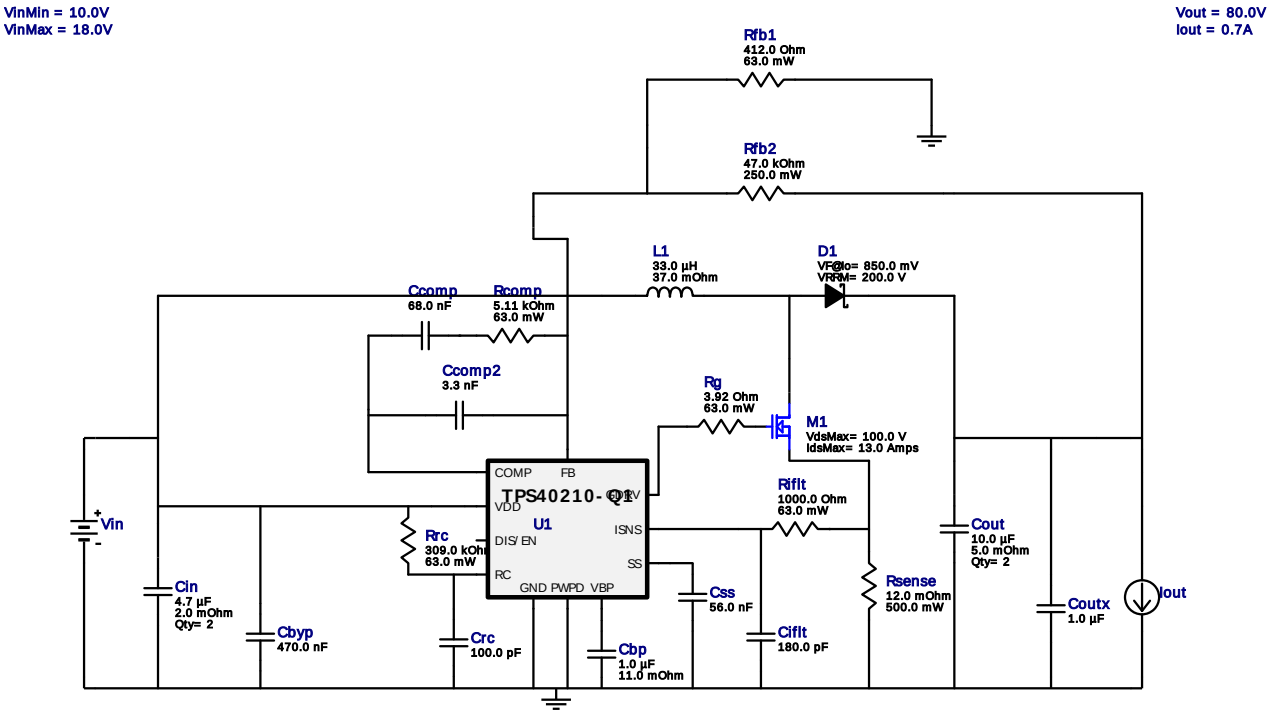
WEBENCH ® Design Report

VinMin = 10.0V
VinMax = 18.0V
Vout = 80.0V
Iout = 0.7A

Device = TPS40210QDGQRQ1
Topology = Boost
Created = 4/30/15 8:04:31 PM
BOM Cost = $6.70
Footprint = 665.0 mm²
BOM Count = 1
Total Pd = 3.6W

Design : 16221/33 TPS40210QDGQRQ1
TPS40210QDGQRQ1 10.0V-18.0V to 80.55V @ 0.7A



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.	Cbp	MuRata	GRM188R71C105KA12D Series= X7R	Cap= 1.0 uF ESR= 11.0 mOhm VDC= 16.0 V IRMS= 2.72 A	1	$0.01	0603 5 mm²
2.	Cbyp	Taiyo Yuden	TMK212BJ474KD-T Series= X5R	Cap= 470.0 nF VDC= 20.0 V IRMS= 0.0 A	1	$0.02	0805 7 mm²
3.	Ccomp	MuRata	GRM155R61A683KA01D Series= X5R	Cap= 68.0 nF VDC= 10.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
4.	Ccomp2	Yageo America	CC0805KRX7R9BB332 Series= X7R	Cap= 3.3 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
5.	Cifilt	Kemet	C0805C181K5GACTU Series= C0G/NP0	Cap= 180.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
6.	Cin	MuRata	GRM21BR61E475MA12L Series= X5R	Cap= 4.7 uF ESR= 2.0 mOhm VDC= 25.0 V IRMS= 7.29 A	2	$0.06	0805 7 mm²

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#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
7.	Cout	TDK	C5750X7S2A106M Series= 479	Cap= 10.0 uF ESR= 5.0 mOhm VDC= 100.0 V IRMS= 6.45 A	2	$0.84	2220 60 mm²
8.	Coutx	MuRata	GRM31CR72A105KA01L Series= X7R	Cap= 1.0 uF VDC= 100.0 V IRMS= 0.0 A	1	$0.12	1206 11 mm²
9.	Crc	Yageo America	CC0805JRNPO9BN101 Series= C0G/NP0	Cap= 100.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
10.	Css	MuRata	GRM155R61A563KA01D Series= X5R	Cap= 56.0 nF VDC= 10.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
11.	D1	Diodes Inc.	DFLS1200-7	VF@Io= 850.0 mV VRRM= 200.0 V	1	$0.21	PowerDI123 13 mm²
12.	L1	Vishay-Dale	IHLP6767GZER330M11	L= 33.0 µH DCR= 37.0 mOhm	1	$2.55	IHLP-6767GZ 367 mm²
13.	M1	Texas Instruments	CSD19533Q5A	VdsMax= 100.0 V IdsMax= 13.0 Amps	1	$0.83	TRANS_NexFET_Q5A 55 mm²
14.	Rcomp	Vishay-Dale	CRCW04025K11FKED Series= CRCW..e3	Res= 5.11 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
15.	Rfb1	Vishay-Dale	CRCW0402412RFKED Series= CRCW..e3	Res= 412.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
16.	Rfb2	Yageo America	RC1206FR-0747KL Series= ?	Res= 47.0 kOhm Power= 250.0 mW Tolerance= 1.0%	1	$0.01	1206 11 mm²
17.	Rg	Vishay-Dale	CRCW04023R92FKED Series= CRCW..e3	Res= 3.92 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	Stackpole Electronics Inc	CSR1206FK12L0 Series= ?	Res= 12.0 mOhm Power= 500.0 mW Tolerance= 1.0%	1	$0.11	1206 11 mm²
21.	U1	Texas Instruments	TPS40210QDGQRQ1	Switcher	1	$0.94	S-PDSO-G10 24 mm²

