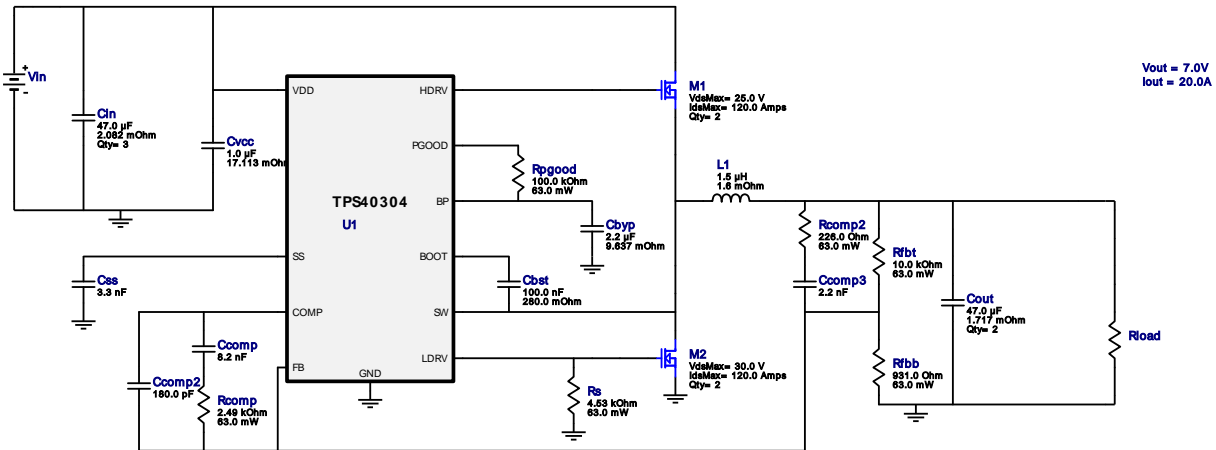


WEBENCH® Design Report

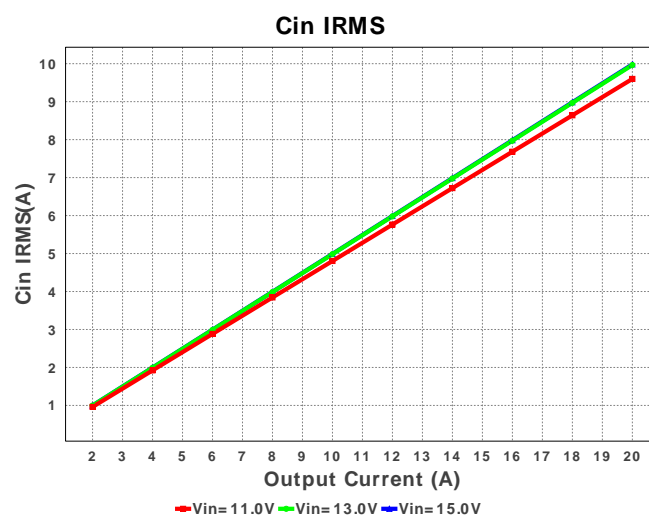
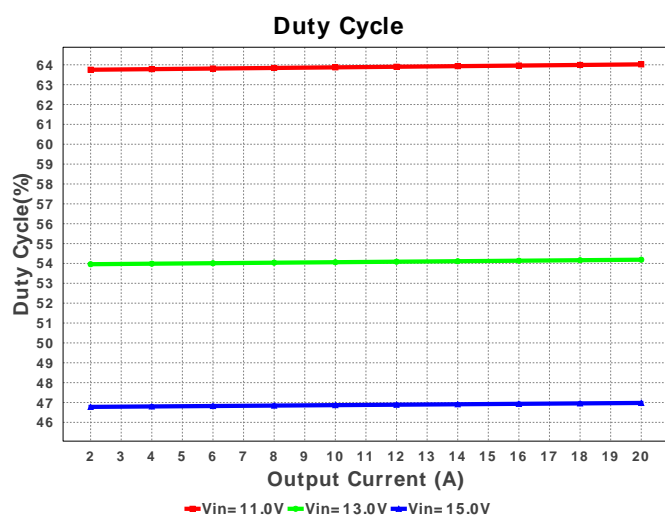
Design : 4613839/1 TPS40304DRCR
TPS40304DRCR 11.0V-15.0V to 7.00V @ 20.0A



