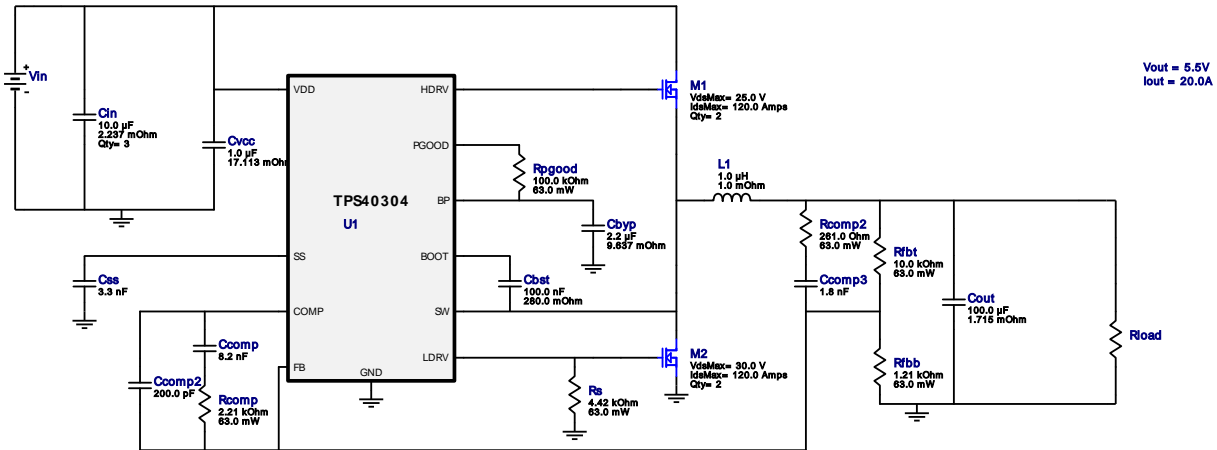



WEBENCH[®] Design Report

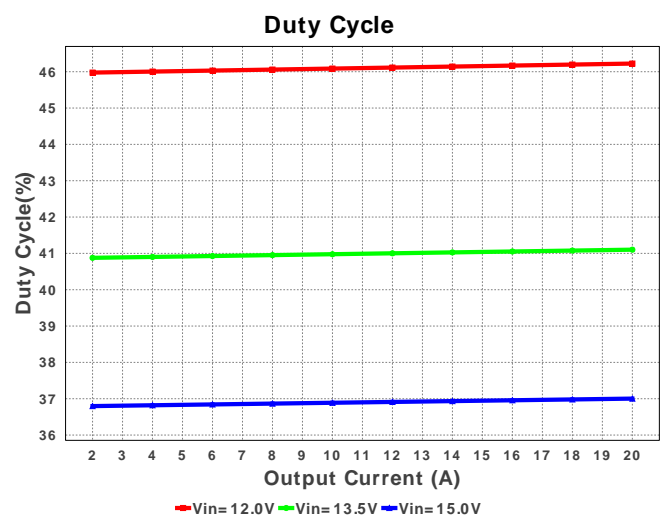
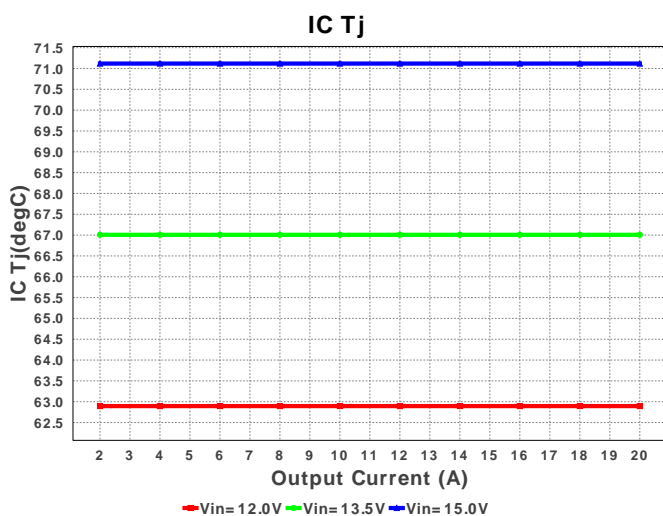
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TPS40304DRCR 12.0V-15.0V to 5.50V @ 20.0A

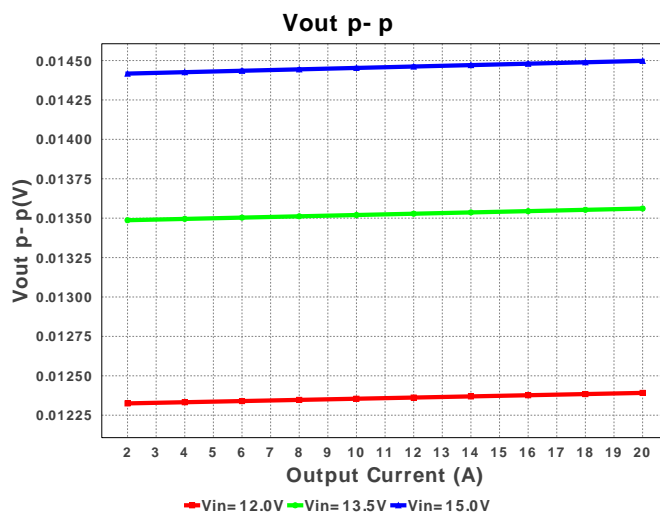
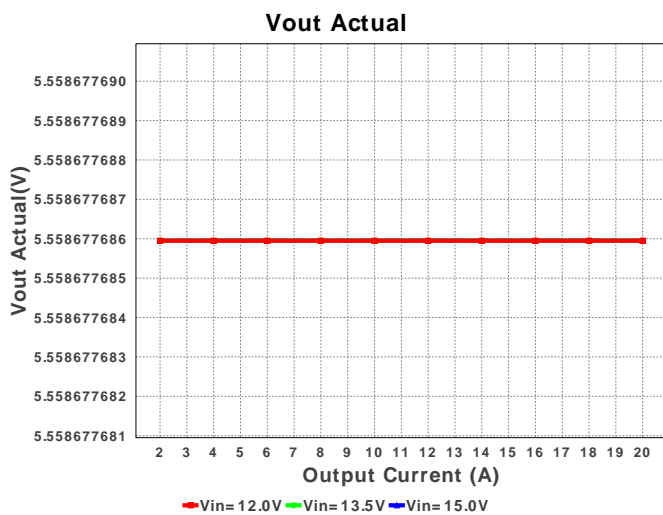
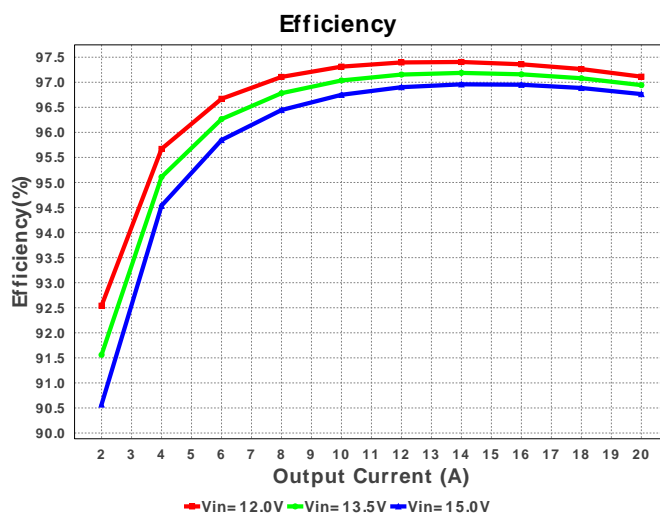
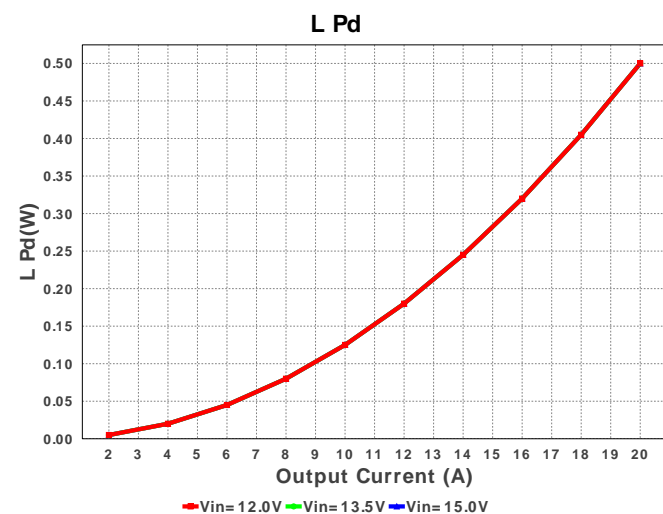
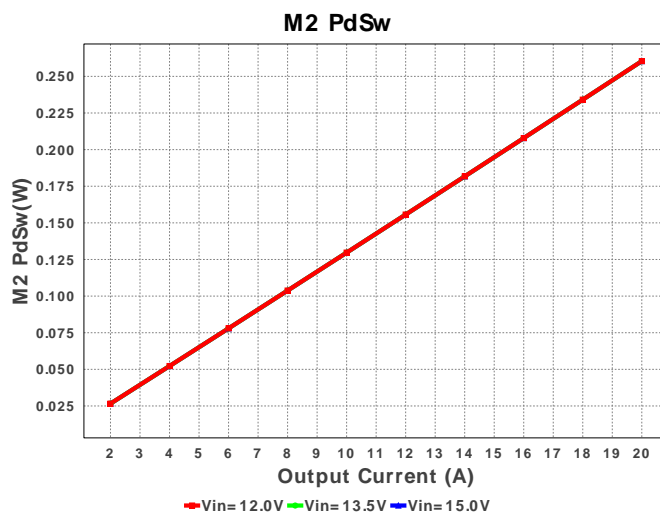
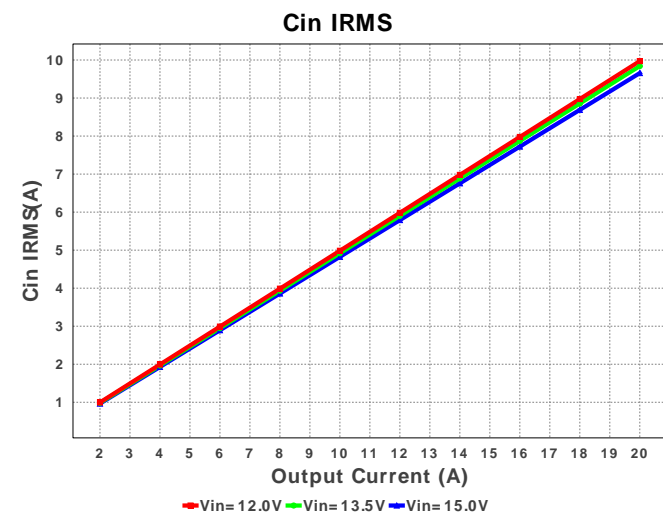


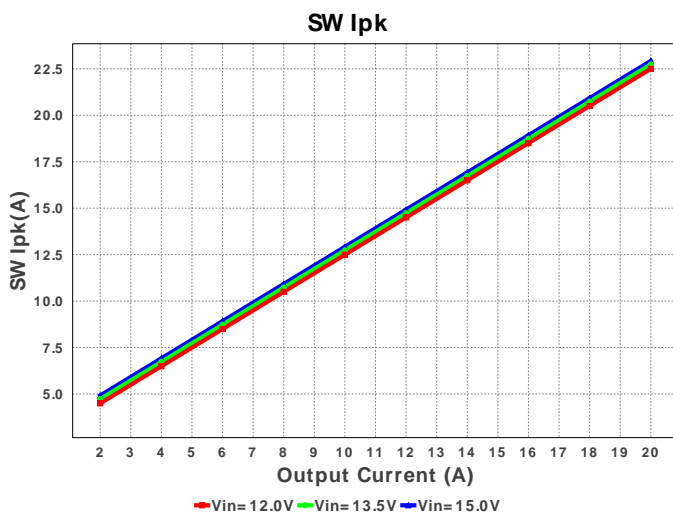
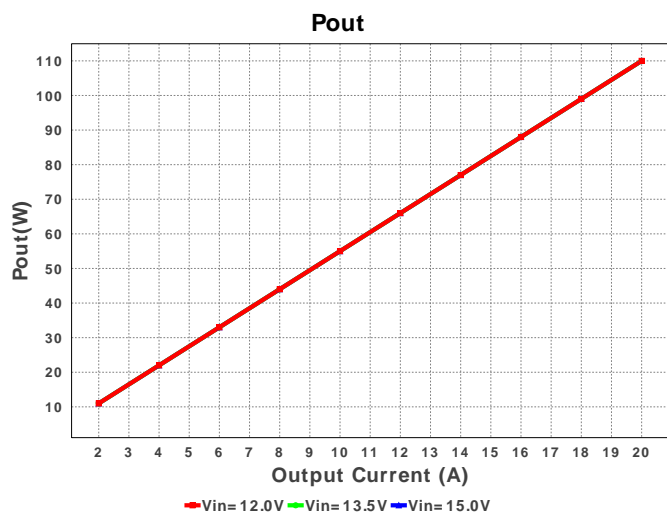
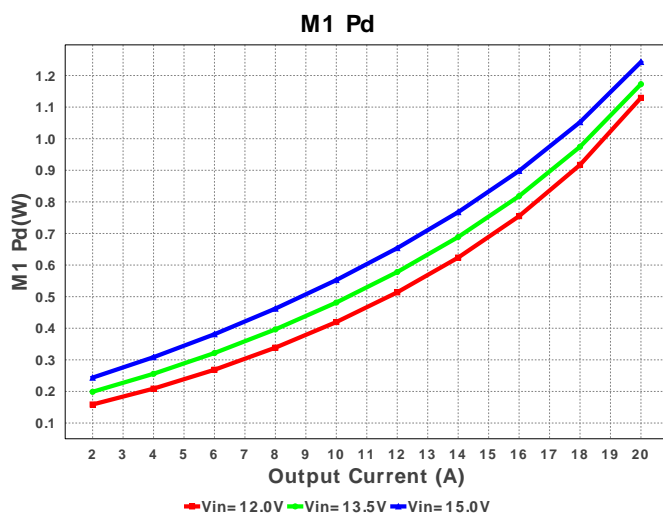
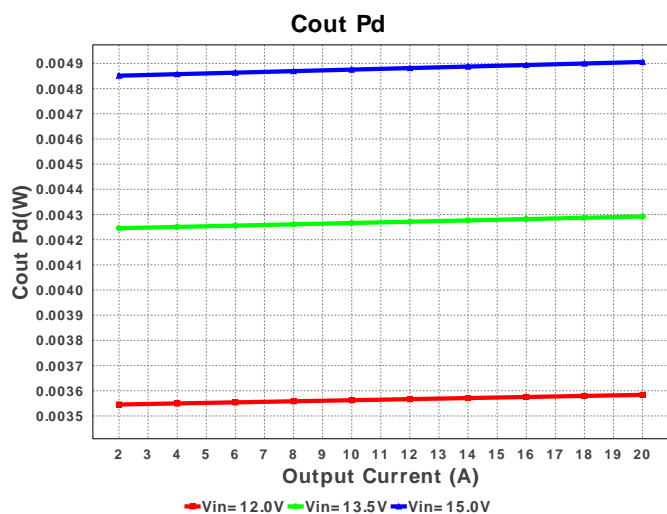
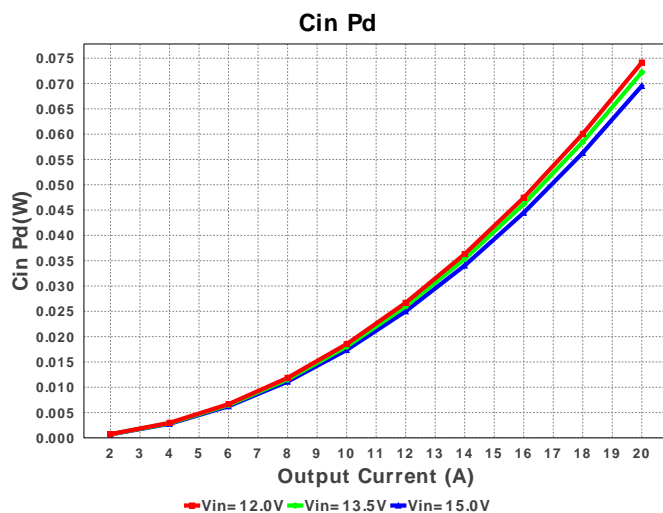
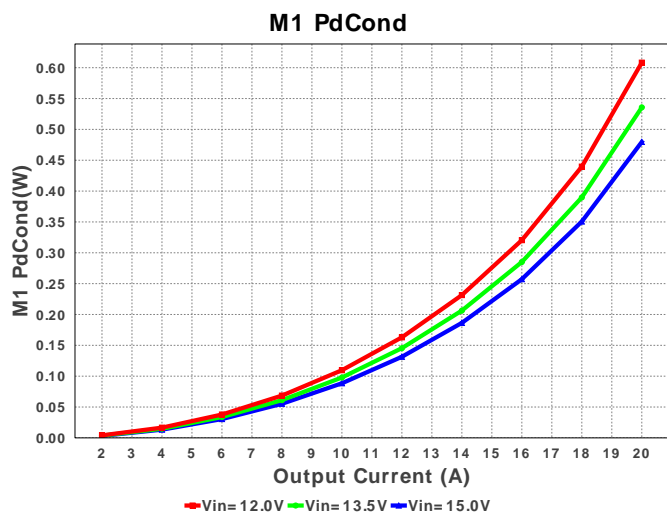
