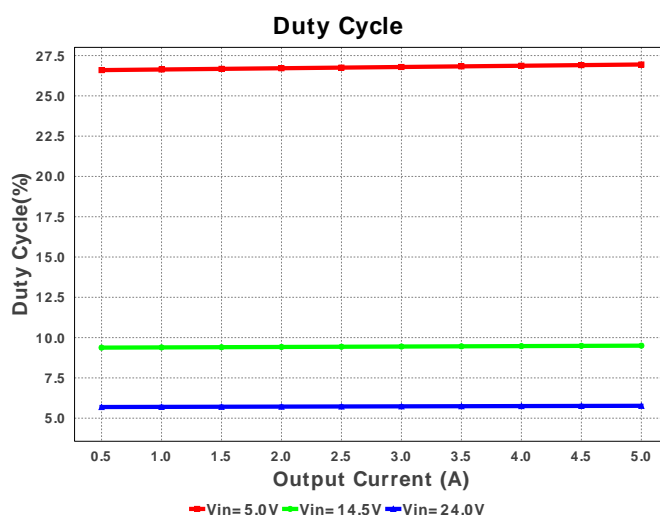
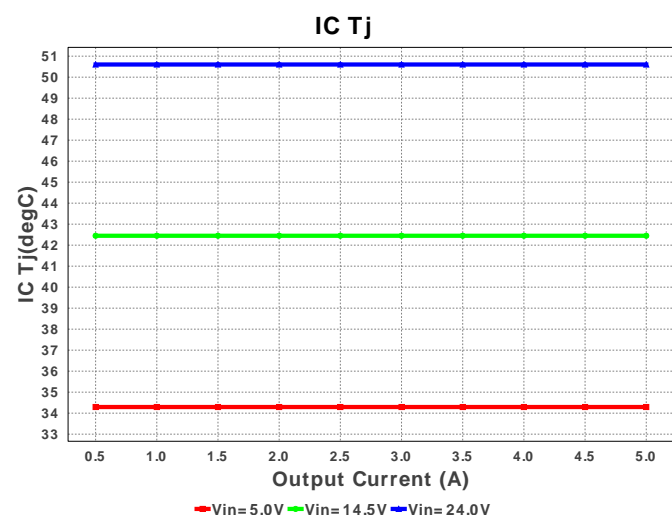
1. This regulator device is qualified for Automotive applications. All passives and other components selected in this design may not be qualified for Automotive applications. The user is required to verify that all components in the design meet the qualification and safety requirements for their specific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

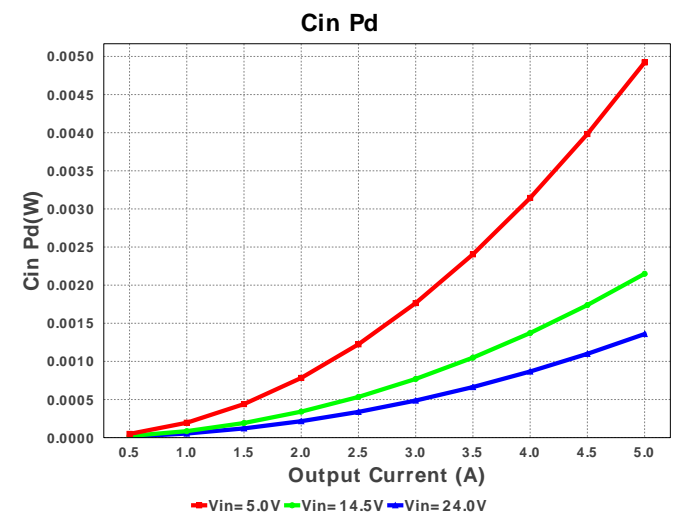
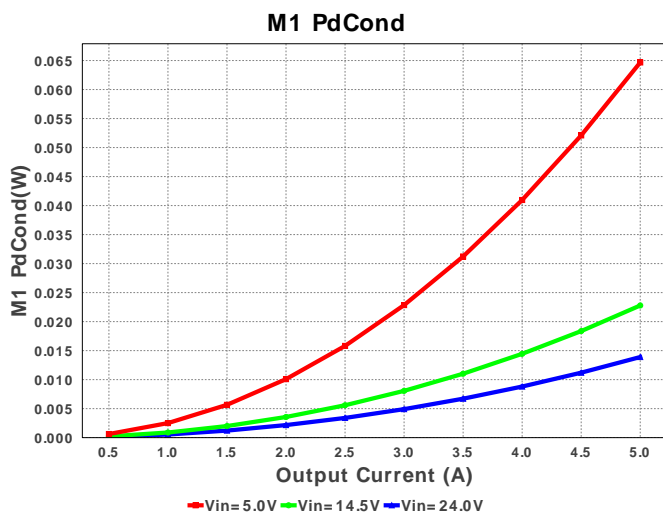
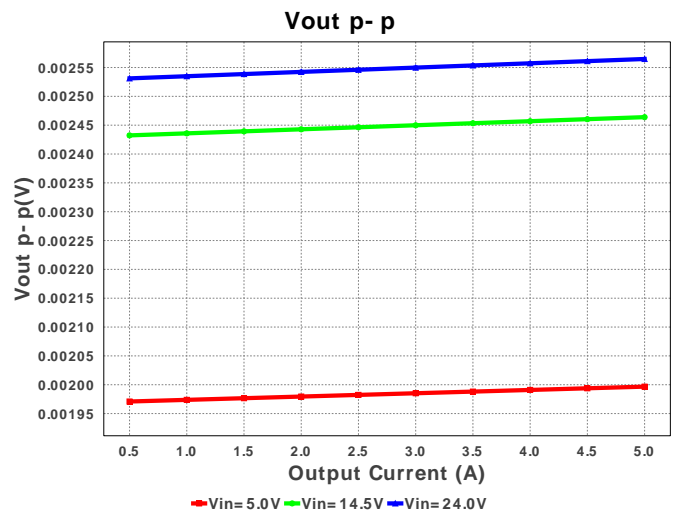
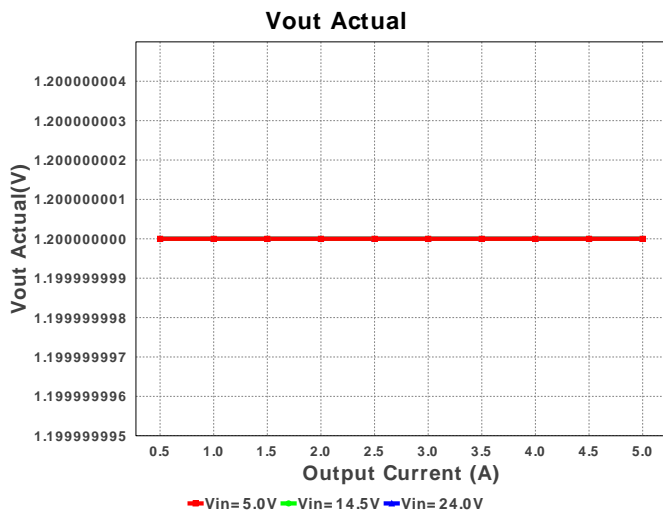
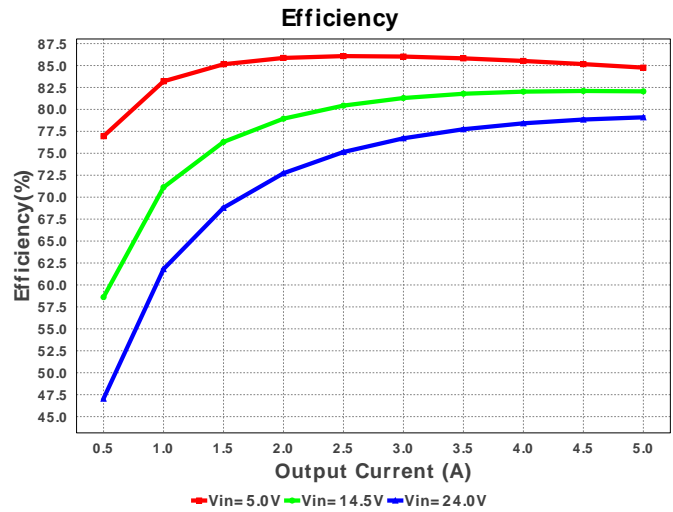
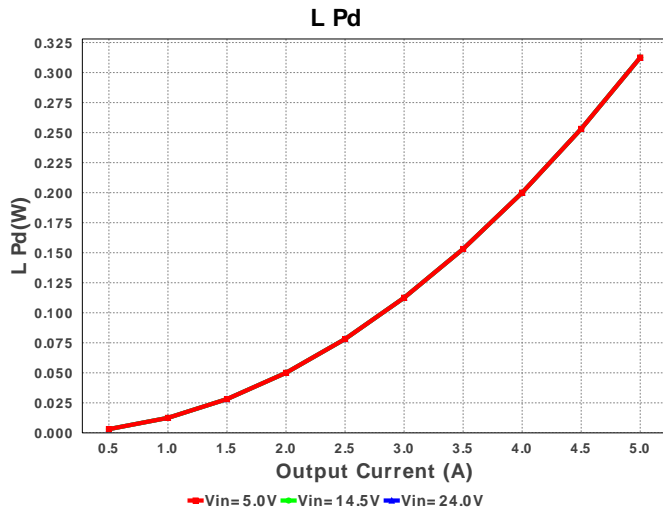
Electrical BOM

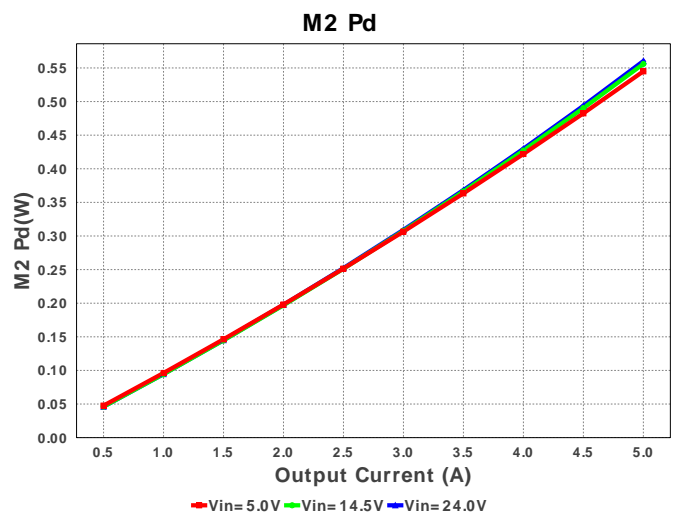
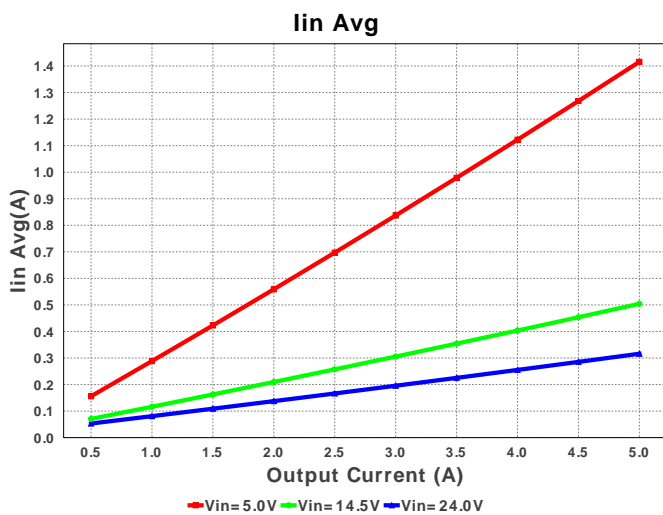
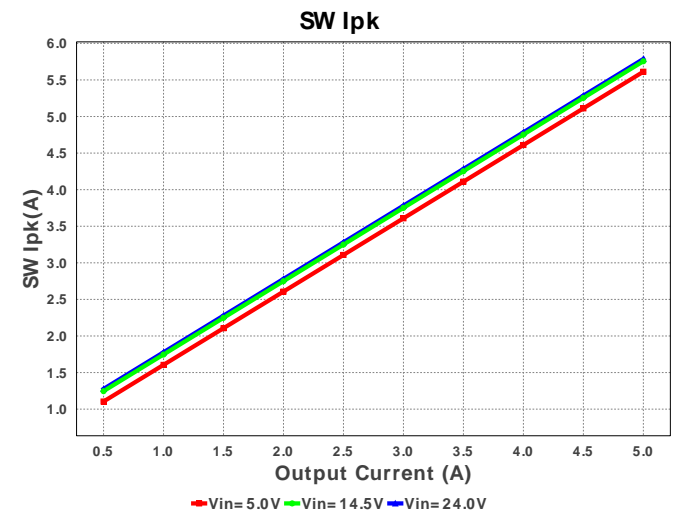
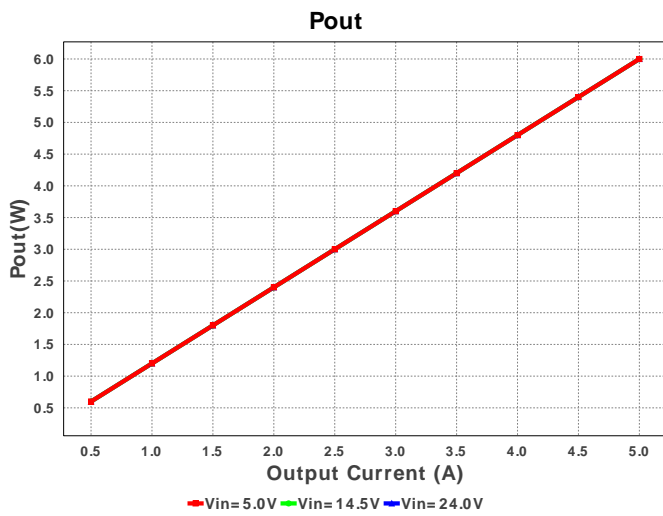
