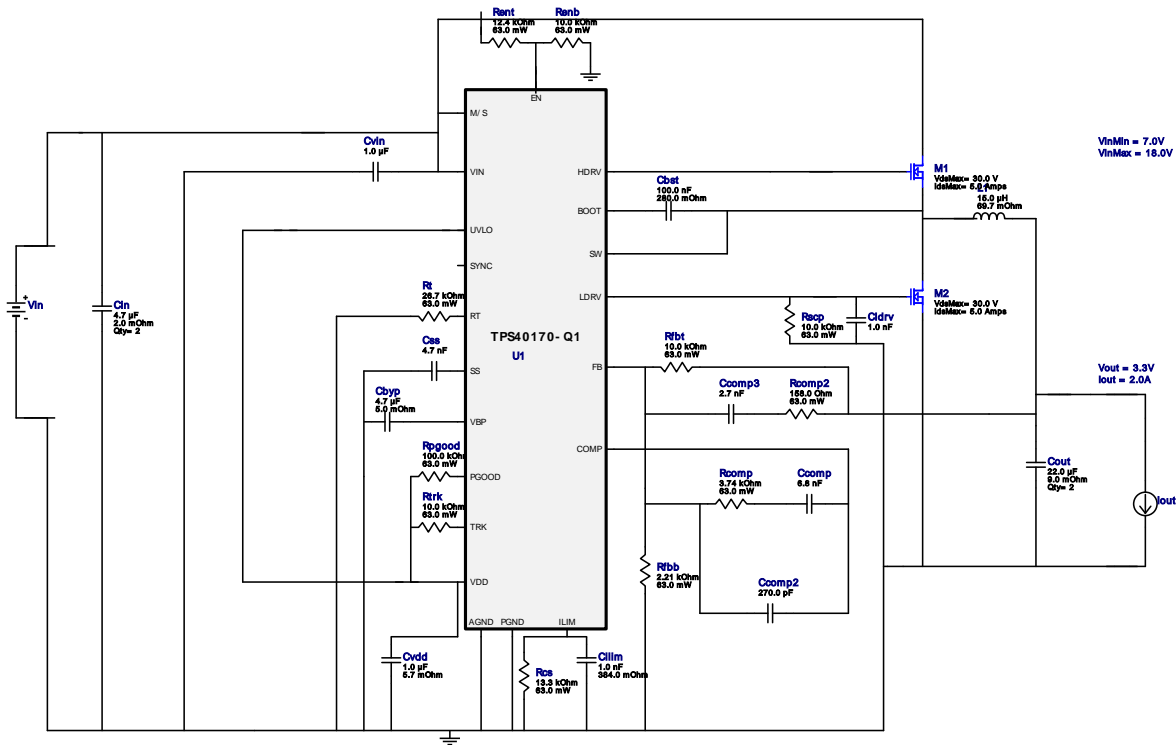






















## WEBENCH® Design Report

Design : 3550864/9 TPS40170QRGYRQ1  
TPS40170QRGYRQ1 7.0V-18.0V to 3.3V @ 2.0A


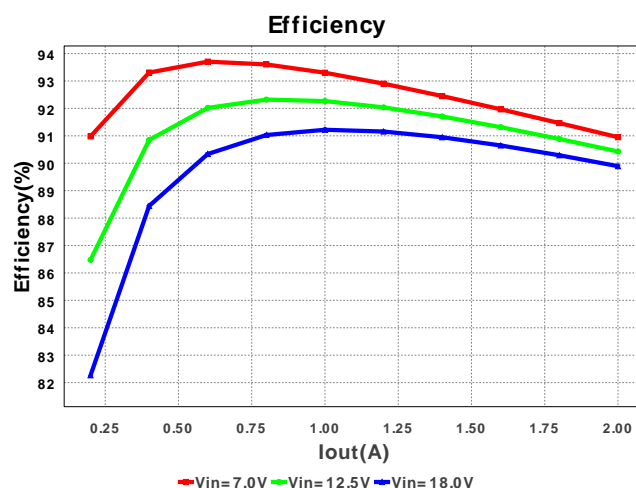
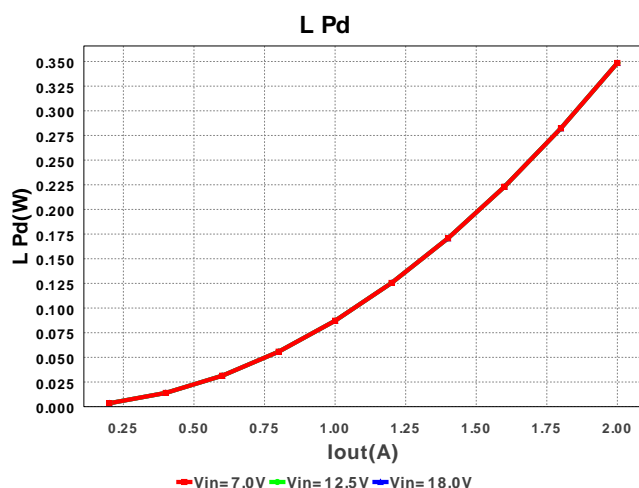
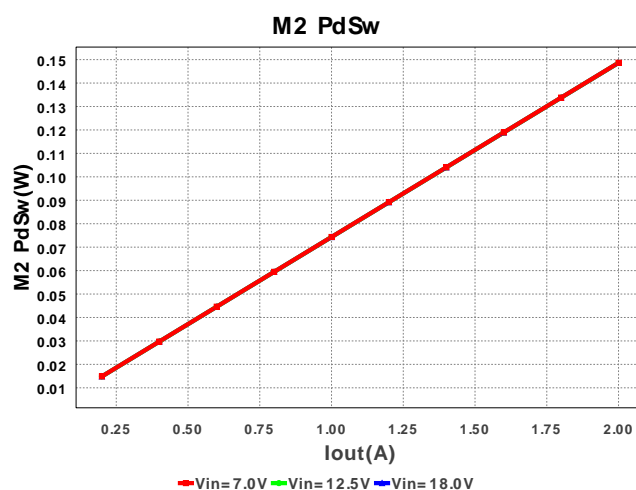
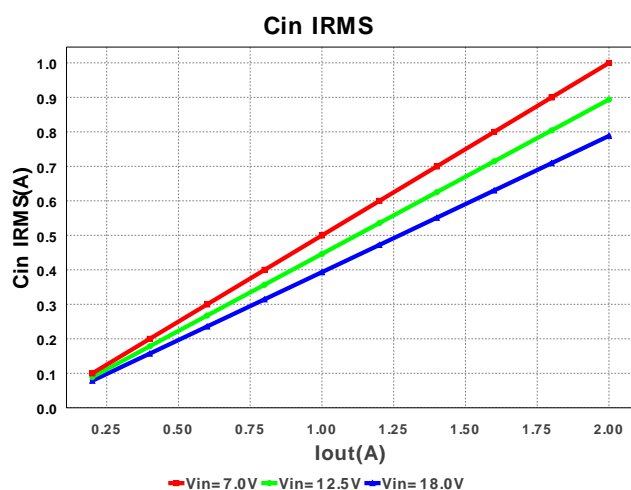
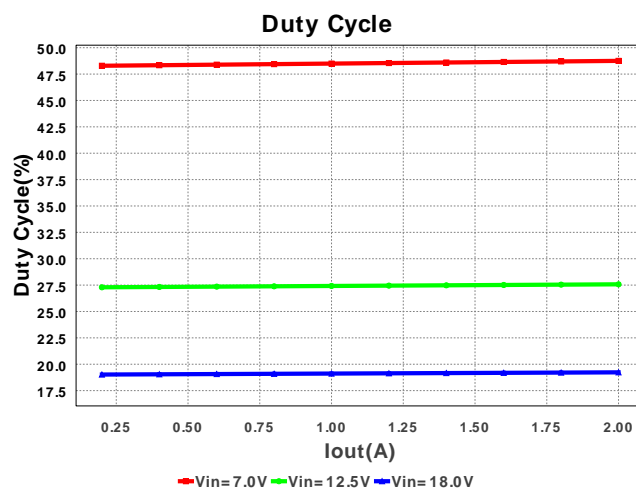
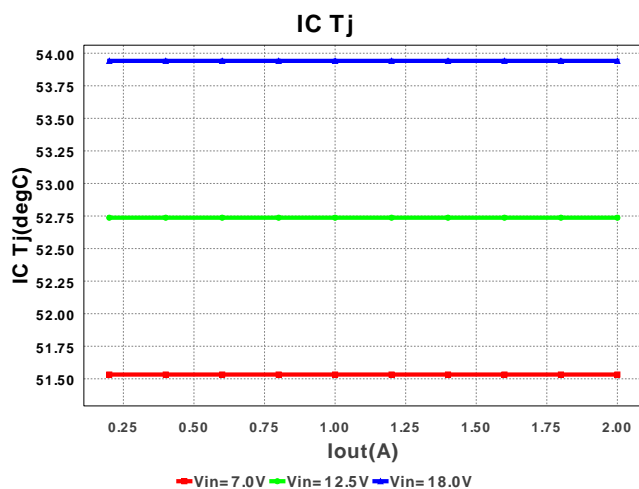
1. This regulator device is qualified for Automotive applications. All passives and other components selected in this design may not be qualified for Automotive applications. The user is required to verify that all components in the design meet the qualification and safety requirements for their specific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

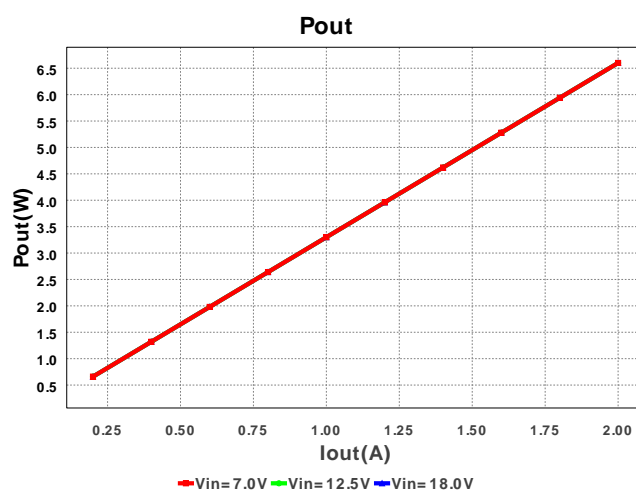
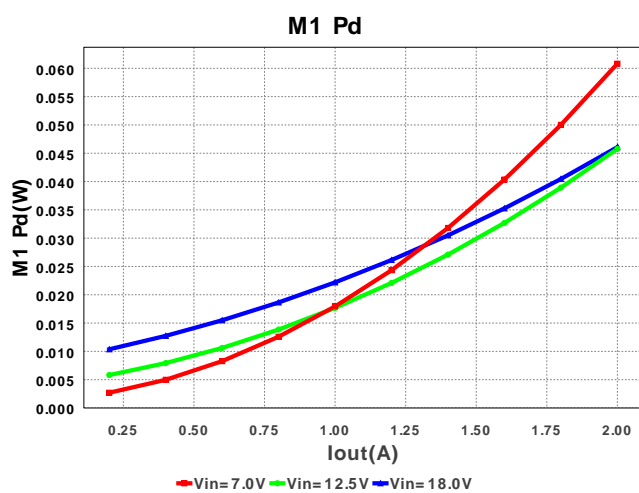