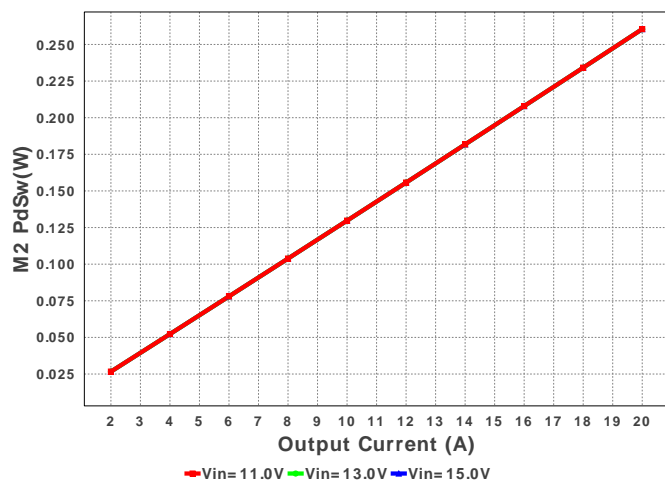
Electrical BOM

#	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	Kemet	C0805C181K5GACTU Series= C0G/NP0	Cap= 180.0 pF 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.	Cin	TDK	C3216X5R1E476M160AC Series= X5R	Cap= 47.0 uF ESR= 2.082 mOhm VDC= 25.0 V IRMS= 5.0279 A	3	\$0.35	1206 11 mm ²
7.	Cout	TDK	C3216JB1A476M Series= JB	Cap= 47.0 uF ESR= 1.717 mOhm VDC= 10.0 V IRMS= 0.0 A	2	\$0.34	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

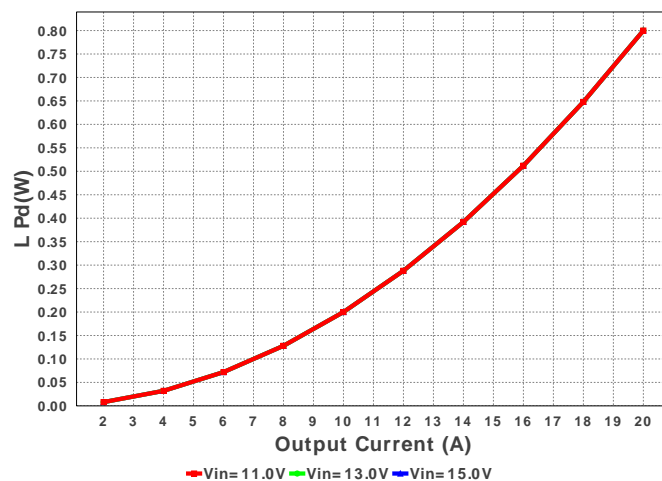
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	L1	Coilcraft	XAL1010-152MEB	L= 1.5 μ H DCR= 1.6 mOhm	1	\$1.71	 XAL1010 160 mm²
11.	M1	Texas Instruments	CSD16323Q3	VdsMax= 25.0 V IdsMax= 120.0 Amps	2	\$0.44	 TRANS_NexFET_Q3 18 mm²
12.	M2	Texas Instruments	CSD17309Q3	VdsMax= 30.0 V IdsMax= 120.0 Amps	2	\$0.44	 TRANS_NexFET_Q3 18 mm²
13.	Rcomp	Vishay-Dale	CRCW04022K49FKED Series= CRCW..e3	Res= 2.49 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
14.	Rcomp2	Vishay-Dale	CRCW0402226RFKED Series= CRCW..e3	Res= 226.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
15.	Rfbb	Vishay-Dale	CRCW0402931RFKED Series= CRCW..e3	Res= 931.0 Ohm 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	CRCW04024K53FKED Series= CRCW..e3	Res= 4.53 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