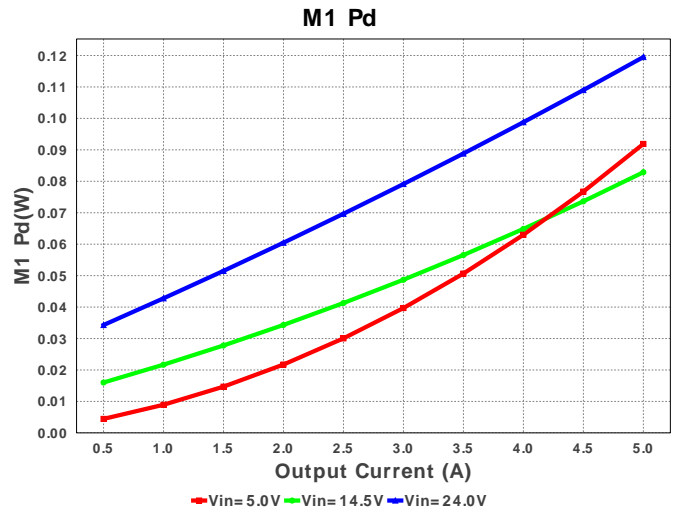
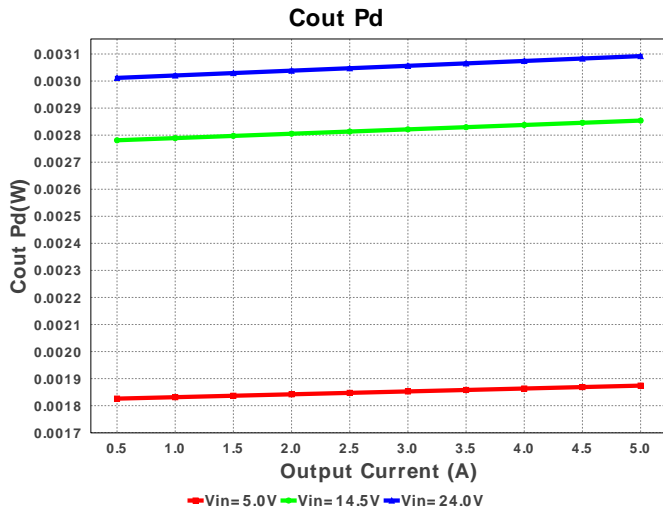
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbst	Kemet	C0805C104K5RACTU Series= X7R	Cap= 100.0 nF ESR= 64.0 mOhm VDC= 50.0 V IRMS= 1.64 A	1	\$0.01	0805 7 mm ²
2.	Cbyp	MuRata	GRM21BR61E475KA12L Series= X5R	Cap= 4.7 uF ESR= 5.189 mOhm VDC= 25.0 V IRMS= 2.03531 A	1	\$0.02	0805 7 mm ²
3.	Ccomp	MuRata	GRM033C80J123KE01D Series= X6S	Cap= 12.0 nF VDC= 6.3 V IRMS= 0.0 A	1	\$0.01	0201 2 mm ²
4.	Ccomp2	Samsung Electro-Mechanics	CL21C102JBCNFNC Series= C0G/NP0	Cap= 1.0 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
5.	Ccomp3	Yageo America	CC0805KRX7R9BB222 Series= X7R	Cap= 2.2 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
6.	Cilim	MuRata	GRM216R71E102KA01D Series= X7R	Cap= 1.0 nF VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