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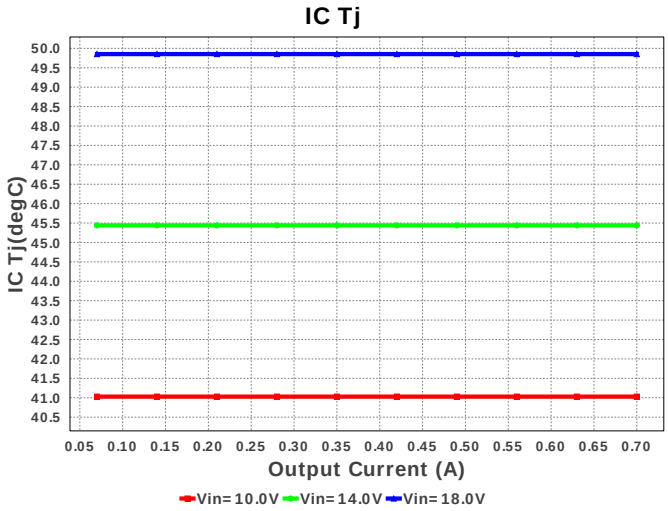

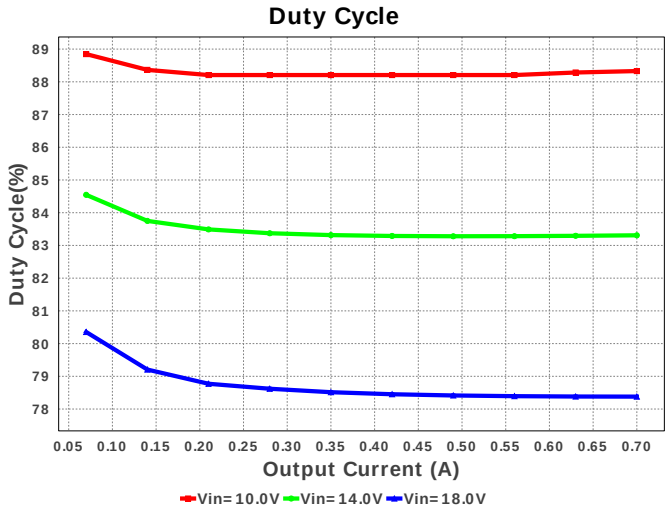

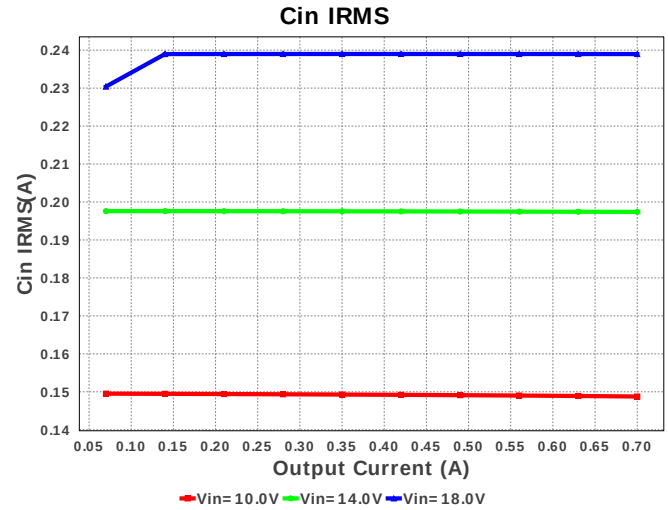

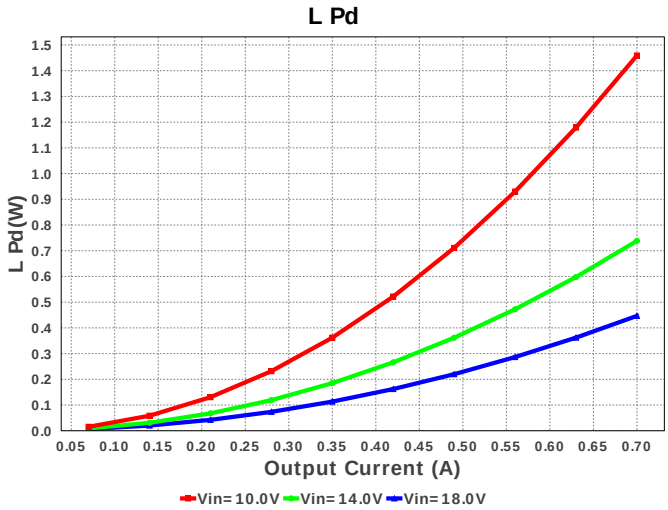

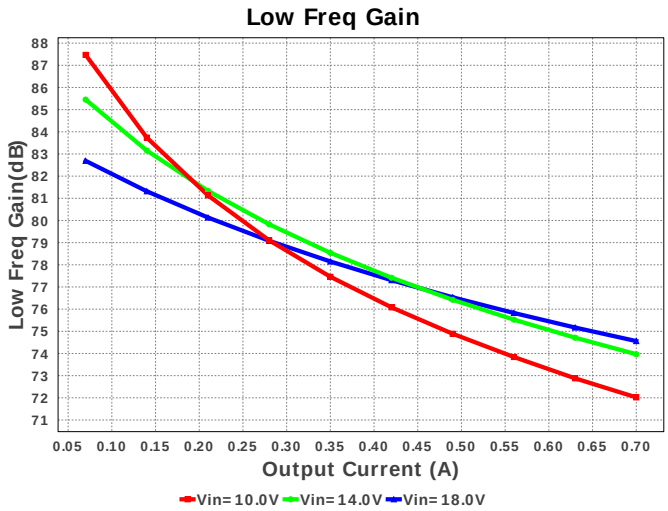

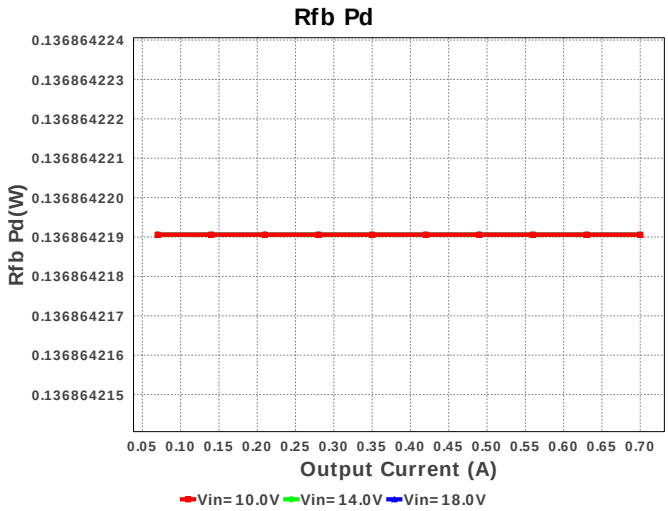

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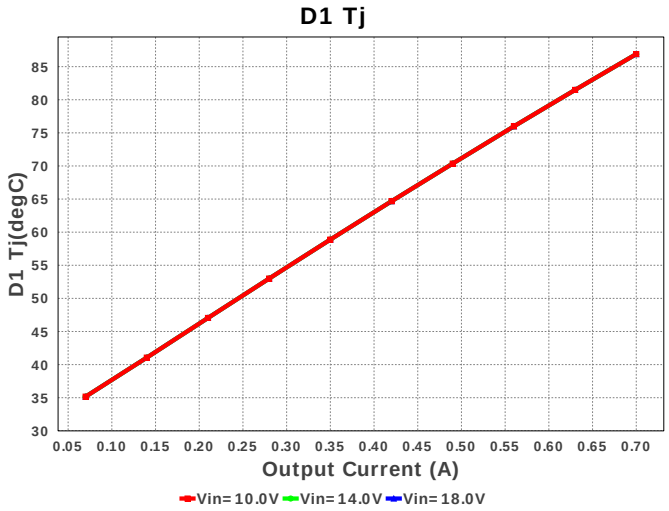
