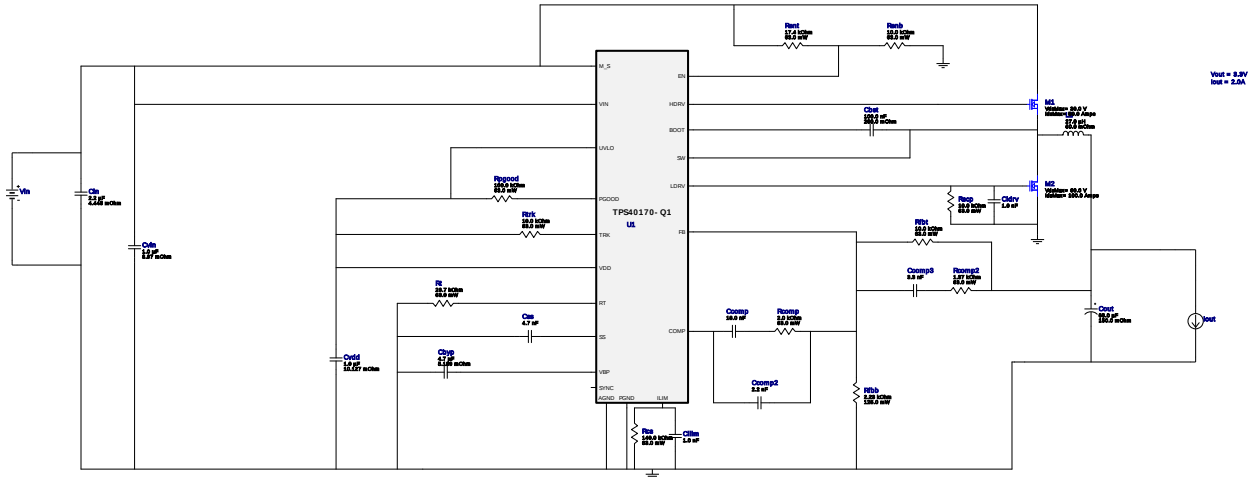


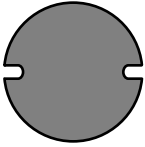
WEBENCH® Design Report

Design : 1913968/1487 TPS40170QRGYRQ1
TPS40170QRGYRQ1 14.0V-22.0V to 3.30V @ 2.0A


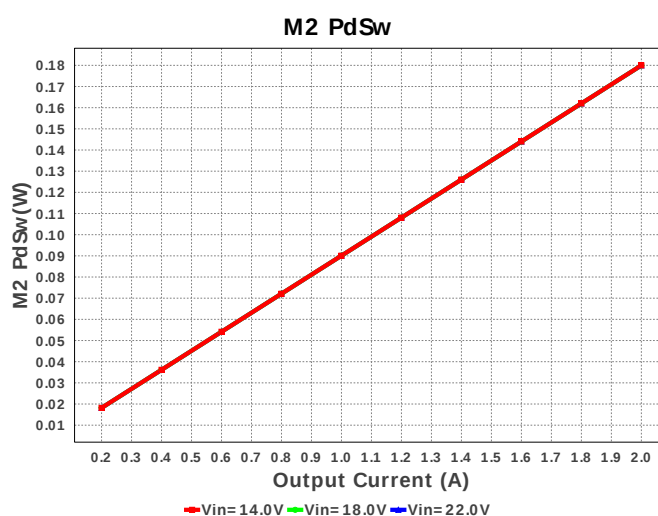
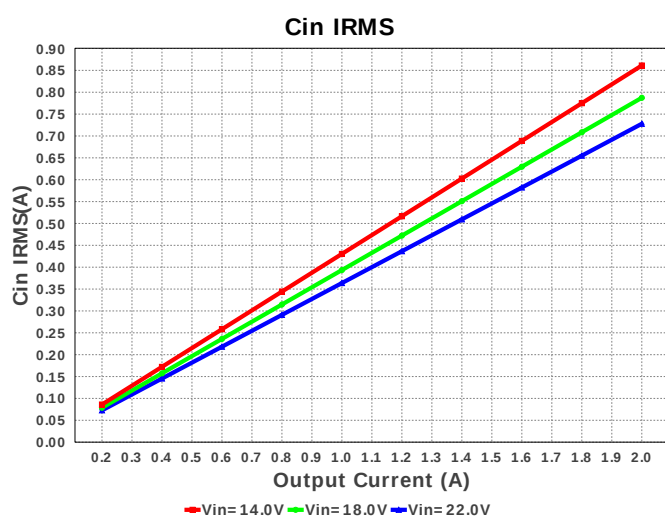
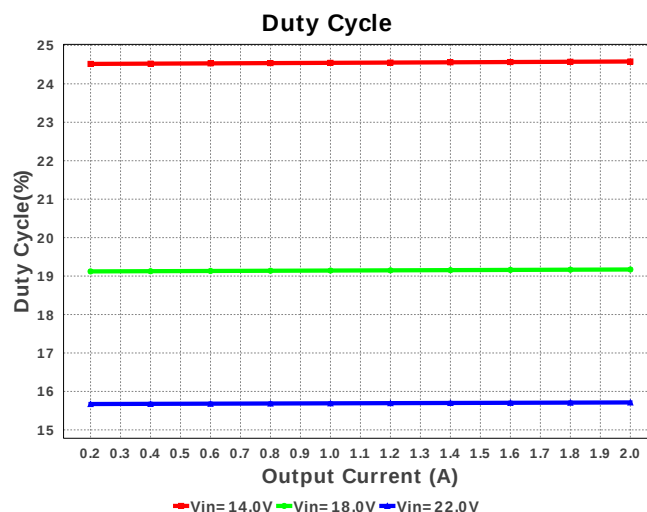
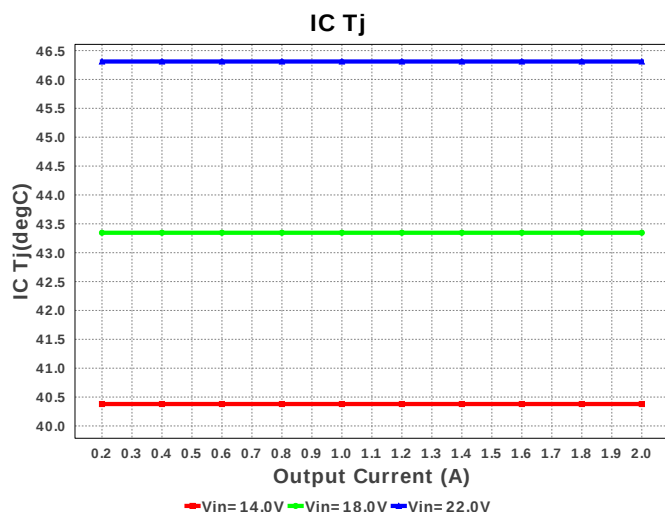
1. This regulator device is qualified for Automotive applications. All passives and other components selected in this design may not be qualified for Automotive applications. The user is required to verify that all components in the design meet the qualification and safety requirements for their specific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

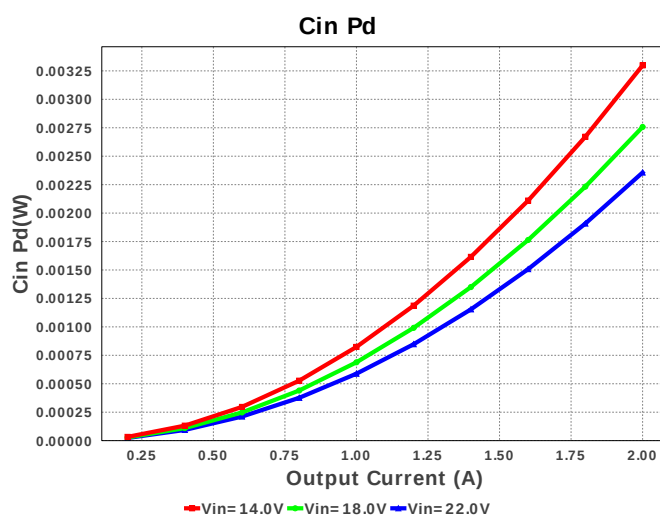