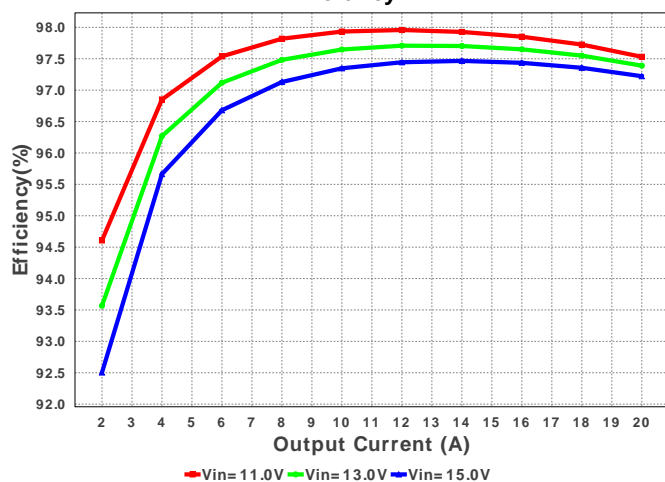
M2 PdSw



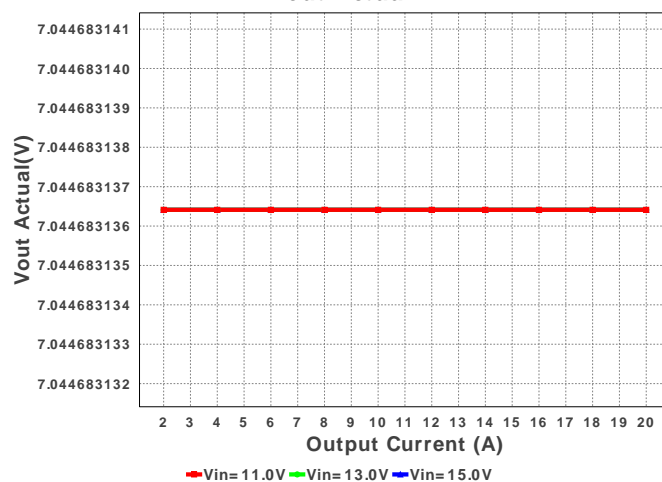
L Pd



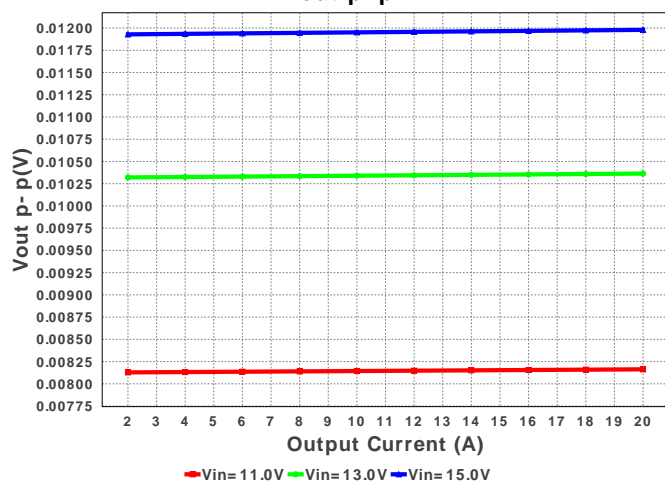
Efficiency



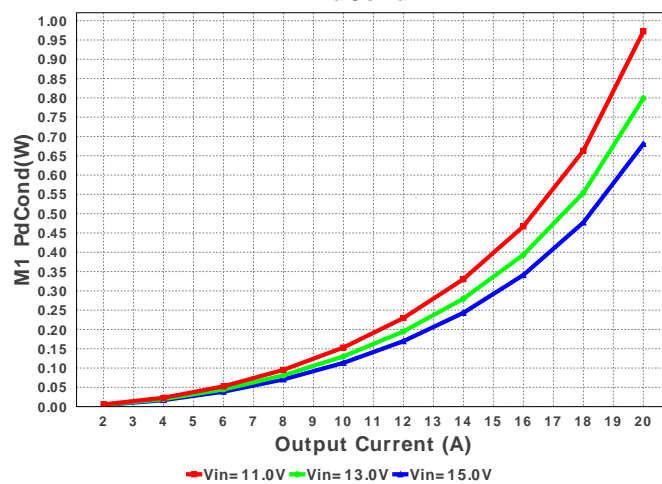