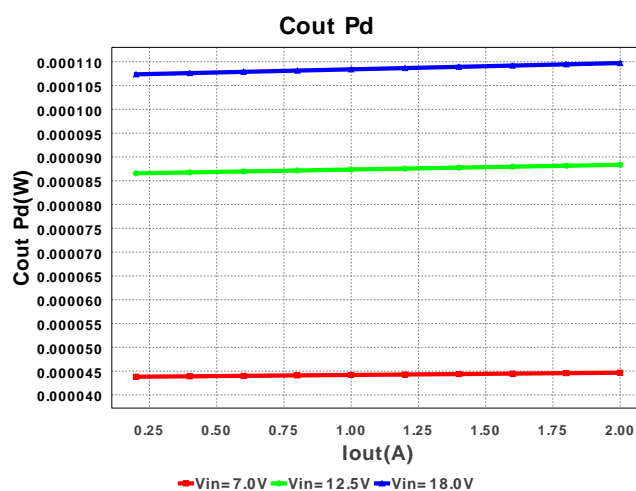
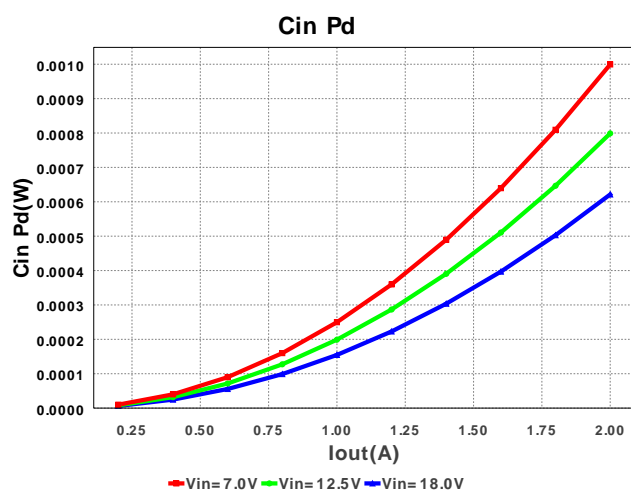
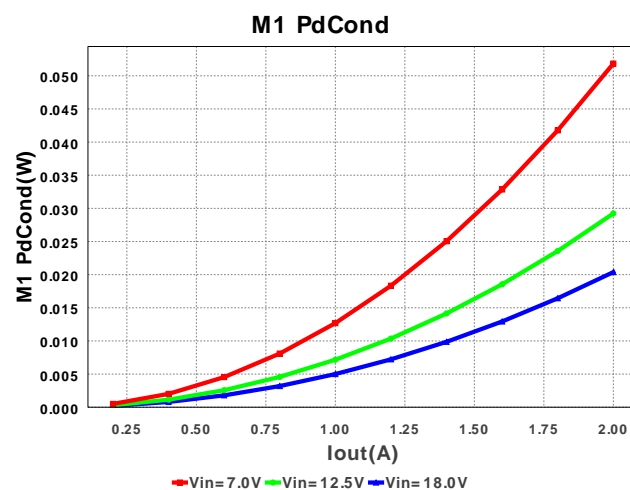
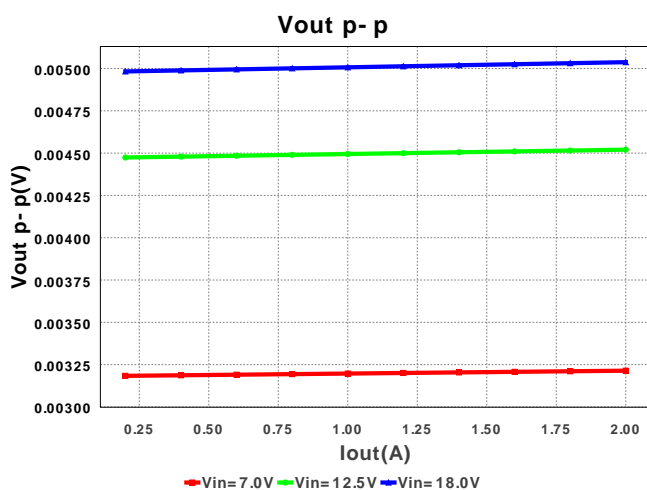
### Electrical BOM

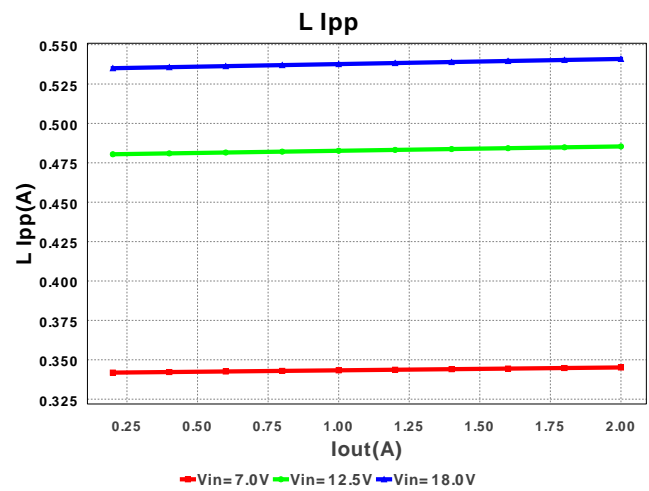
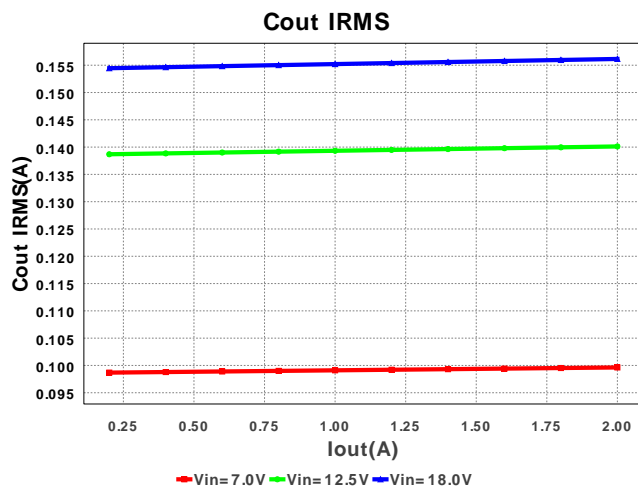
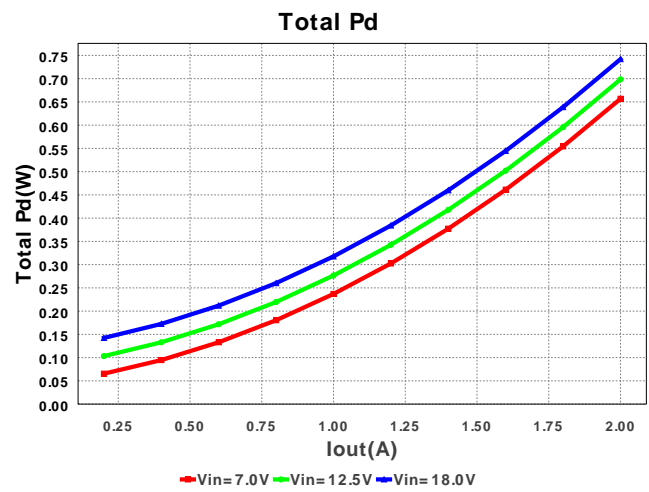
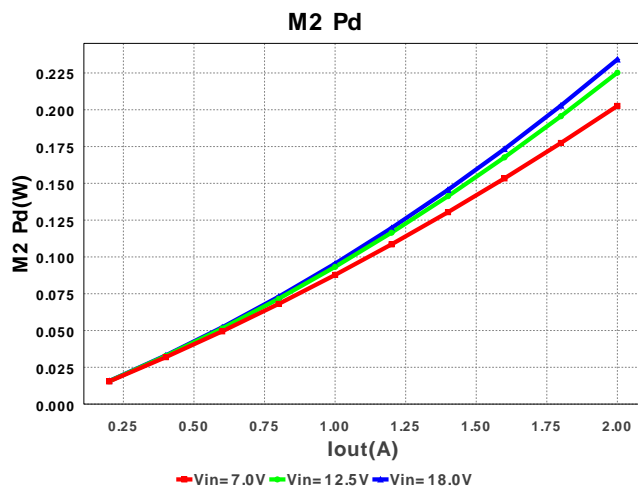
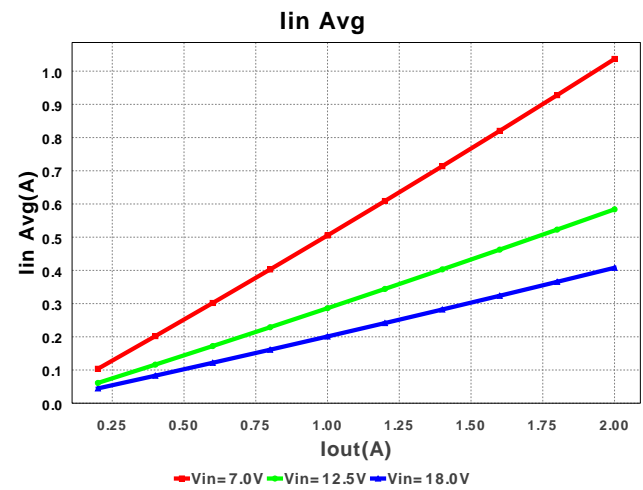
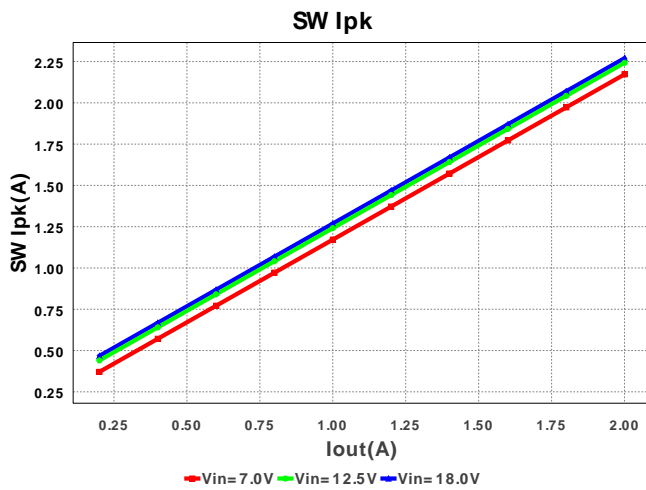
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1.	Cbst	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	0805 7mm2
2.	Cbyp	MuRata	GRM21BR61C475KA88L Series= X5R	Cap= 4.7 µF ESR= 5.0 mOhm VDC= 16.0 V IRMS= 0.0 A	1	\$0.04	0805 7mm2
3.	Ccomp	Yageo America	CC0805KRX7R9BB682 Series= X7R	Cap= 6.8 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7mm2
4.	Ccomp2	Yageo America	CC0805KRX7R9BB271 Series= X7R	Cap= 270.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7mm2