D1 Tj
D1 Tj(degC)
Output Current (A)
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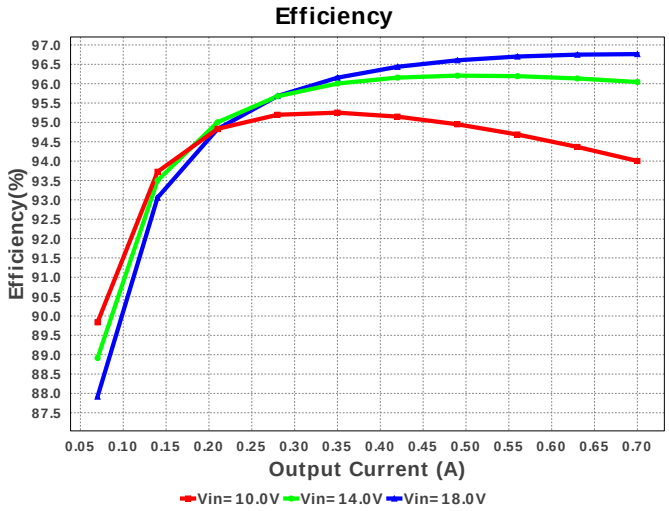
Efficiency
Efficiency(%)
Output Current (A)
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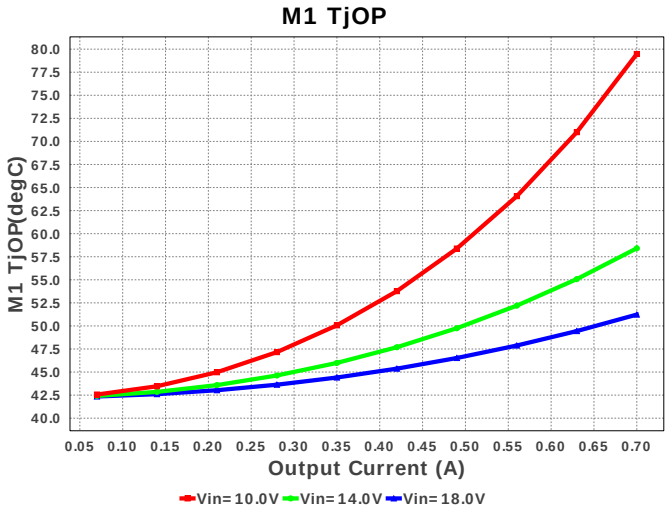
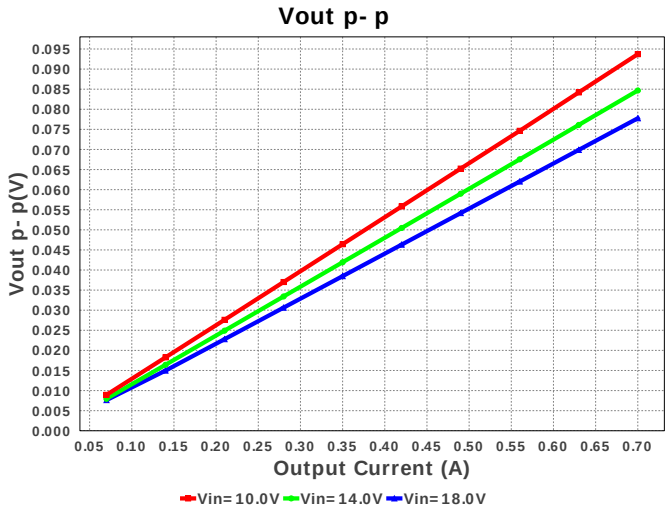
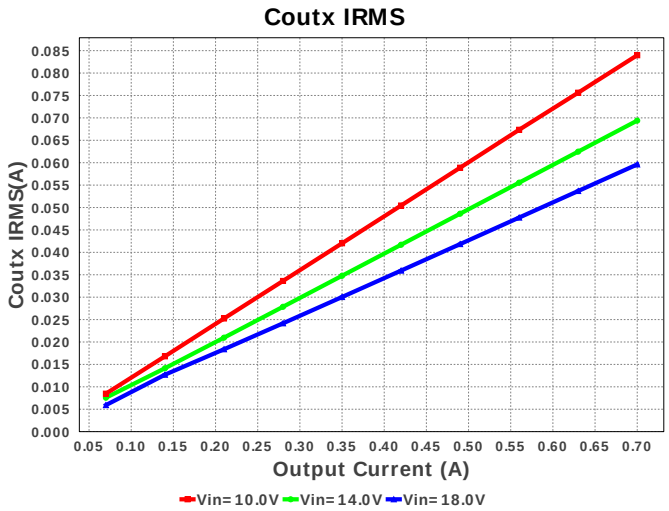