Vout Actual



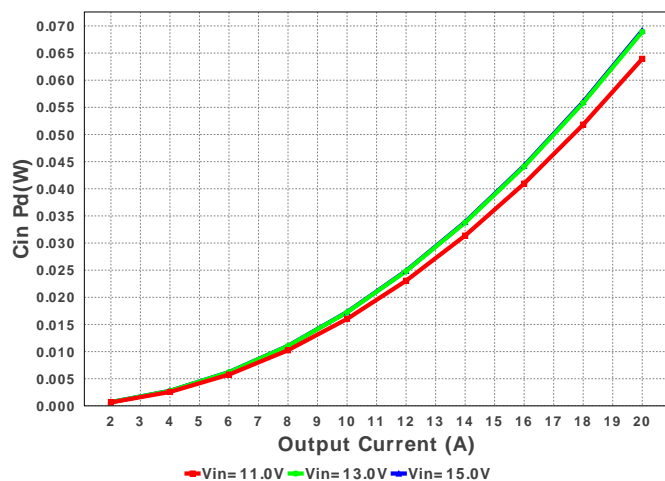
Vout p-p



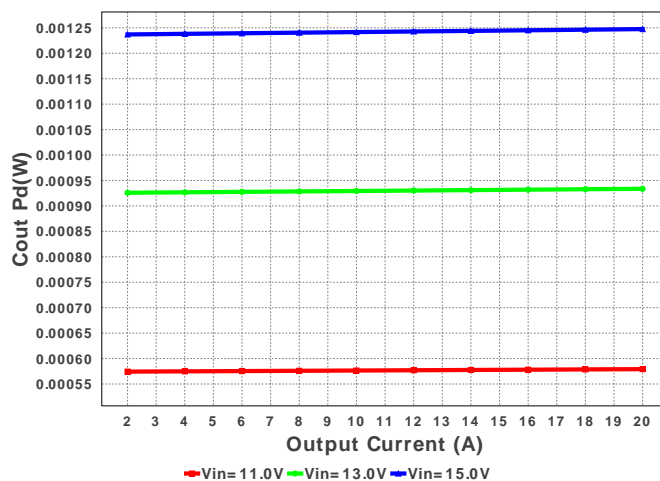
M1 PdCond



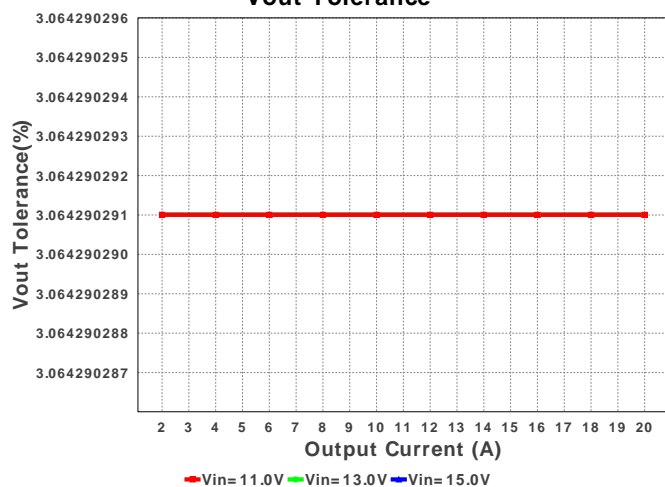
Cin Pd