5.	Ccomp3	Yageo America	CC0805KRX7R9BB272 Series= X7R	Cap= 2.7 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7mm2
6.	Cilim	Kemet	C0805C102K5RACTU Series= X7R	Cap= 1.0 nF ESR= 384.0 mOhm VDC= 50.0 V IRMS= 214.0 mA	1	\$0.01	0805 7mm2

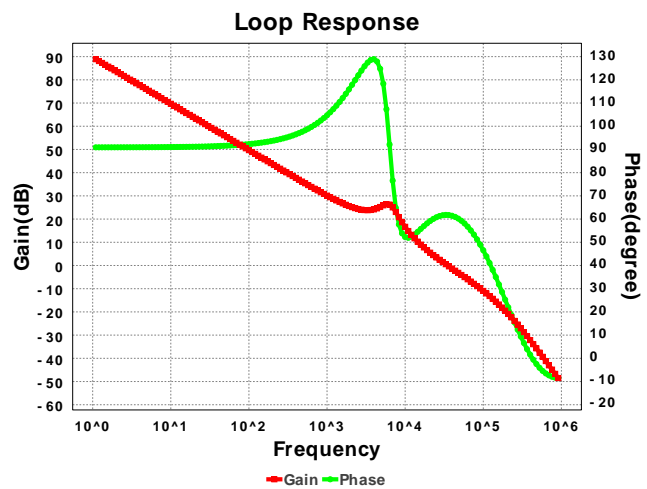
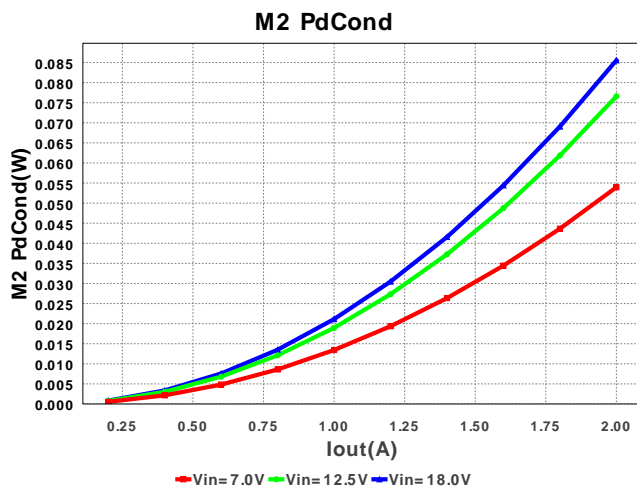
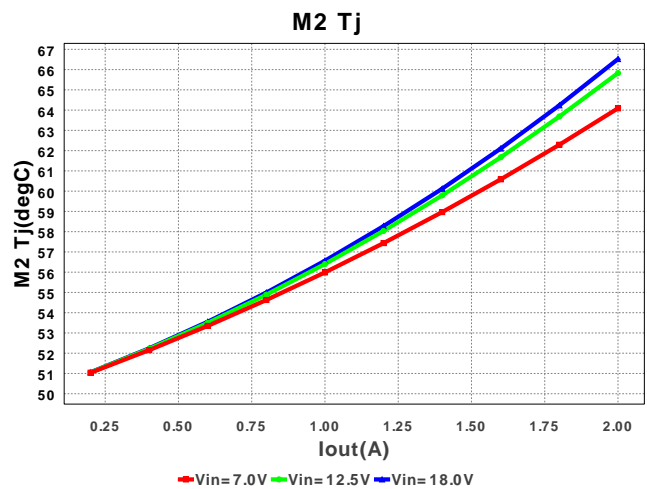
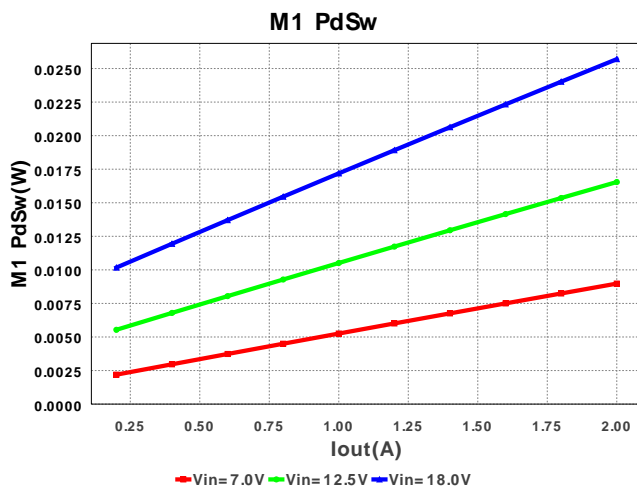
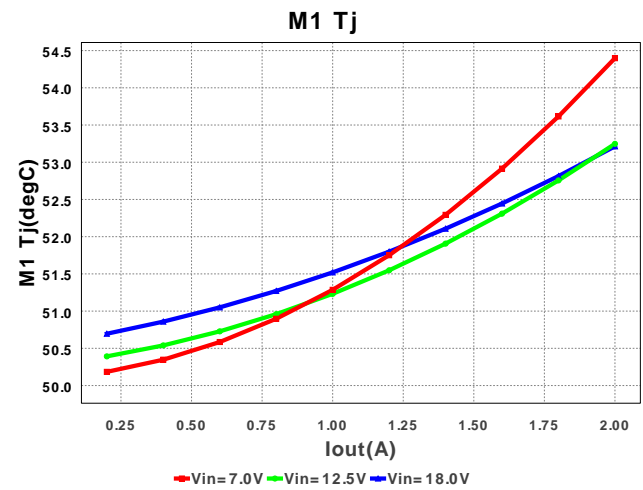
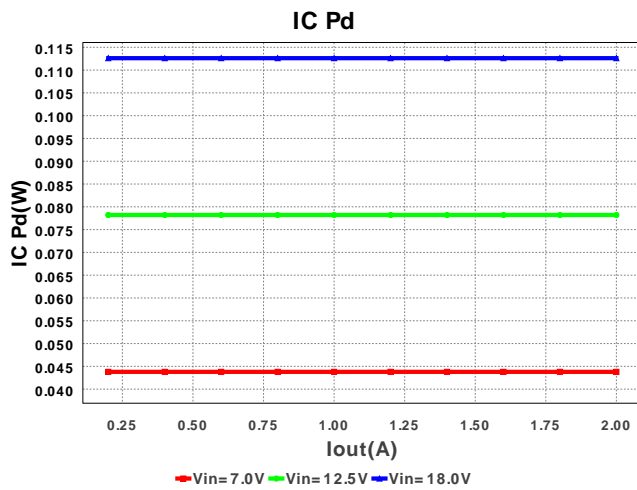
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
7.	Cin	MuRata	GRM21BR61E475MA12L Series= X5R	Cap= 4.7 $\mu$ F ESR= 2.0 mOhm VDC= 25.0 V IRMS= 7.29 A	2	\$0.06	 0805 7mm2
8.	Cldrv	MuRata	GRM033R71E102KA01D Series= X7R	Cap= 1.0 nF VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	 0201 2mm2