M1 TjOP
M1 TjOP(degC)
Output Current (A)
Vin=10.0V Vin=14.0V Vin=18.0V


Vout p- p
Vout p- p(V)
Output Current (A)
Vin=10.0V Vin=14.0V Vin=18.0V


Coutx IRMS
Coutx IRMS(A)
Output Current (A)
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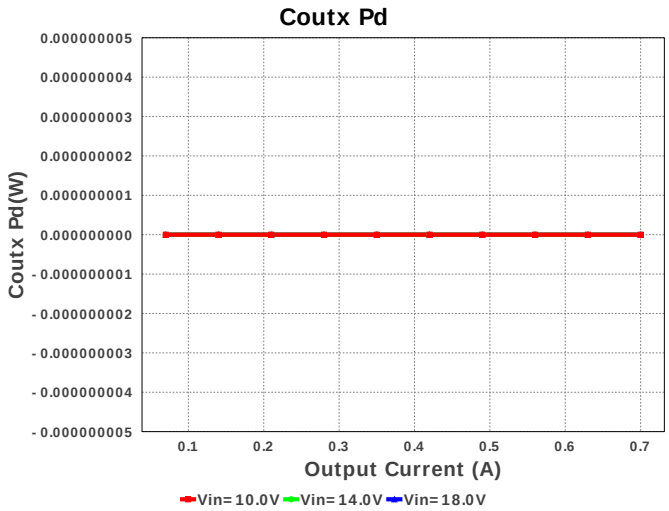
Coutx Pd
Coutx Pd(W)
Output Current (A)
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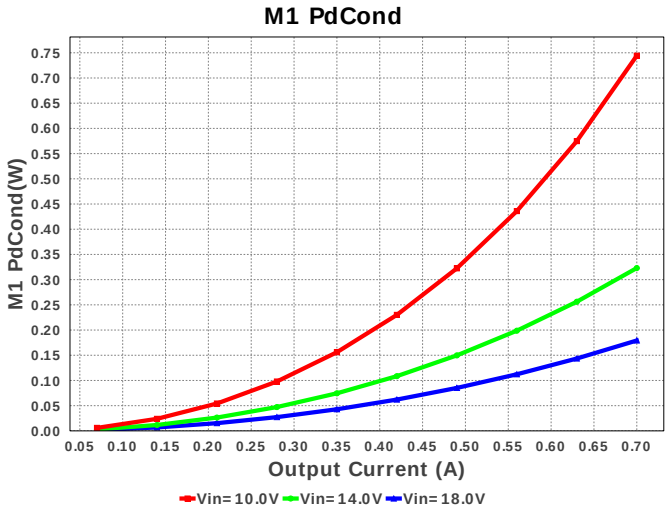