Electrical BOM

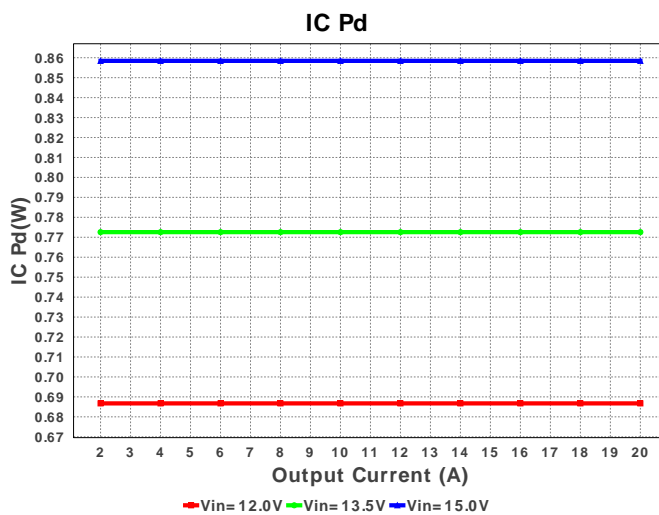
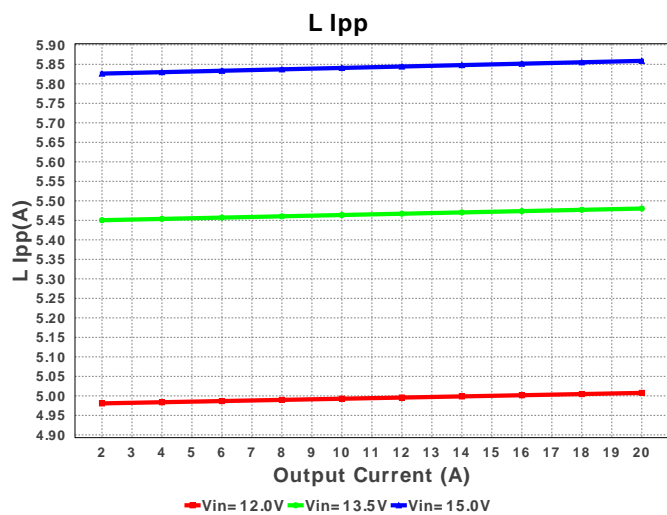
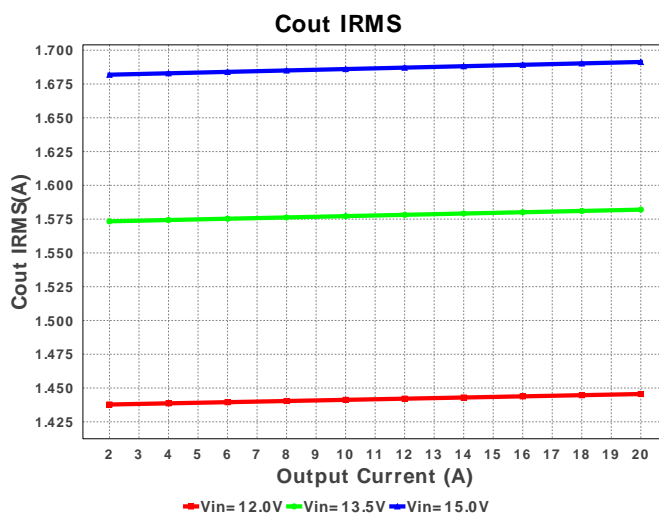
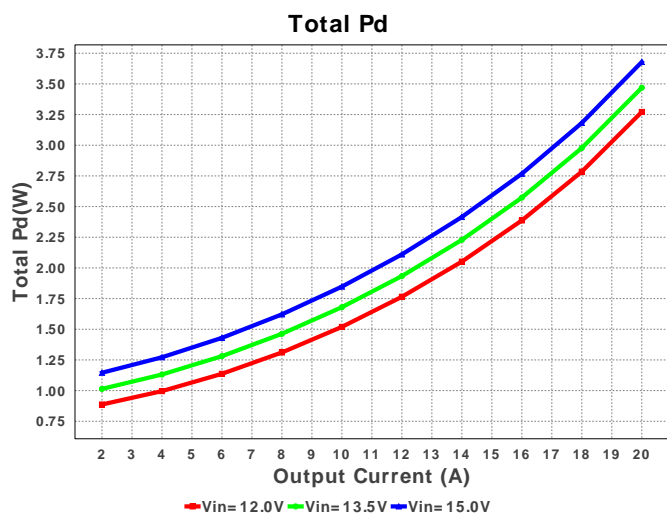
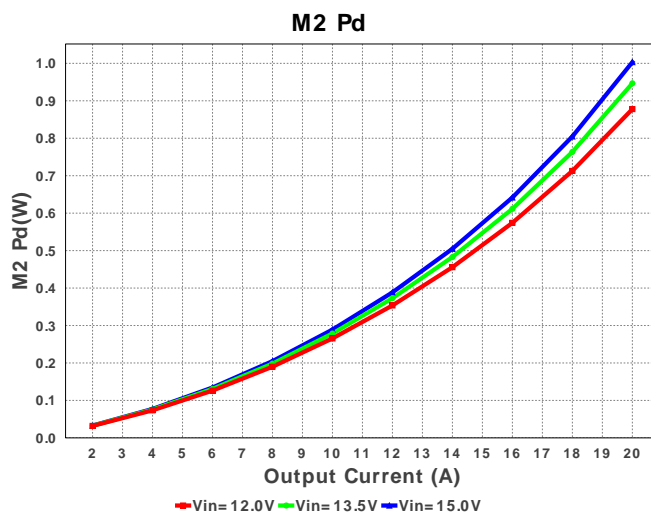
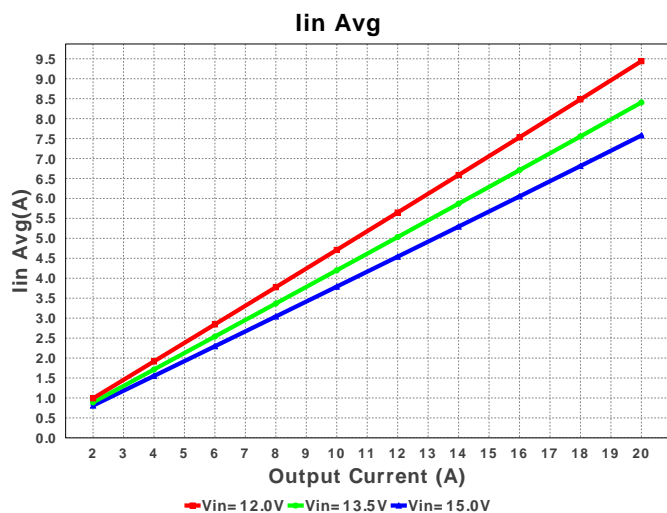
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbst	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
2.	Cbyp	MuRata	GRM188R61A225KE34D Series= X5R	Cap= 2.2 uF ESR= 9.637 mOhm VDC= 10.0 V IRMS= 1.24283 A	1	\$0.02	0603 5 mm ²
3.	Ccomp	MuRata	GRM033R61A822KA01D Series= X5R	Cap= 8.2 nF VDC= 10.0 V IRMS= 0.0 A	1	\$0.01	0201 2 mm ²
4.	Ccomp2	Samsung Electro-Mechanics	CL21C201JBANNNC Series= C0G/NP0	Cap= 200.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