9.	Cout	MuRata	GRM21BR60J226ME39L Series= X5R	Cap= 22.0 $\mu$ F ESR= 9.0 mOhm VDC= 6.3 V IRMS= 3.5 A	2	\$0.05	 0805 7mm2
10.	Css	MuRata	GRM033R61A472KA01D Series= X5R	Cap= 4.7 nF VDC= 10.0 V IRMS= 0.0 A	1	\$0.01	 0201 2mm2
11.	Cvdd	TDK	C1608X5R1C105K Series= X5R	Cap= 1.0 $\mu$ F ESR= 5.7 mOhm VDC= 16.0 V IRMS= 0.0 A	1	\$0.01	 0603 5mm2
12.	Cvin	MuRata	GRM188R61E105KA12D Series= X5R	Cap= 1.0 $\mu$ F VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	 0603 5mm2
13.	L1	Coilcraft	XAL5050-153MEB	L= 15.0 $\mu$ H DCR= 69.7 mOhm	1	\$0.60	 XAL5050 54mm2
14.	M1	Texas Instruments	CSD17313Q2	VdsMax= 30.0 V IdsMax= 5.0 Amps	1	\$0.17	 TRANS_NexFET_Q2 9mm2
15.	M2	Texas Instruments	CSD17313Q2	VdsMax= 30.0 V IdsMax= 5.0 Amps	1	\$0.17	 TRANS_NexFET_Q2 9mm2
16.	Rcomp	Vishay-Dale	CRCW04023K74FKED Series= CRCW..e3	Res= 3.74 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3mm2