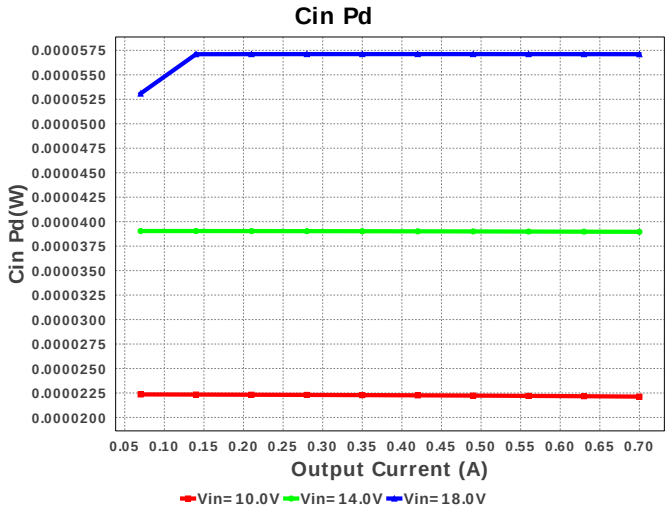

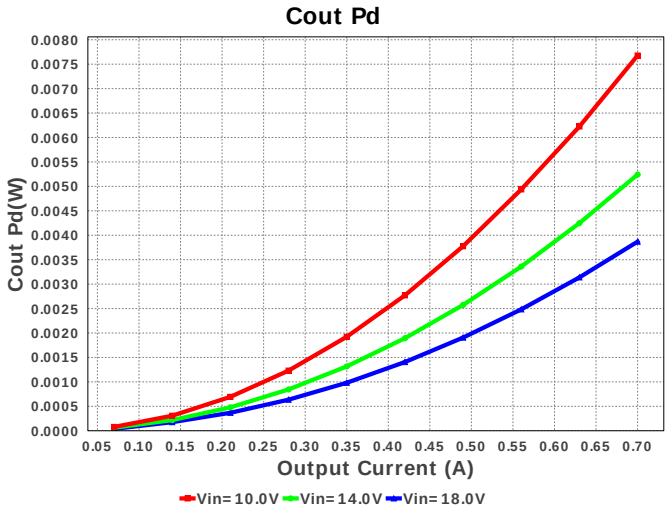

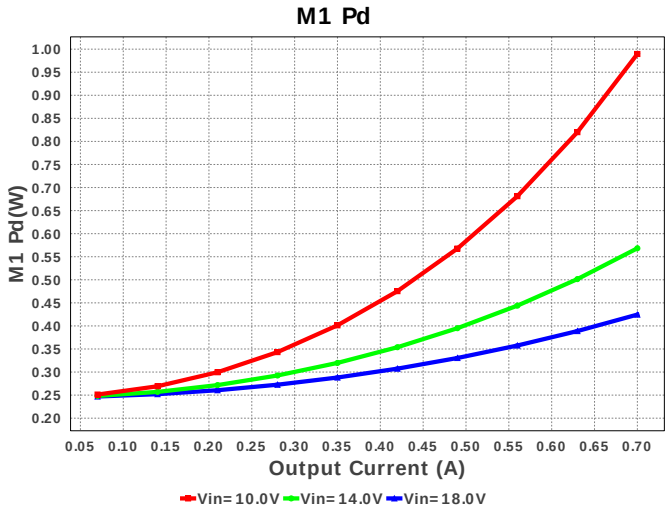

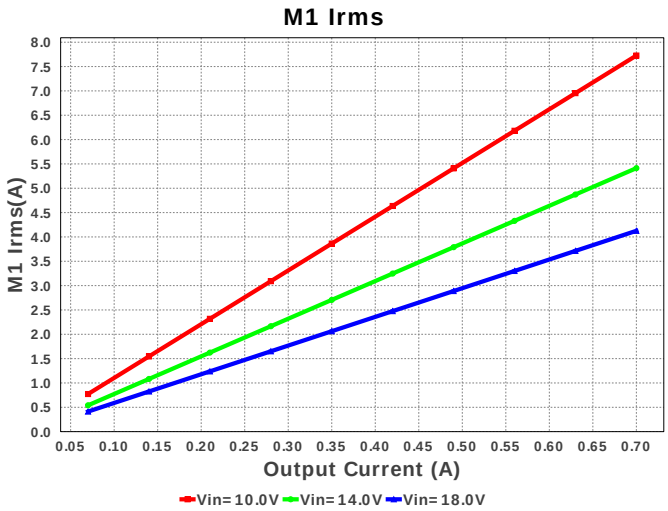

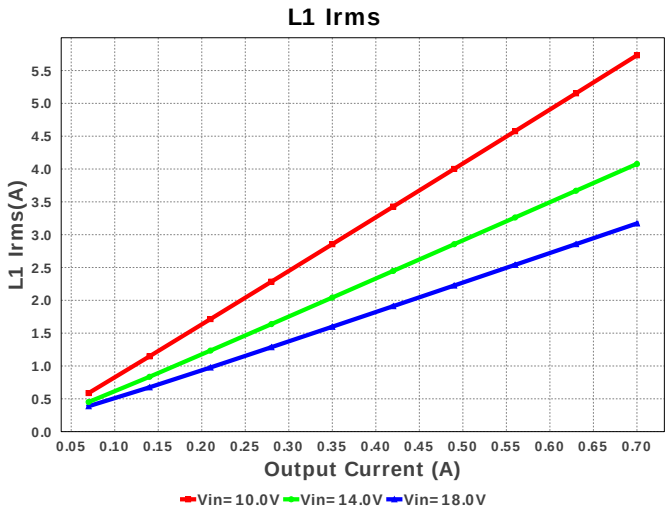

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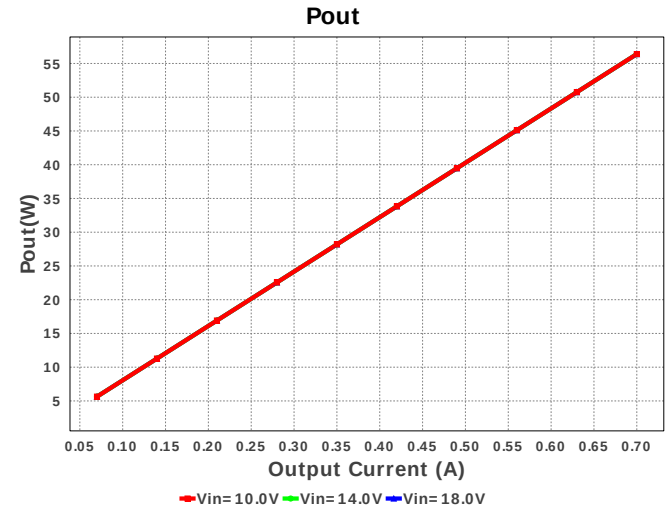