7.	Cin	MuRata	GRM31CR71H475KA12L Series= X7R	Cap= 4.7 uF ESR= 3.0 mOhm VDC= 50.0 V IRMS= 4.98 A	3	\$0.07	1206 11 mm ²
8.	Cldr	MuRata	GRM216R71E102KA01D Series= X7R	Cap= 1.0 nF VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
9.	Cout	Panasonic	6SVPE220MW Series= SVPE	Cap= 220.0 uF ESR= 15.0 mOhm VDC= 6.3 V IRMS= 3.15 A	1	\$0.20	CAPSMT_62_E61 53 mm ²

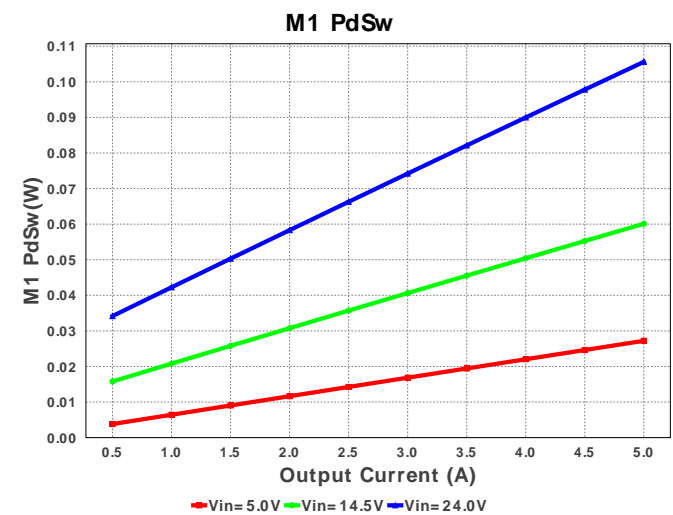
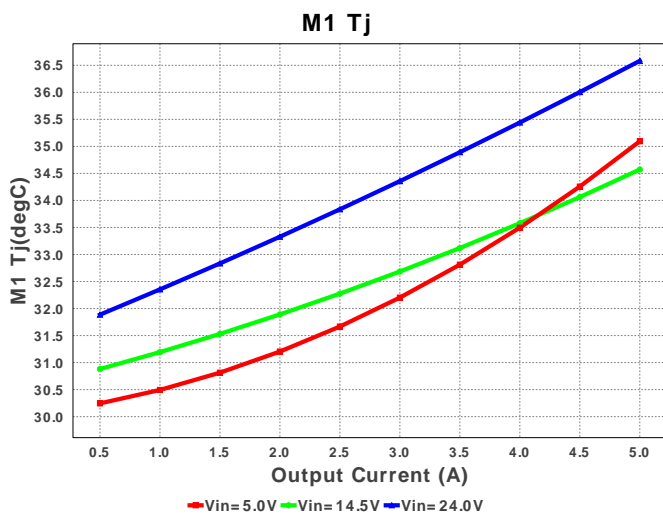
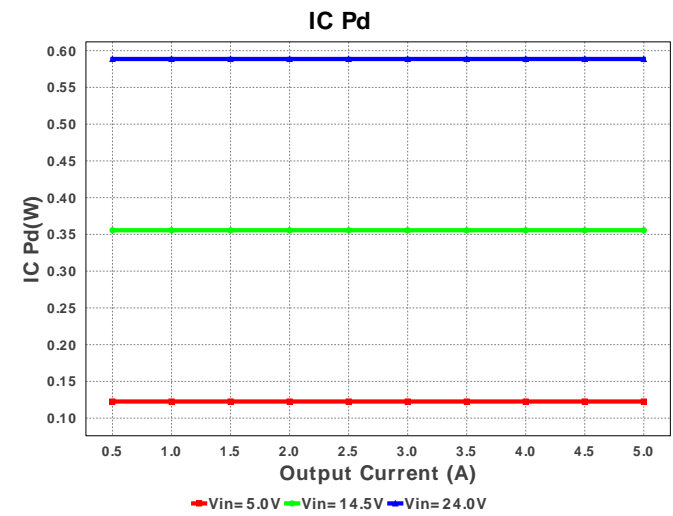
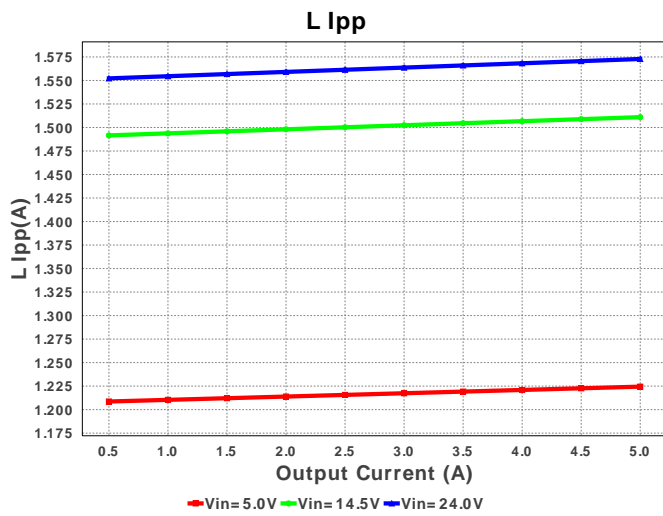
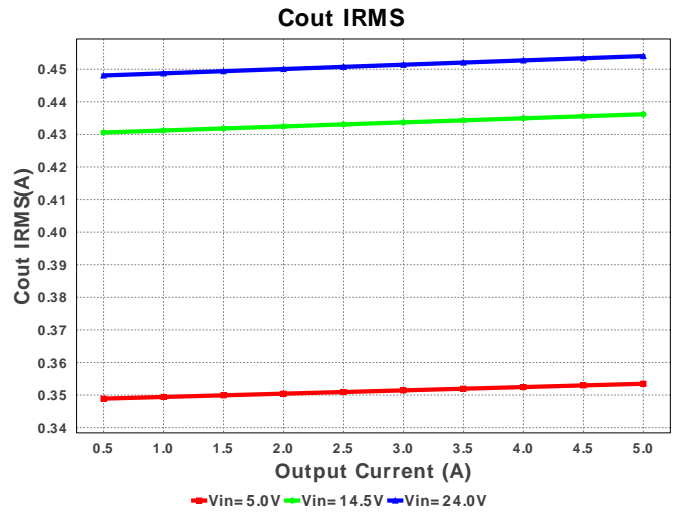
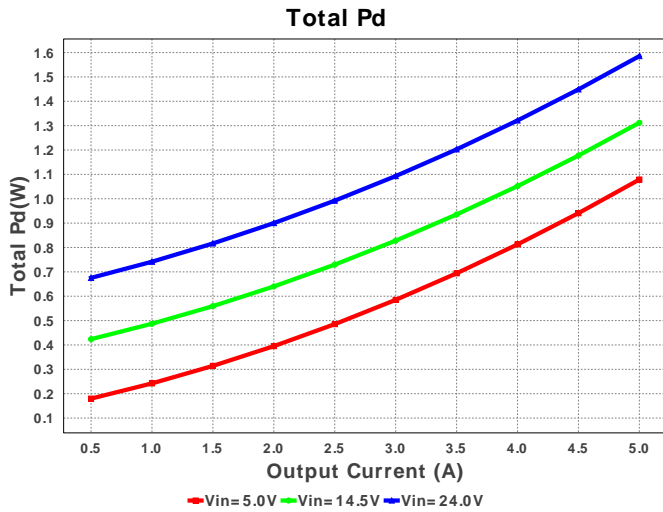
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	Css	MuRata	GRM033R70J472KA01D Series= X7R	Cap= 4.7 nF VDC= 6.3 V IRMS= 0.0 A	1	\$0.01	 0201 2 mm ²
11.	Cvdd	MuRata	GRM188R61C105KA93D Series= X5R	Cap= 1.0 uF ESR= 10.127 mOhm VDC= 16.0 V IRMS= 994.63 mA	1	\$0.01	 0603 5 mm ²
12.	Cvin	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 mm ²