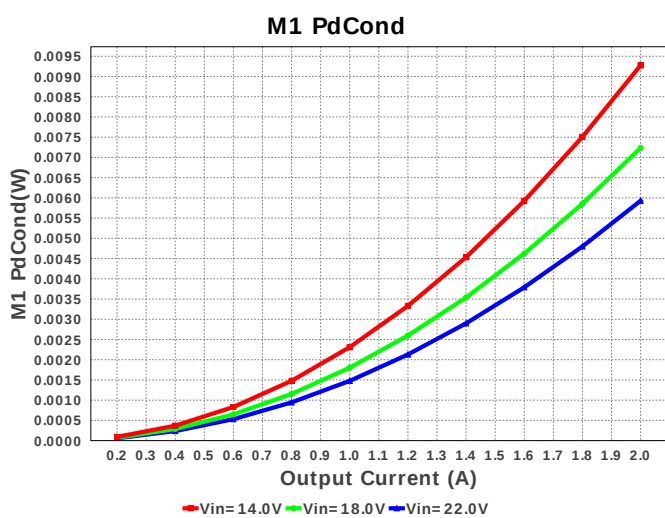
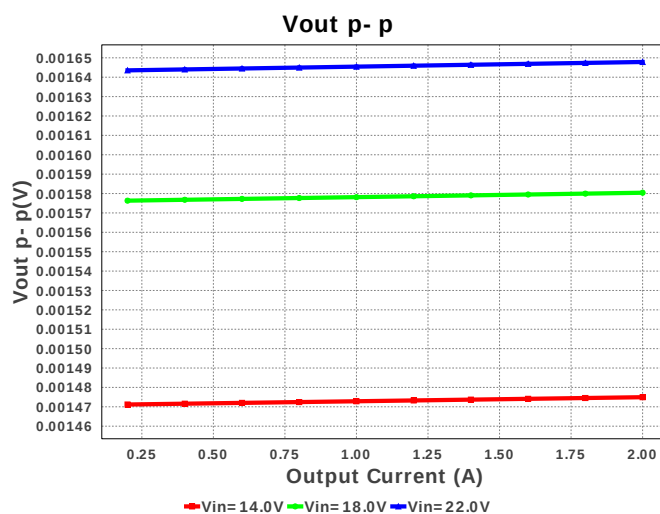
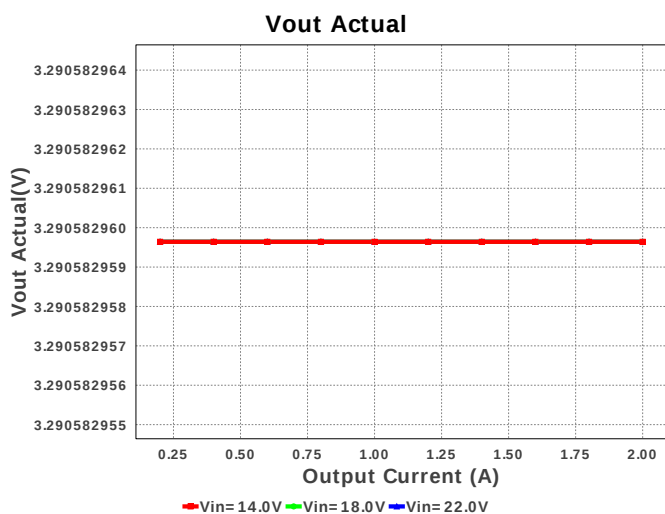
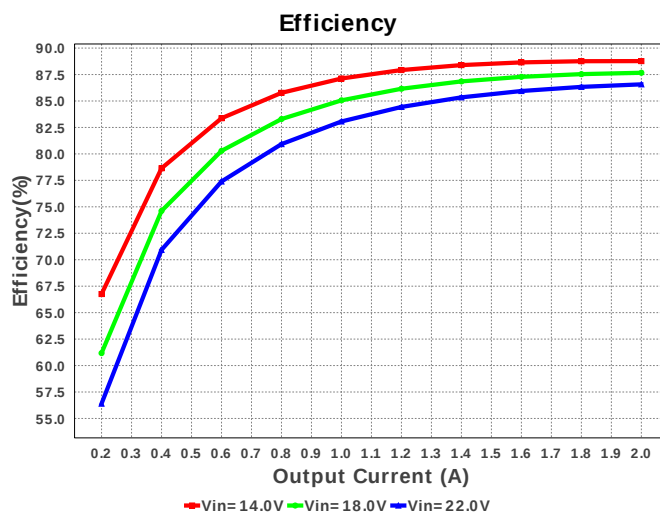
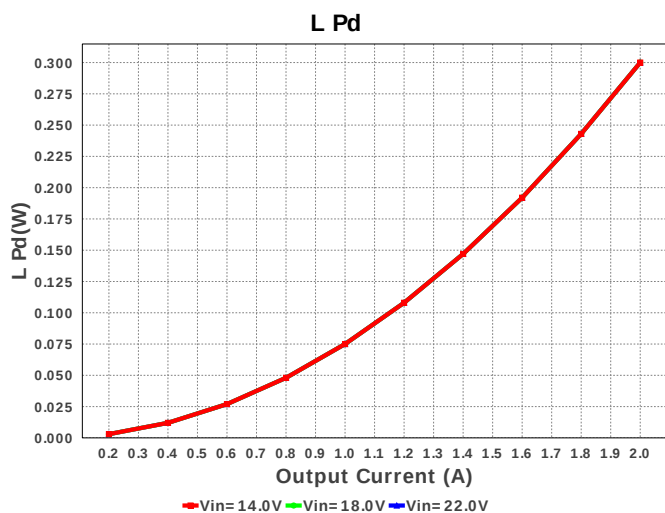
Electrical BOM

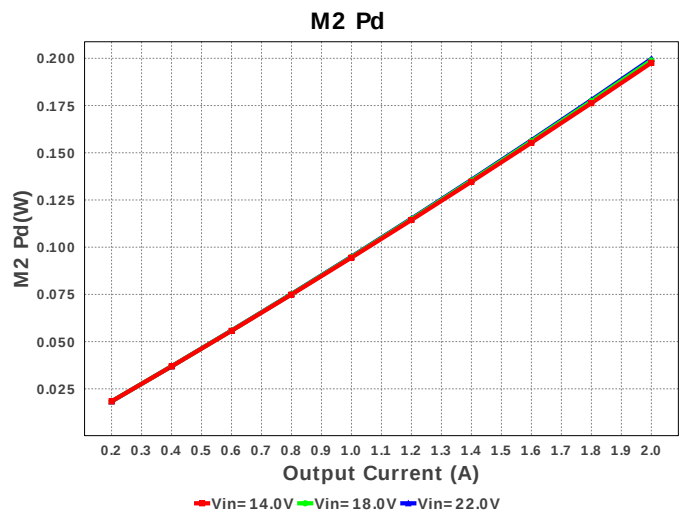
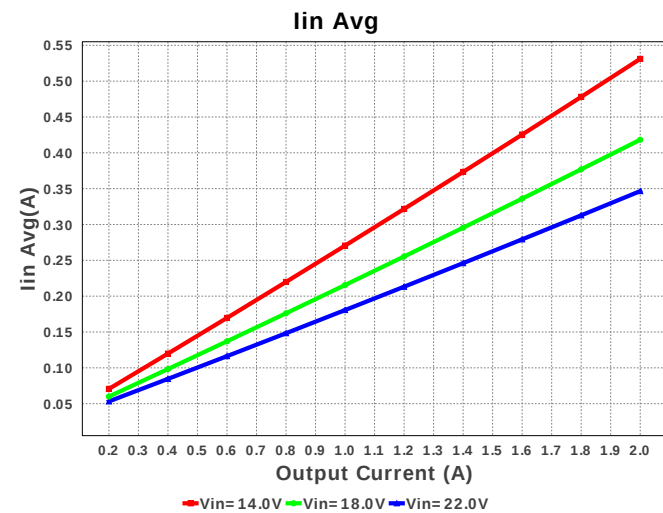
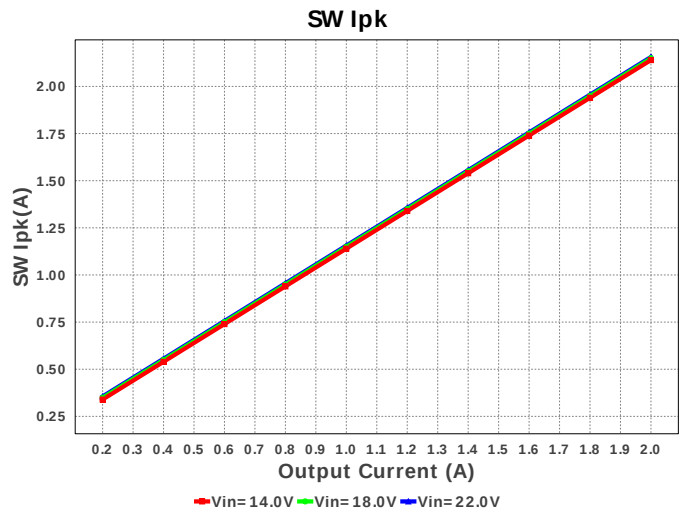
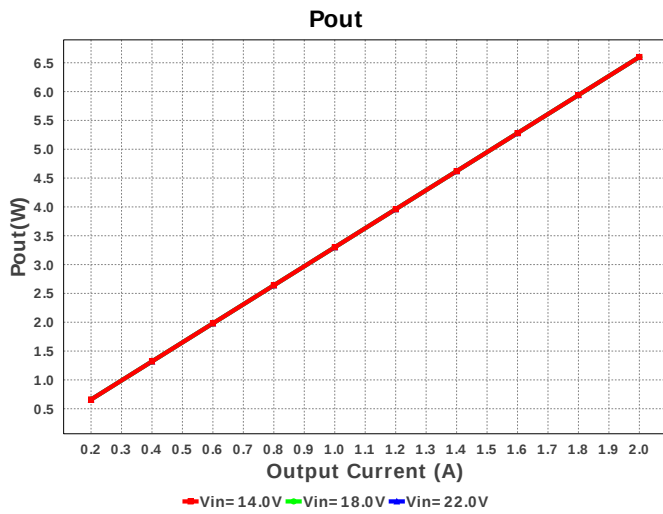
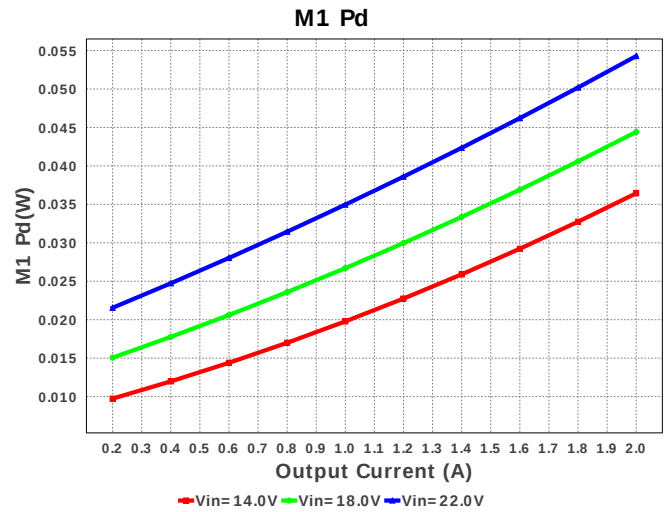
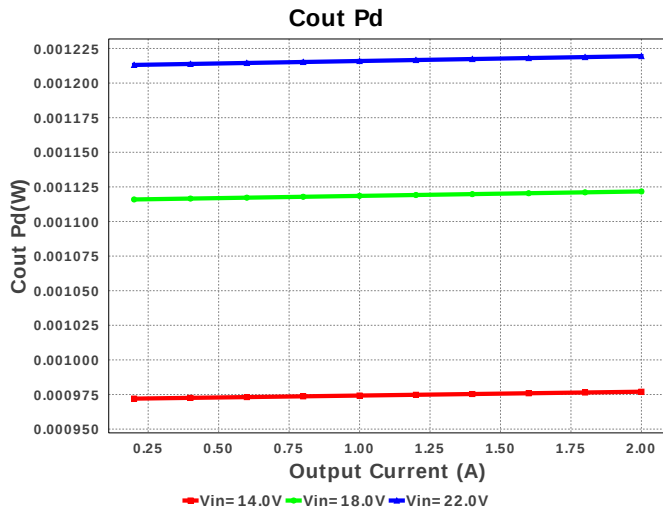
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbst	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
2.	Cbyp	MuRata	GRM21BR61E475KA12L Series= X5R	Cap= 4.7 uF ESR= 5.189 mOhm VDC= 25.0 V IRMS= 2.03531 A	1	\$0.02	0805 7 mm ²