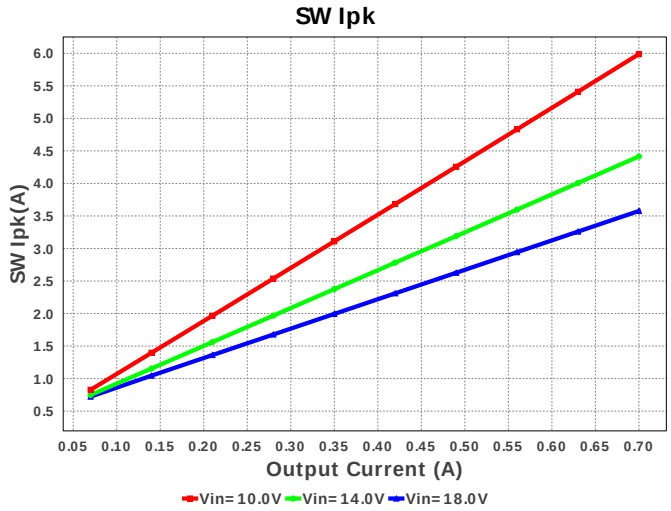

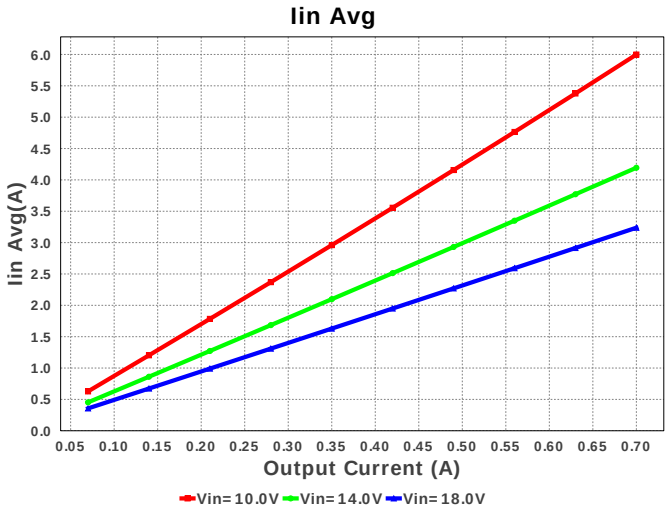

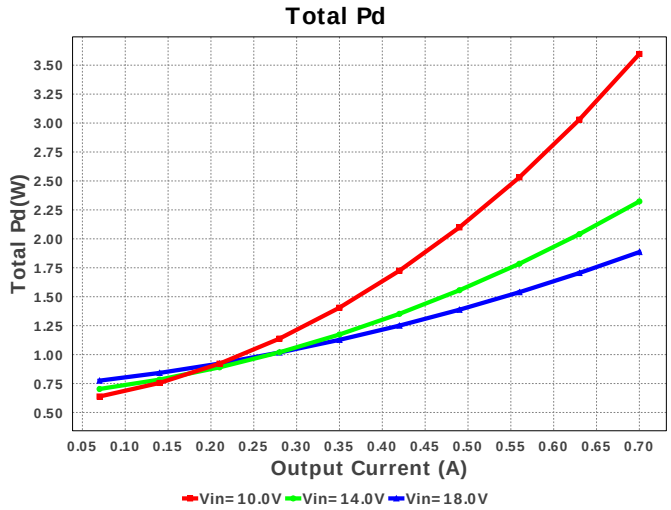

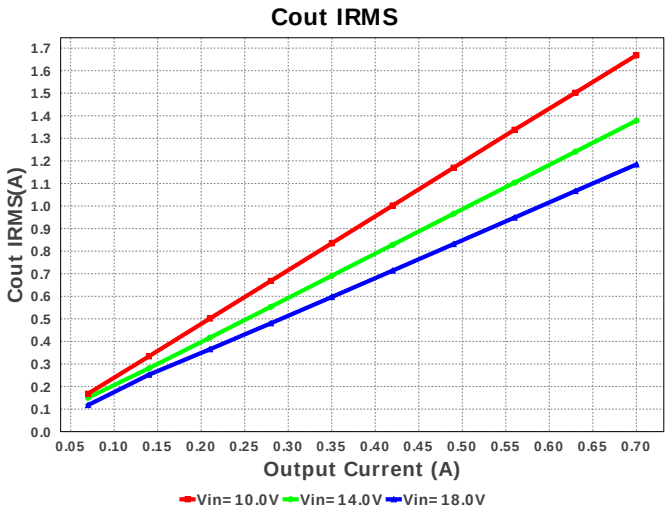

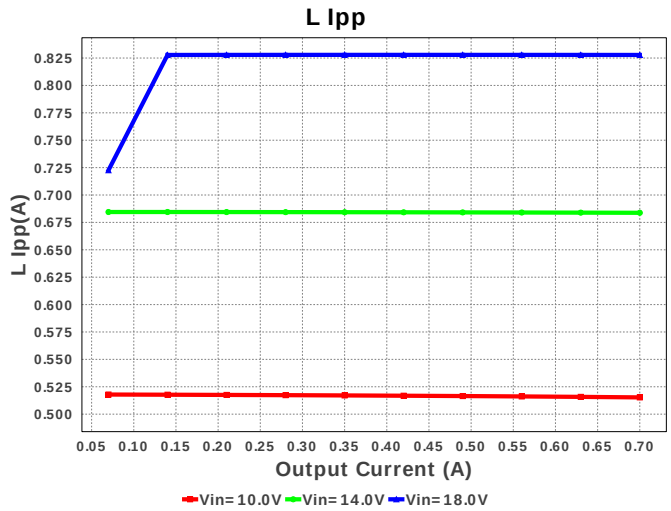

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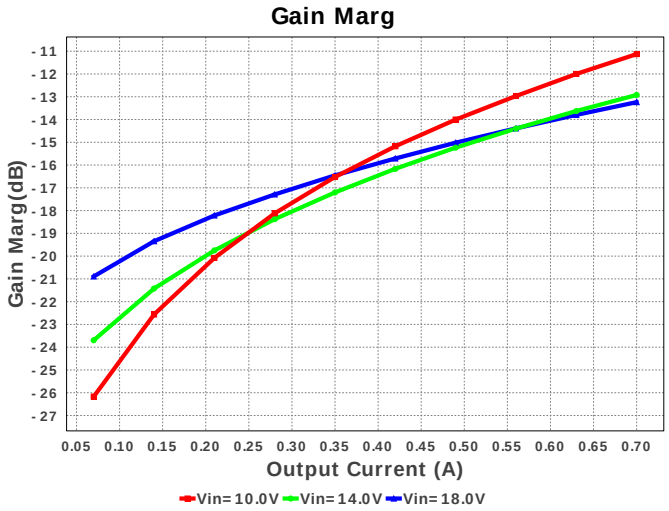
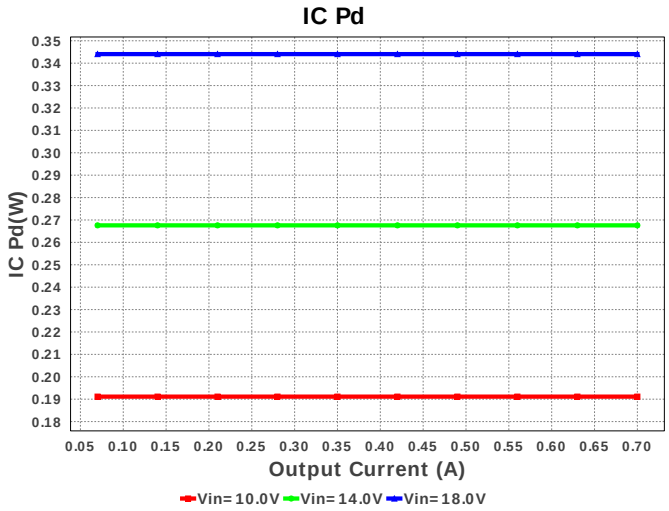

Gain Marg
Gain Marg(dB)
Output Current (A)
Vin=10.0V Vin=14.0V Vin=18.0V


IC Pd
IC Pd(W)
Output Current (A)
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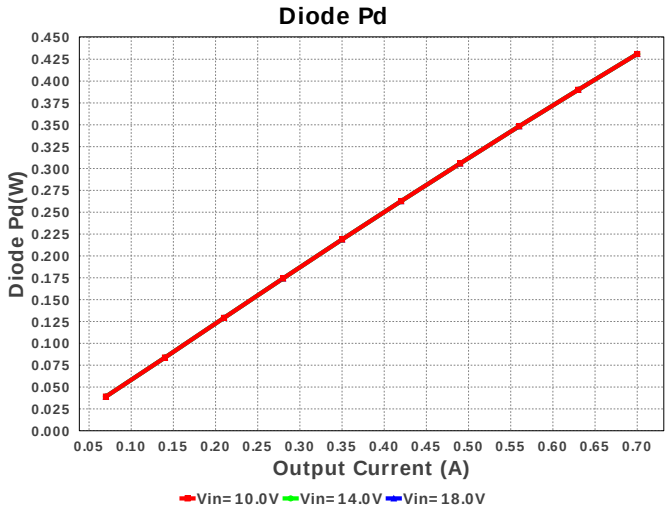