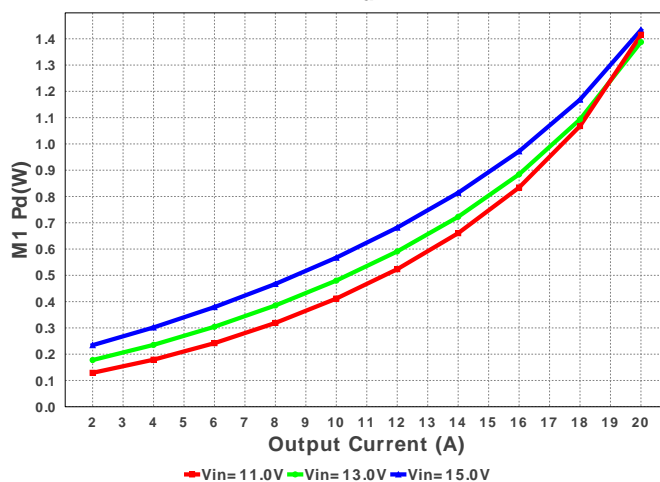
Cout Pd



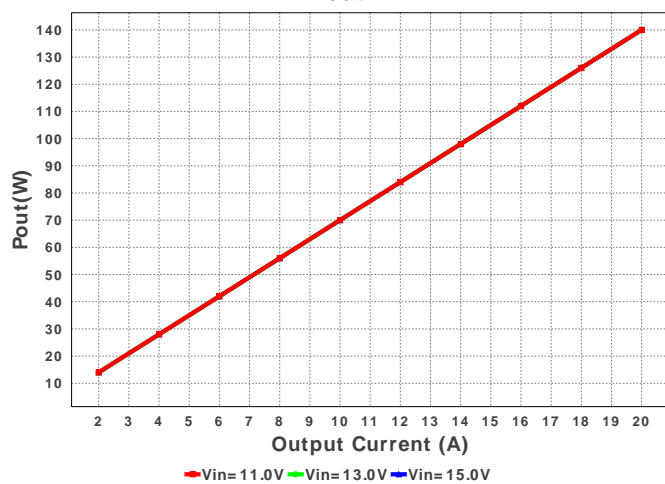
Vout Tolerance



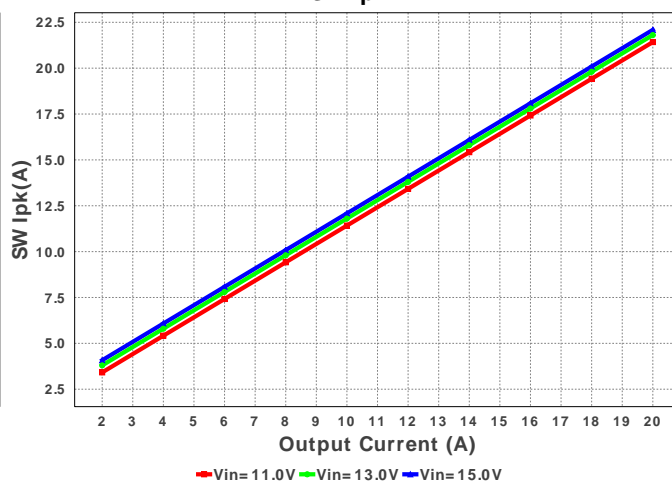
M1 Pd

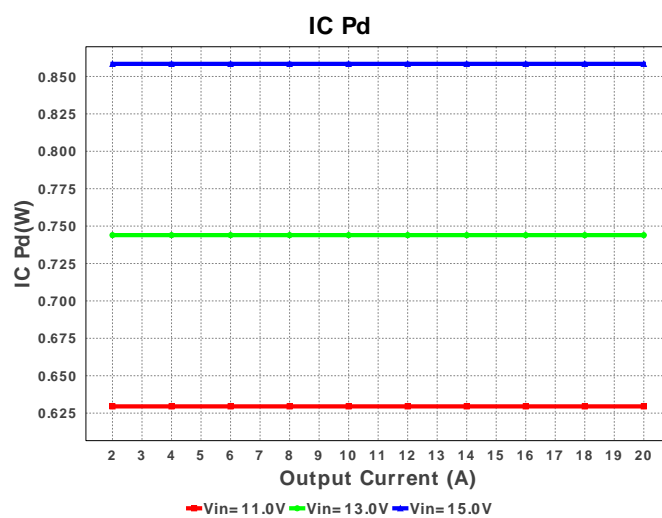