3.	Ccomp	Yageo America	CC0805KRX7R9BB183 Series= X7R	Cap= 18.0 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
4.	Ccomp2	Yageo America	CC0805KRX7R9BB222 Series= X7R	Cap= 2.2 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
5.	Ccomp3	MuRata	GRM216R71E332KA01D Series= X7R	Cap= 3.3 nF VDC= 25.0 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	GRM31CR71H225KA88L Series= X7R	Cap= 2.2 uF ESR= 4.448 mOhm VDC= 50.0 V IRMS= 2.2252 A	1	\$0.05	1206_190 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	4TPH68MHA Series= ?	Cap= 68.0 uF ESR= 150.0 mOhm VDC= 4.0 V IRMS= 510.0 mA	1	\$0.34	CAPSMT_6_A09 11 mm ²

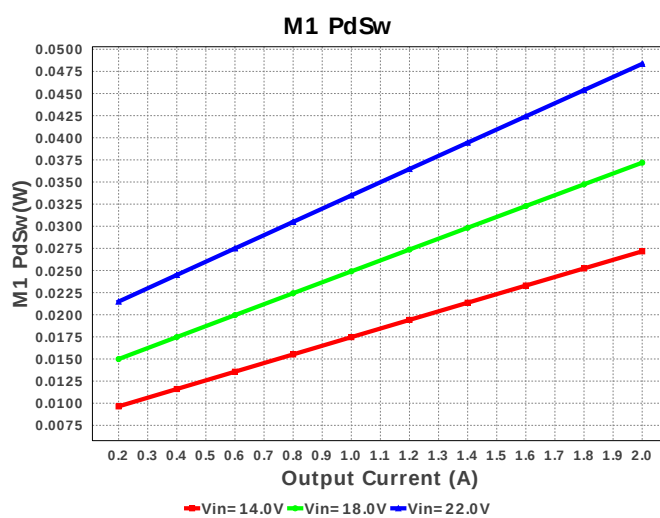
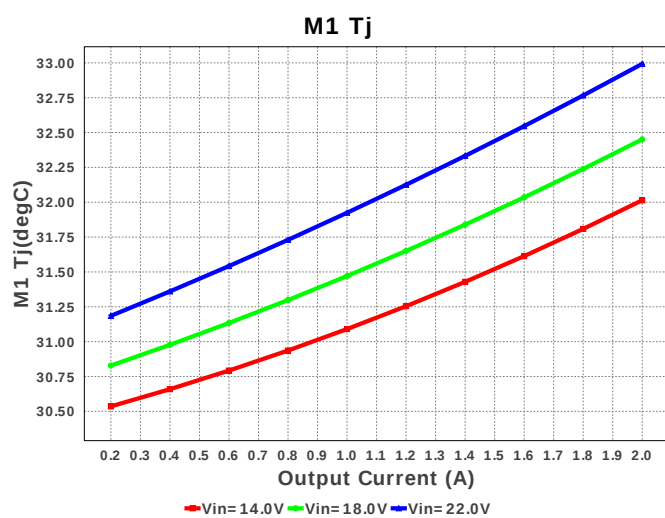
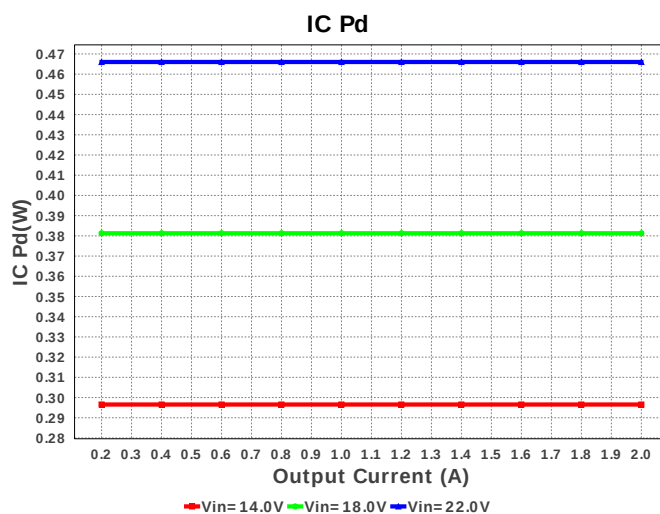
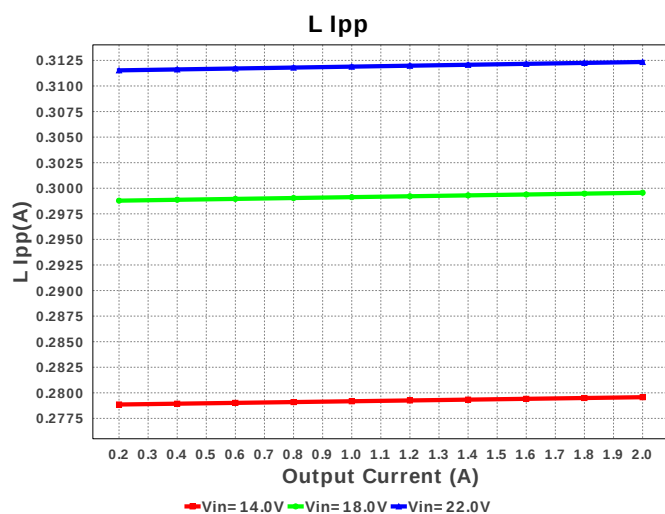