Diode Pd
Diode Pd(W)
Output Current (A)
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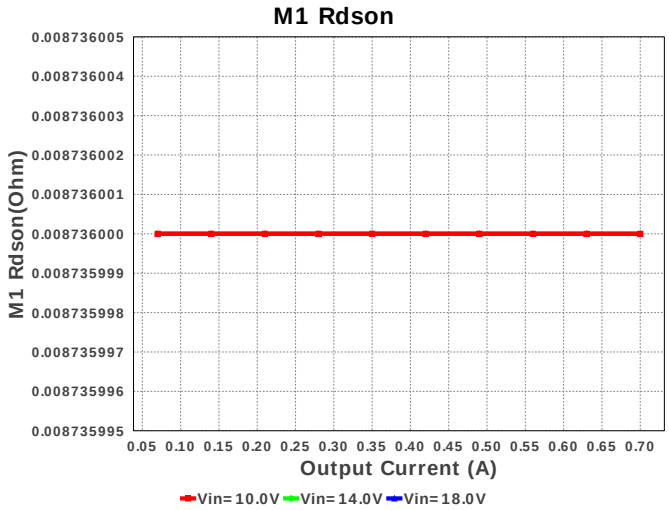
M1 Rdson
M1 Rdson(Ohm)
Output Current (A)
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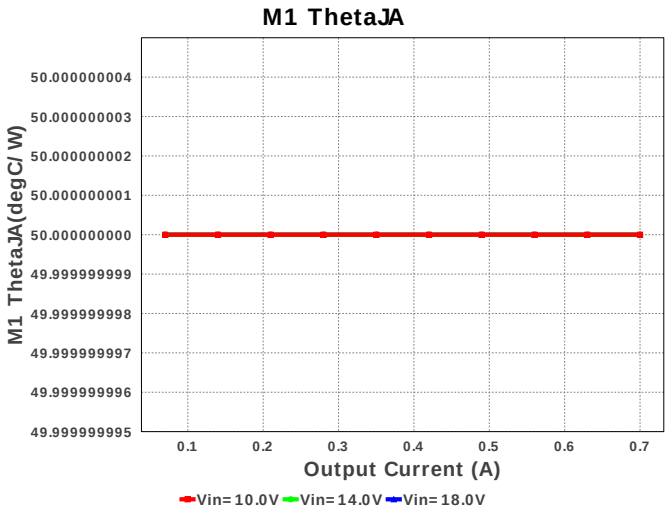
M1 ThetaJA
M1 ThetaJA(degC/ W)
Output Current (A)
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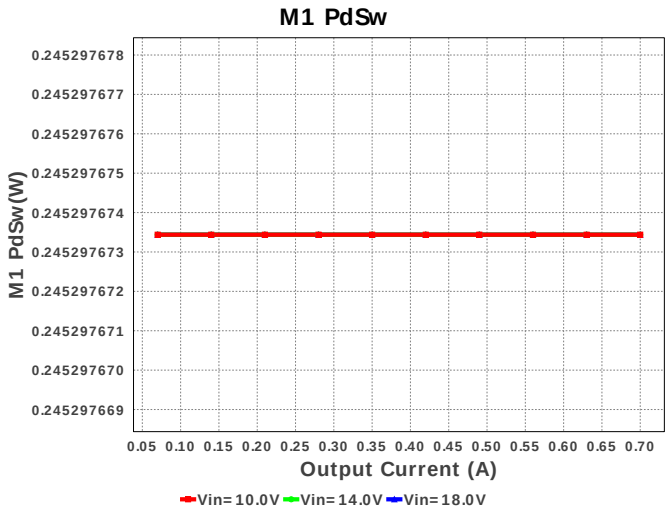
M1 PdSw
M1 PdSw(W)
Output Current (A)
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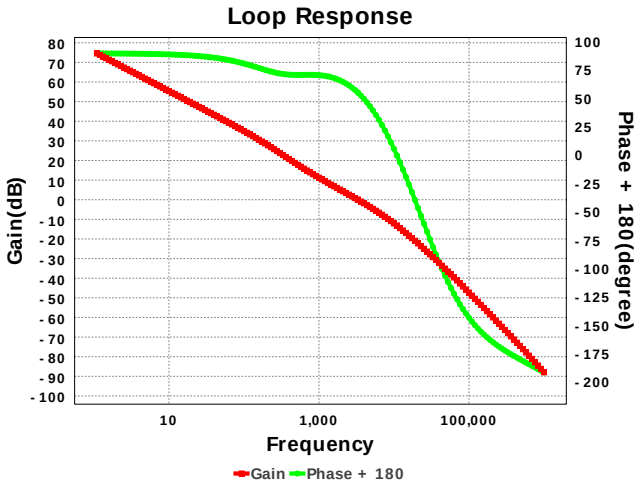