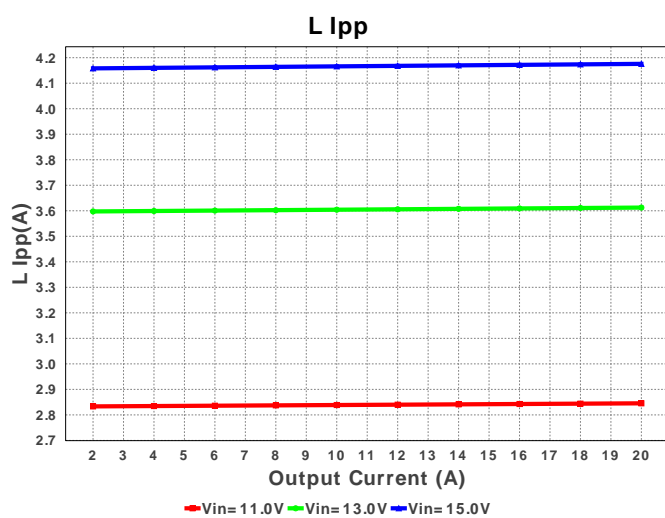
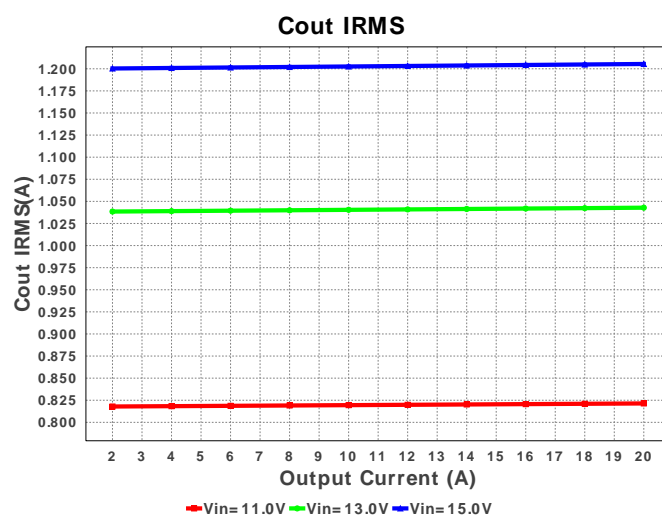
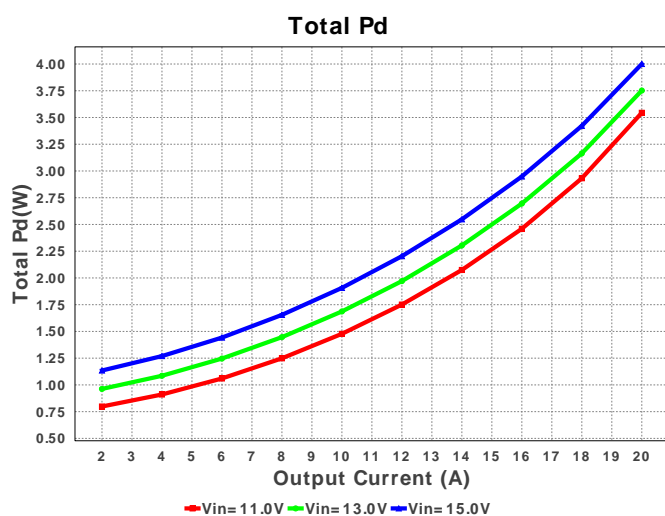
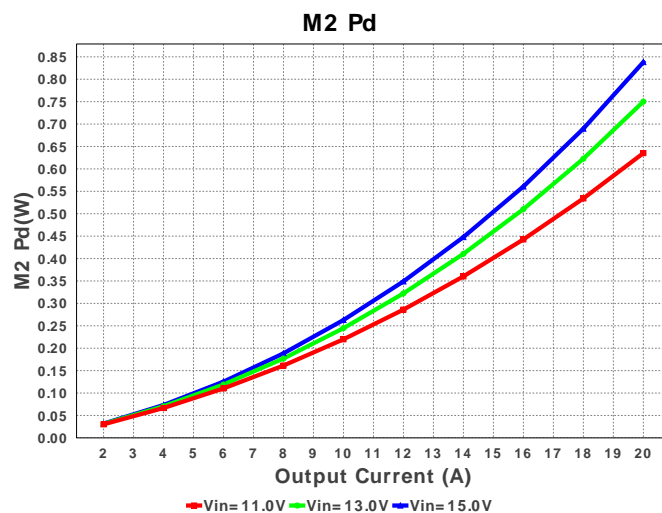
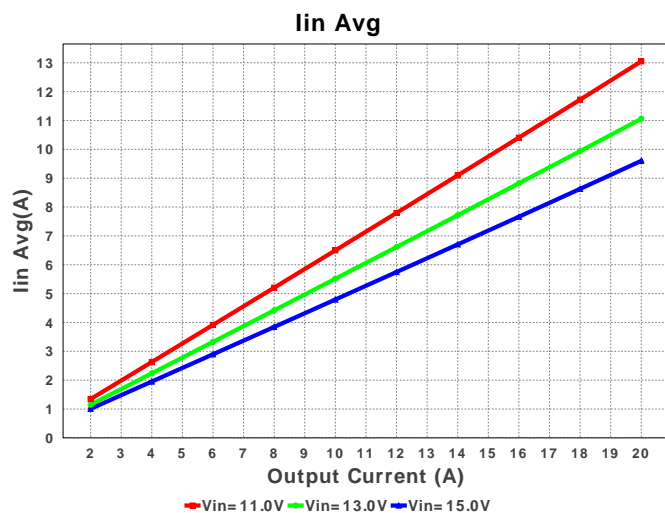