5.	Ccomp3	MuRata	GRM033R71A182KA01D Series= X7R	Cap= 1.8 nF VDC= 10.0 V IRMS= 0.0 A	1	\$0.01	0201 2 mm ²
6.	Cin	MuRata	GRM32DR61E106KA12L Series= X5R	Cap= 10.0 uF ESR= 2.237 mOhm VDC= 25.0 V IRMS= 4.30653 A	3	\$0.12	1210_280 15 mm ²
7.	Cout	TDK	C3216X5R1A107M Series= X5R	Cap= 100.0 uF ESR= 1.715 mOhm VDC= 10.0 V IRMS= 0.0 A	1	\$0.67	1206 11 mm ²
8.	Css	MuRata	GRM033R61A332KA01D Series= X5R	Cap= 3.3 nF VDC= 10.0 V IRMS= 0.0 A	1	\$0.01	0201 2 mm ²
9.	Cvcc	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 mm ²

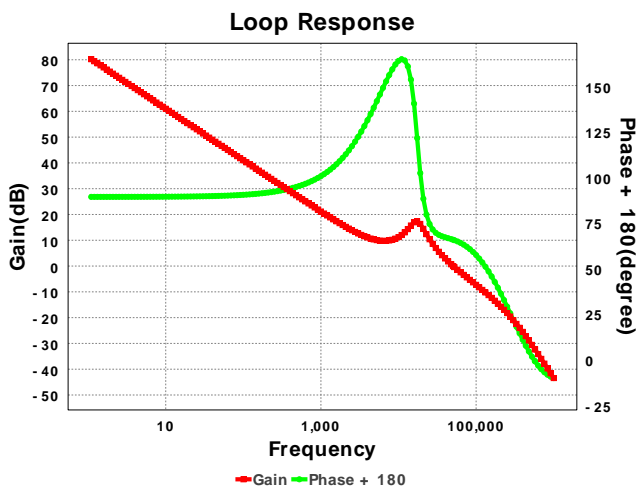
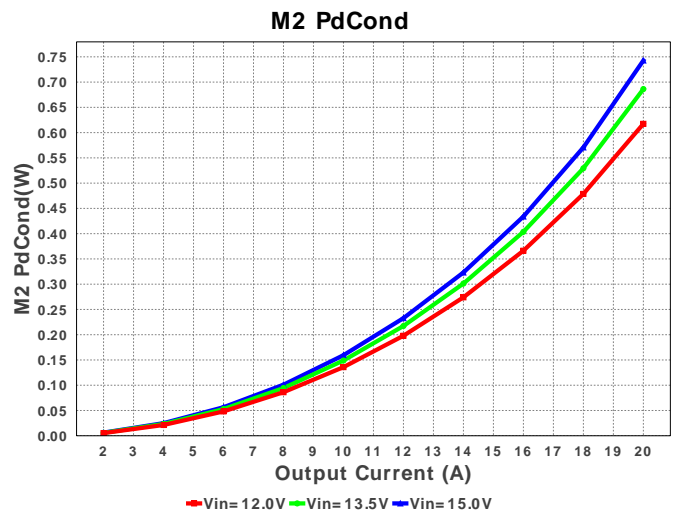
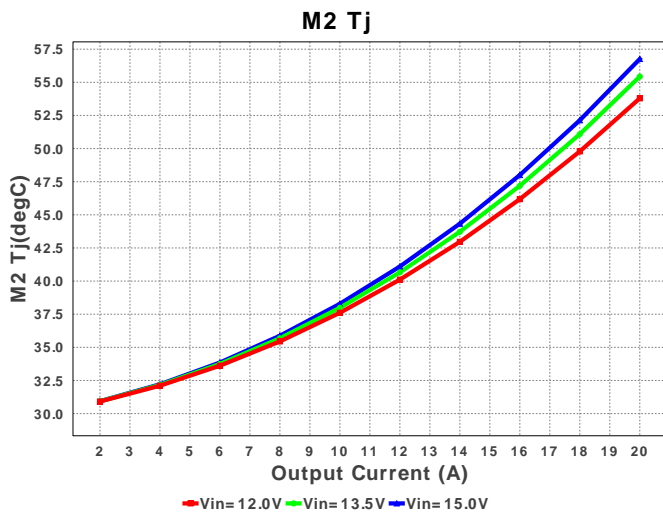
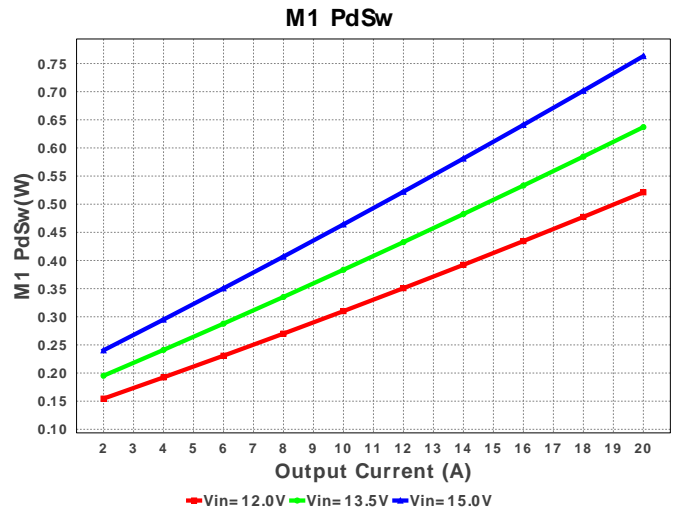
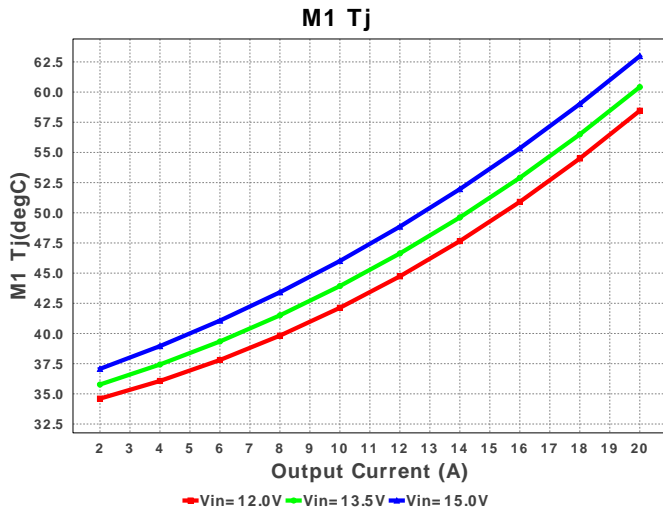