Operating Values

#	Name	Value	Category	Description
1.	Total BOM	$6.7		Total BOM Cost
2.	Cin IRMS	148.755 mA	Current	Input capacitor RMS ripple current
3.	Cout IRMS	1.668 A	Current	Output capacitor RMS ripple current
4.	Coutx IRMS	83.975 mA	Current	Output capacitor_x RMS ripple current
5.	Iin Avg	5.998 A	Current	Average input current
6.	L Ipp	515.304 mA	Current	Peak-to-peak inductor ripple current
7.	L1 Irms	5.732 A	Current	Inductor ripple current
8.	M1 Irms	7.726 A	Current	M1 MOSFET Irms
9.	SW Ipk	5.988 A	Current	Peak switch current
10.	BOM Count	1	General	Total Design BOM count
11.	FootPrint	665.0 mm^2	General	Total Foot Print Area of BOM components
12.	Frequency	512.777 kHz	General	Switching frequency
13.	IC Tolerance	10.0 mV	General	IC Feedback Tolerance
14.	M1 Rdson	8.736 mOhm	General	Drain-Source On-resistance
15.	M1 ThetaJA	50.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
16.	Pout	56.388 W	General	Total output power
17.	D1 Tj	86.894 degC	Op_Point	D1 junction temperature
18.	Vout OP	80.554 V	Op_Point	Operational Output Voltage
19.	Cross Freq	1.933 kHz	Op_point	Bode plot crossover frequency
20.	Duty Cycle	88.329 %	Op_point	Duty cycle
21.	Efficiency	94.004 %	Op_point	Steady state efficiency
22.	Gain Marg	-11.127 dB	Op_point	Bode Plot Gain Margin
23.	IC Tj	41.029 degC	Op_point	IC junction temperature
24.	ICThetaJA	57.7 degC/W	Op_point	IC junction-to-ambient thermal resistance
25.	IOUT_OP	700.0 mA	Op_point	Iout operating point
26.	M1 TjOP	79.476 degC	Op_point	M1 MOSFET junction temperature
27.	Phase Marg	55.511 deg	Op_point	Bode Plot Phase Margin
28.	VIN_OP	10.0 V	Op_point	Vin operating point
29.	Vout p-p	93.717 mV	Op_point	Peak-to-peak output ripple voltage
30.	Cin Pd	22.128 µW	Power	Input capacitor power dissipation
31.	Cout Pd	7.677 mW	Power	Output capacitor power dissipation
32.	Coutx Pd	0.0 W	Power	Output capacitor_x power loss
33.	Diode Pd	431.015 mW	Power	Diode power dissipation
34.	IC Pd	191.14 mW	Power	IC power dissipation
35.	L Pd	1.459 W	Power	Inductor power dissipation
36.	M1 Pd	989.53 mW	Power	M1 MOSFET total power dissipation
37.	M1 PdCond	744.232 mW	Power	M1 MOSFET conduction losses
38.	M1 PdSw	245.298 mW	Power	M1 MOSFET switching losses
39.	Rfb Pd	136.864 mW	Power	Rfb Power Dissipation
40.	Total Pd	3.597 W	Power	Total Power Dissipation
41.	Low Freq Gain	72.019 dB	Unknown	Gain at 10Hz

Design Inputs

#	Name	Value	Description
1.	Iout	700.0 m	Maximum Output Current
2.	Iout1	700.0 m	Output Current #1
3.	VinMax	18.0	Maximum input voltage
4.	VinMin	10.0	Minimum input voltage
5.	Vout	80.0	Output Voltage
6.	Vout1	80.0	Output Voltage #1
7.	base_pn	TPS40210-Q1	Base Product Number

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#	Name	Value	Description
8.	source	DC	Input Source Type
9.	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 : contains the data sheet and other resources.

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