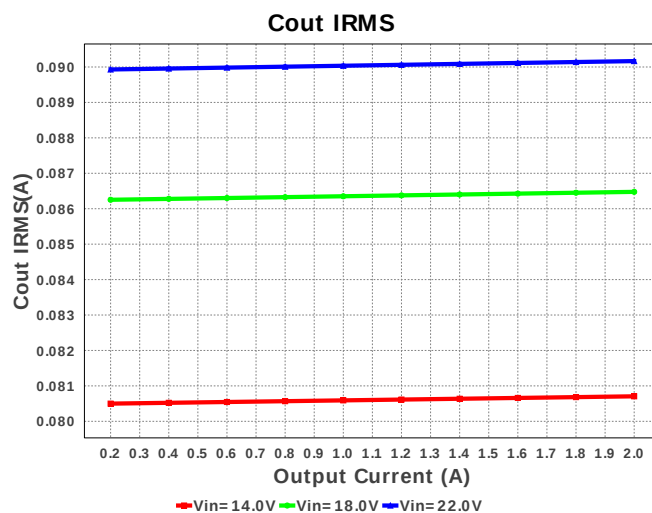
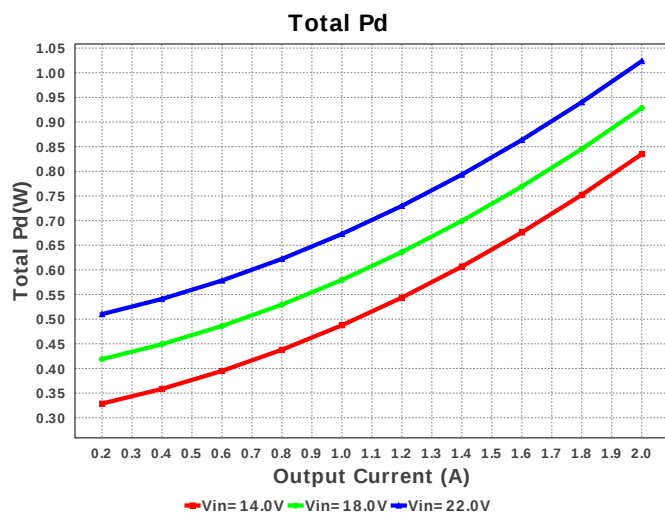
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	Css	MuRata	GRM033R70J472KA01D Series= X7R	Cap= 4.7 nF VDC= 6.3 V IRMS= 0.0 A	1	\$0.01	 0201 2 mm ²
11.	Cvdd	MuRata	GRM188R61C105KA93D Series= X5R	Cap= 1.0 uF ESR= 10.127 mOhm VDC= 16.0 V IRMS= 994.63 mA	1	\$0.01	 0603 5 mm ²
12.	Cvin	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	SDR1307-270ML	L= 27.0 µH DCR= 60.0 mOhm	1	\$0.35	 SDR1307 227 mm ²
14.	M1	Texas Instruments	CSD17308Q3	VdsMax= 30.0 V IdsMax= 50.0 Amps	1	\$0.28	 DQG0008A 18 mm ²
15.	M2	Texas Instruments	CSD18531Q5A	VdsMax= 60.0 V IdsMax= 100.0 Amps	1	\$0.65	 TRANS_NexFET_Q5A 55 mm ²
16.	Rcomp	Vishay-Dale	CRCW04022K00FKED Series= CRCW..e3	Res= 2.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