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	L1	Coilcraft	XAL1010-102MEB	L= 1.0 μ H DCR= 1.0 mOhm	1	\$1.71	 XAL1010 160 mm²
11.	M1	Texas Instruments	CSD16323Q3	VdsMax= 25.0 V IdsMax= 120.0 Amps	2	\$0.44	 TRANS_NexFET_Q3 18 mm²
12.	M2	Texas Instruments	CSD17309Q3	VdsMax= 30.0 V IdsMax= 120.0 Amps	2	\$0.44	 TRANS_NexFET_Q3 18 mm²
13.	Rcomp	Vishay-Dale	CRCW04022K21FKED Series= CRCW..e3	Res= 2.21 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
14.	Rcomp2	Vishay-Dale	CRCW0402261R1FKED Series= CRCW..e3	Res= 261.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
15.	Rfbb	Vishay-Dale	CRCW04021K21FKED Series= CRCW..e3	Res= 1.21 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
16.	Rfbt	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
17.	Rpgood	Vishay-Dale	CRCW0402100KFKED Series= CRCW..e3	Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
18.	Rs	Vishay-Dale	CRCW04024K42FKED Series= CRCW..e3	Res= 4.42 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
19.	U1	Texas Instruments	TPS40304DRCR	Switcher	1	\$0.95	 S-PVSON-N10 17 mm²











Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	9.656 A	Current	Input capacitor RMS ripple current
2.	Cout IRMS	1.691 A	Current	Output capacitor RMS ripple current
3.	Iin Avg	7.567 A	Current	Average input current
4.	L Ipp	5.859 A	Current	Peak-to-peak inductor ripple current
5.	SW Ipk	22.929 A	Current	Peak switch current
6.	BOM Count	23	General	Total Design BOM count