17.	Rcomp2	Vishay-Dale	CRCW0402158RFKED Series= CRCW..e3	Res= 158.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3mm2
18.	Rcs	Vishay-Dale	CRCW040213K3FKED Series= CRCW..e3	Res= 13.3 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3mm2
19.	Renb	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3mm2
20.	Rent	Vishay-Dale	CRCW040212K4FKED Series= CRCW..e3	Res= 12.4 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3mm2
21.	Rfbb	Vishay-Dale	CRCW04022K21FKED Series= CRCW..e3	Res= 2.21 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3mm2
22.	Rfbt	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3mm2
23.	Rpgood	Vishay-Dale	CRCW0402100KFKED Series= CRCW..e3	Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3mm2
24.	Rscp	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3mm2
25.	Rt	Vishay-Dale	CRCW040226K7FKED Series= CRCW..e3	Res= 26.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3mm2
26.	Rtrk	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3mm2

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
27.	U1	Texas Instruments	TPS40170QRGYRQ1	Switcher	1	\$2.63	R-PVQFN-N20 25mm2









## Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	788.244 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	156.149 mA	Current	Output capacitor RMS ripple current
3.	Iin Avg	407.93 mA	Current	Average input current
4.	L Ipp	540.915 mA	Current	Peak-to-peak inductor ripple current
5.	SW Ipk	2.27 A	Current	Peak switch current
6.	BOM Count	29	General	Total Design BOM count
7.	FootPrint	211.0 mm2	General	Total Foot Print Area of BOM components
8.	Frequency	348.432 kHz	General	Switching frequency
9.	IC Tolerance	6.0 $\mu$ V	General	IC Feedback Tolerance
10.	Pout	6.6 W	General	Total output power
11.	Total BOM	\$4.03	General	Total BOM Cost