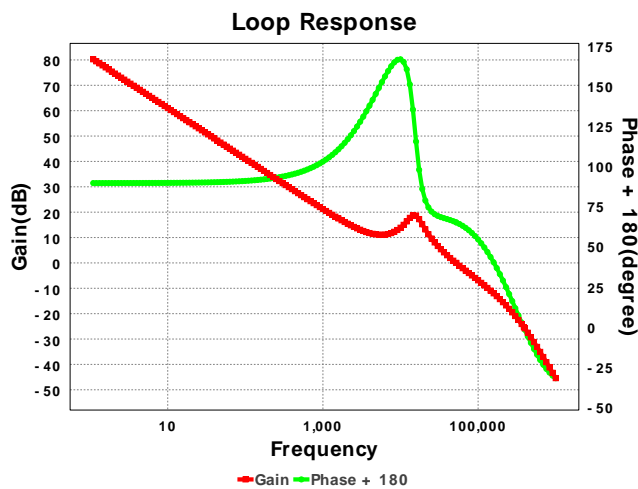
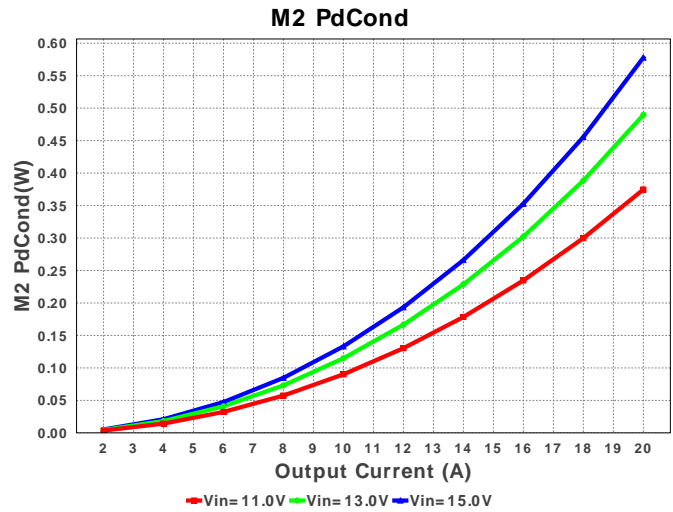
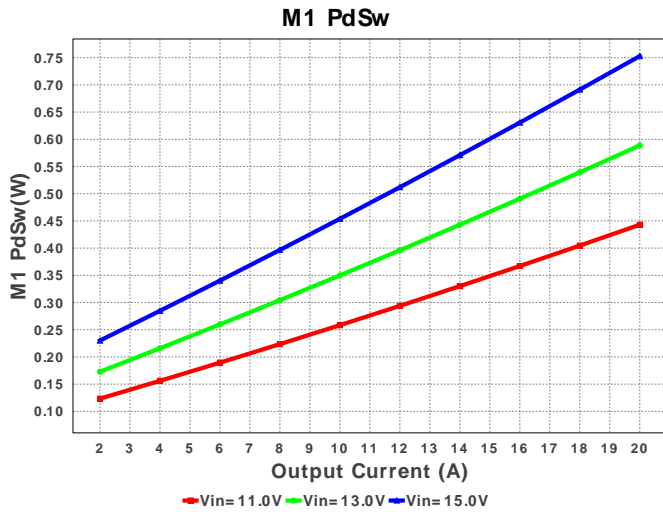
Pout