7.	FootPrint	352.0 mm ²	General	Total Foot Print Area of BOM components
8.	Frequency	600.0 kHz	General	Switching frequency
9.	IC Tolerance	10.0 mV	General	IC Feedback Tolerance
10.	Pout	110.0 W	General	Total output power
11.	Total BOM	\$5.59	General	Total BOM Cost

#	Name	Value	Category	Description
12.	Low Freq Gain	80.282 dB	Op_Point	Gain at 10Hz
13.	Vout Actual	5.559 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
14.	Cross Freq	50.758 kHz	Op_point	Bode plot crossover frequency
15.	Duty Cycle	37.003 %	Op_point	Duty cycle
16.	Efficiency	96.916 %	Op_point	Steady state efficiency
17.	Gain Marg	-32.152 dB	Op_point	Bode Plot Gain Margin
18.	IC Tj	71.118 degC	Op_point	IC junction temperature
19.	IOUT_OP	20.0 A	Op_point	Iout operating point
20.	M1 Tj	62.981 degC	Op_point	M1 MOSFET junction temperature
21.	M2 Tj	56.76 degC	Op_point	M2 MOSFET junction temperature
22.	Phase Marg	66.027 deg	Op_point	Bode Plot Phase Margin
23.	VIN_OP	15.0 V	Op_point	Vin operating point
24.	Vout p-p	14.498 mV	Op_point	Peak-to-peak output ripple voltage
25.	Cin Pd	69.528 mW	Power	Input capacitor power dissipation
26.	Cout Pd	4.906 mW	Power	Output capacitor power dissipation
27.	IC Pd	858.42 mW	Power	IC power dissipation
28.	L Pd	500.0 mW	Power	Inductor power dissipation
29.	M1 Pd	1.145 W	Power	M1 MOSFET total power dissipation
30.	M1 PdCond	381.776 mW	Power	M1 MOSFET conduction losses
31.	M1 PdSw	763.172 mW	Power	M1 MOSFET switching losses
32.	M2 Pd	923.014 mW	Power	M2 MOSFET total power dissipation
33.	M2 PdCond	662.617 mW	Power	M2 MOSFET conduction losses
34.	M2 PdSw	260.397 mW	Power	M2 MOSFET switching losses
35.	Total Pd	3.5 W	Power	Total Power Dissipation
36.	Vout Tolerance	3.499 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	20.0	Maximum Output Current
2.	VinMax	15.0	Maximum input voltage
3.	VinMin	12.0	Minimum input voltage
4.	Vout	5.5	Output Voltage
5.	base_pn	TPS40304	Texas Instruments Base Part Number
6.	source	DC	Input Source Type
7.	ta	30.0	Ambient temperature

Design Assistance

1. TPS40304 Product Folder : <http://www.ti.com/product/TPS40304> : contains the data sheet and other resources.

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