17.	Rcomp2	Vishay-Dale	CRCW04021K37FKED Series= CRCW..e3	Res= 1.37 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
18.	Rcs	Vishay-Dale	CRCW0402140KFKED Series= CRCW..e3	Res= 140.0 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	CRCW040217K4FKED Series= CRCW..e3	Res= 17.4 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
21.	Rfbb	Yageo America	RT0805BRD072K23L Series= RT0805	Res= 2.23 kOhm Power= 125.0 mW Tolerance= 0.1%	1	\$0.05	 0805 7 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

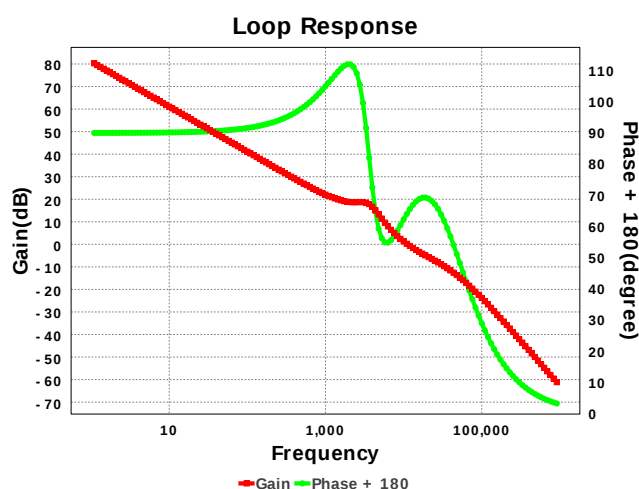
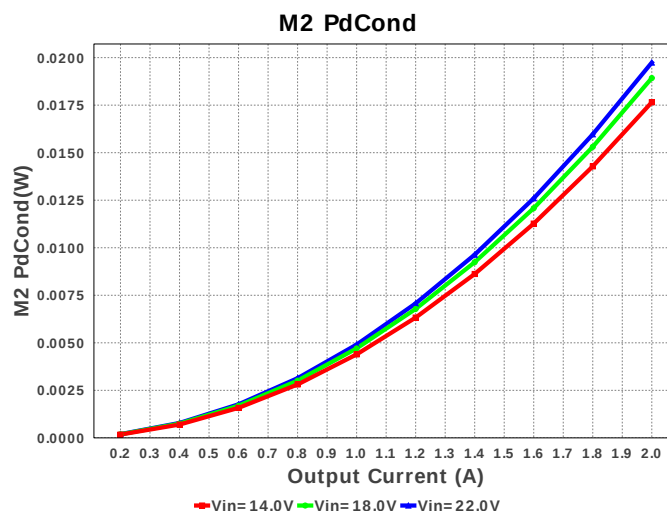
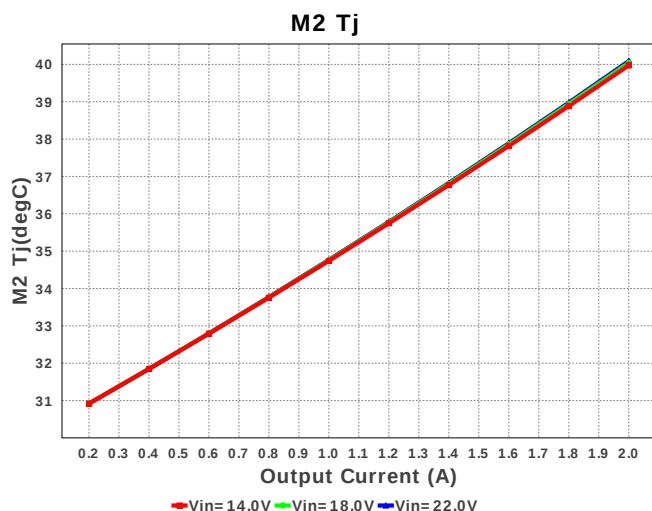
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