#	Name	Value	Category	Description
12.	Cross Freq	34.996 kHz	Op_point	Bode plot crossover frequency
13.	Duty Cycle	19.232 %	Op_point	Duty cycle
14.	Efficiency	89.885 %	Op_point	Steady state efficiency
15.	IC Tj	53.941 degC	Op_point	IC junction temperature
16.	IOUT_OP	2.0 A	Op_point	Iout operating point
17.	M1 Tj	53.213 degC	Op_point	M1 MOSFET junction temperature
18.	M2 Tj	66.52 degC	Op_point	M2 MOSFET junction temperature
19.	Phase Marg	60.837 deg	Op_point	Bode Plot Phase Margin
20.	VIN_OP	18.0 V	Op_point	Vin operating point
21.	Vout p-p	5.037 mV	Op_point	Peak-to-peak output ripple voltage
22.	Cin Pd	621.329 $\mu$ W	Power	Input capacitor power dissipation
23.	Cout Pd	109.721 $\mu$ W	Power	Output capacitor power dissipation
24.	IC Pd	112.61 mW	Power	IC power dissipation
25.	L Pd	348.5 mW	Power	Inductor power dissipation
26.	M1 Pd	46.203 mW	Power	M1 MOSFET total power dissipation
27.	M1 PdCond	20.505 mW	Power	M1 MOSFET conduction losses
28.	M1 PdSw	25.698 mW	Power	M1 MOSFET switching losses
29.	M2 Pd	234.692 mW	Power	M2 MOSFET total power dissipation
30.	M2 PdCond	86.074 mW	Power	M2 MOSFET conduction losses
31.	M2 PdSw	148.618 mW	Power	M2 MOSFET switching losses
32.	Total Pd	742.718 mW	Power	Total Power Dissipation

## Design Inputs

#	Name	Value	Description
1.	Iout	2.0 A	Maximum Output Current
2.	Iout1	2.0 Amps	Output Current #1
3.	VinMax	18.0 V	Maximum input voltage
4.	VinMin	7.0 V	Minimum input voltage
5.	Vout	3.3 V	Output Voltage
6.	Vout1	3.3 Volt	Output Voltage #1
7.	base_pn	TPS40170-Q1	Base Product Number
8.	source	DC	Input Source Type
9.	Ta	50.0 degC	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-q1> : 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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