SW Ipk







Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	9.982 A	Current	Input capacitor RMS ripple current
2.	Cout IRMS	1.205 A	Current	Output capacitor RMS ripple current
3.	Iin Avg	9.586 A	Current	Average input current
4.	L Ipp	4.176 A	Current	Peak-to-peak inductor ripple current
5.	SW Ipk	22.088 A	Current	Peak switch current
6.	BOM Count	24	General	Total Design BOM count
7.	FootPrint	357.0 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	140.0 W	General	Total output power
11.	Total BOM	\$6.29	General	Total BOM Cost
12.	Low Freq Gain	80.295 dB	Op_Point	Gain at 10Hz
13.	Vout Actual	7.045 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
14.	Cross Freq	51.896 kHz	Op_point	Bode plot crossover frequency
15.	Duty Cycle	46.977 %	Op_point	Duty cycle
16.	Efficiency	97.363 %	Op_point	Steady state efficiency
17.	Gain Marg	-25.311 dB	Op_point	Bode Plot Gain Margin
18.	IOUT_OP	20.0 A	Op_point	Iout operating point
19.	Phase Marg	65.328 deg	Op_point	Bode Plot Phase Margin
20.	VIN_OP	15.0 V	Op_point	Vin operating point
21.	Vout p-p	11.98 mV	Op_point	Peak-to-peak output ripple voltage
22.	Cin Pd	69.146 mW	Power	Input capacitor power dissipation
23.	Cout Pd	1.247 mW	Power	Output capacitor power dissipation
24.	IC Pd	858.42 mW	Power	IC power dissipation
25.	L Pd	800.0 mW	Power	Inductor power dissipation
26.	M1 Pd	1.252 W	Power	M1 MOSFET total power dissipation
27.	M1 PdCond	498.59 mW	Power	M1 MOSFET conduction losses
28.	M1 PdSw	752.915 mW	Power	M1 MOSFET switching losses
29.	M2 Pd	810.845 mW	Power	M2 MOSFET total power dissipation
30.	M2 PdCond	550.395 mW	Power	M2 MOSFET conduction losses
31.	M2 PdSw	260.45 mW	Power	M2 MOSFET switching losses

#	Name	Value	Category	Description
32.	Total Pd	3.792 W	Power	Total Power Dissipation
33.	Vout Tolerance	3.064 %	Unknown	Vout Tolerance based on IC Tolerance 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	11.0	Minimum input voltage
4.	Vout	7.0	Output Voltage
5.	base_pn	TPS40304	Base Product 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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