13.	L1	Bourns	SRR1280-2R4Y	L= 2.4 uH DCR= 10.0 mOhm	1	\$0.41	 SRR1280 210 mm ²
14.	M1	Texas Instruments	CSD17308Q3	VdsMax= 30.0 V IdsMax= 50.0 Amps	1	\$0.34	 TRANS_NexFET_Q3 18 mm ²
15.	M2	Texas Instruments	CSD18532Q5B	VdsMax= 60.0 V IdsMax= 100.0 Amps	1	\$1.14	 TRANS_NexFET_Q5B 58 mm ²
16.	Rcomp	Vishay-Dale	CRCW04021K96FKED Series= CRCW..e3	Res= 1.96 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
17.	Rcomp2	Vishay-Dale	CRCW0402887RFKED Series= CRCW..e3	Res= 887.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
18.	Rcs	Vishay-Dale	CRCW040211K8FKED Series= CRCW..e3	Res= 11.8 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
19.	Renb	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
20.	Rent	Vishay-Dale	CRCW040220K0FKED Series= CRCW..e3	Res= 20.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
21.	Rfbb	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
22.	Rfbt	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
23.	Rpgood	Vishay-Dale	CRCW0402100KFKED Series= CRCW..e3	Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
24.	Rscp	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
25.	Rt	Vishay-Dale	CRCW040226K7FKED Series= CRCW..e3	Res= 26.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
26.	Rtrk	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²

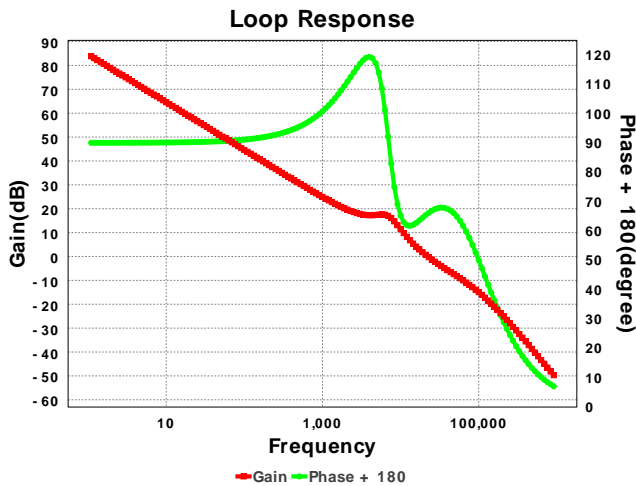
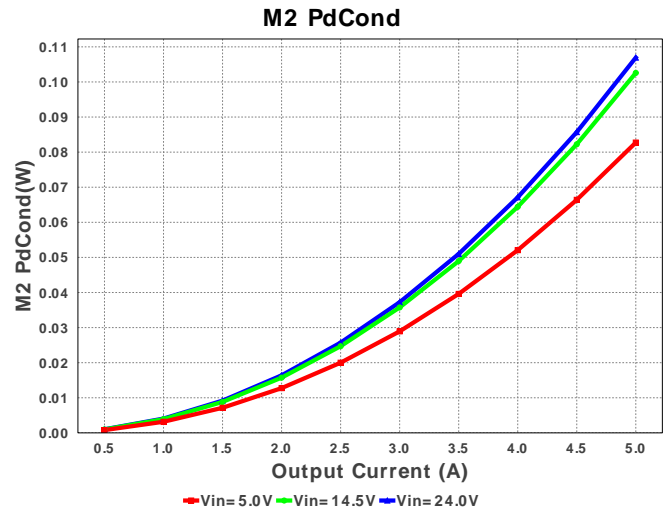
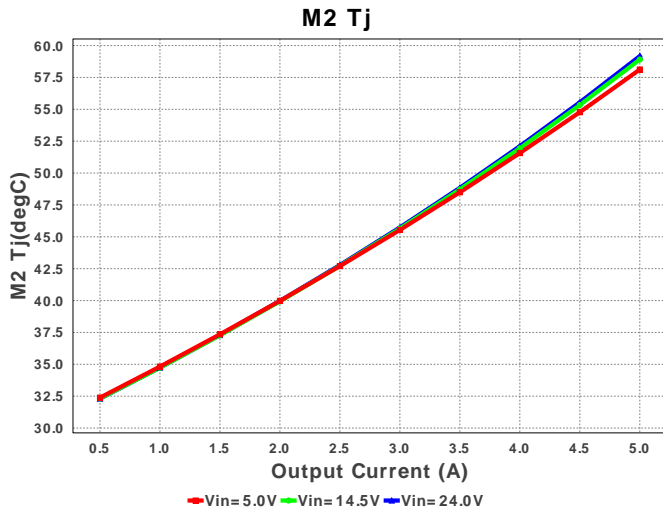
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
27.	U1	Texas Instruments	TPS40170QRGYRQ1	Switcher	1	\$2.46	 R-PVQFN-N20 25 mm ²











Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	1.166 A	Current	Input capacitor RMS ripple current
2.	Cout IRMS	454.037 mA	Current	Output capacitor RMS ripple current