27. U1		Texas Instruments	TPS40170QRGYRQ1	Switcher	1	\$1.77	 R-PVQFN-N20 25 mm ²











Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	727.858 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	90.166 mA	Current	Output capacitor RMS ripple current
3.	Iin Avg	346.53 mA	Current	Average input current
4.	L Ipp	312.35 mA	Current	Peak-to-peak inductor ripple current
5.	SW Ipk	2.156 A	Current	Peak switch current
6.	BOM Count	27	General	Total Design BOM count
7.	FootPrint	448.0 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.	Mode	CCM	General	Conduction Mode
11.	Pout	6.6 W	General	Total output power
12.	Total BOM	\$3.71	General	Total BOM Cost
13.	Vout Actual	3.291 V	Op_point	Vout Actual calculated based on selected voltage divider resistors
14.	Cross Freq	11.238 kHz	Op_point	Bode plot crossover frequency
15.	Duty Cycle	15.714 %	Op_point	Duty cycle
16.	Efficiency	86.573 %	Op_point	Steady state efficiency
17.	IC Tj	46.311 degC	Op_point	IC junction temperature
18.	IOUT_OP	2.0 A	Op_point	Iout operating point
19.	M1 Tj	32.993 degC	Op_point	M1 MOSFET junction temperature
20.	M2 Tj	40.088 degC	Op_point	M2 MOSFET junction temperature
21.	Phase Marg	64.479 deg	Op_point	Bode Plot Phase Margin
22.	VIN_OP	22.0 V	Op_point	Vin operating point
23.	Vout p-p	1.648 mV	Op_point	Peak-to-peak output ripple voltage
24.	Cin Pd	2.356 mW	Power	Input capacitor power dissipation
25.	Cout Pd	1.219 mW	Power	Output capacitor power dissipation
26.	IC Pd	466.024 mW	Power	IC power dissipation
27.	L Pd	300.0 mW	Power	Inductor power dissipation
28.	M1 Pd	54.282 mW	Power	M1 MOSFET total power dissipation
29.	M1 PdCond	5.932 mW	Power	M1 MOSFET conduction losses
30.	M1 PdSw	48.351 mW	Power	M1 MOSFET switching losses
31.	M2 Pd	199.726 mW	Power	M2 MOSFET total power dissipation

#	Name	Value	Category	Description
32.	M2 PdCond	19.753 mW	Power	M2 MOSFET conduction losses
33.	M2 PdSw	179.973 mW	Power	M2 MOSFET switching losses
34.	Total Pd	1.024 W	Power	Total Power Dissipation
35.	Vout Tolerance	901.34 m%		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.	VinMax	22.0	Maximum input voltage
3.	VinMin	14.0	Minimum input voltage
4.	Vout	3.3	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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