3.	Iin Avg	316.1 mA	Current	Average input current
4.	L Ipp	1.573 A	Current	Peak-to-peak inductor ripple current
5.	SW Ipk	5.786 A	Current	Peak switch current
6.	BOM Count	29	General	Total Design BOM count
7.	FootPrint	490.0 mm ²	General	Total Foot Print Area of BOM components
8.	Frequency	348.432 kHz	General	Switching frequency
9.	IC Tolerance	6.0 μ V	General	IC Feedback Tolerance
10.	Pout	6.0 W	General	Total output power
11.	Total BOM	\$4.99	General	Total BOM Cost
12.	Vout Actual	1.2 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
13.	Cross Freq	22.333 kHz	Op_point	Bode plot crossover frequency
14.	Duty Cycle	5.769 %	Op_point	Duty cycle
15.	Efficiency	79.09 %	Op_point	Steady state efficiency
16.	IC Tj	50.603 degC	Op_point	IC junction temperature
17.	IOUT_OP	5.0 A	Op_point	Iout operating point
18.	M1 Tj	36.583 degC	Op_point	M1 MOSFET junction temperature
19.	M2 Tj	59.173 degC	Op_point	M2 MOSFET junction temperature
20.	Phase Marg	65.281 deg	Op_point	Bode Plot Phase Margin
21.	VIN_OP	24.0 V	Op_point	Vin operating point
22.	Vout p-p	2.565 mV	Op_point	Peak-to-peak output ripple voltage
23.	Cin Pd	1.359 mW	Power	Input capacitor power dissipation
24.	Cout Pd	3.092 mW	Power	Output capacitor power dissipation
25.	IC Pd	588.669 mW	Power	IC power dissipation
26.	L Pd	312.5 mW	Power	Inductor power dissipation
27.	M1 Pd	119.596 mW	Power	M1 MOSFET total power dissipation
28.	M1 PdCond	13.985 mW	Power	M1 MOSFET conduction losses
29.	M1 PdSw	105.611 mW	Power	M1 MOSFET switching losses
30.	M2 Pd	561.095 mW	Power	M2 MOSFET total power dissipation
31.	M2 PdCond	107.729 mW	Power	M2 MOSFET conduction losses

#	Name	Value	Category	Description
32.	M2 PdSw	453.365 mW	Power	M2 MOSFET switching losses
33.	Total Pd	1.586 W	Power	Total Power Dissipation
34.	Vout Tolerance	1.011 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	5.0	Maximum Output Current
2.	VinMax	24.0	Maximum input voltage
3.	VinMin	5.0	Minimum input voltage
4.	Vout	1.2	Output Voltage
5.	base_pn	TPS40170-Q1	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	30.0	Ambient temperature

Design Assistance

1. Feature Highlights: Automotive Qualified 4.5V to 60V Wide Input Synchronous PWM Buck Controller
2. The TPS40170-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
3. **TPS40170-Q1** Product Folder : <http://www.ti.com/product/TPS40170%2DQ1> : contains the data sheet and other resources.

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You should completely validate and test your design implementation to confirm the system functionality for your application prior to production.

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