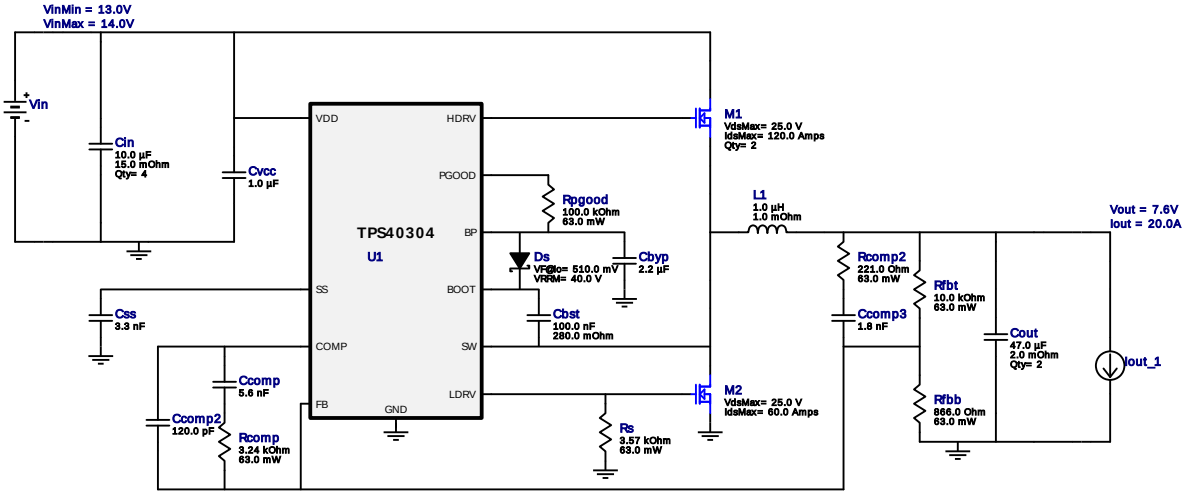
WEBENCH® Design Report

VinMin = 13.0V
VinMax = 14.0V
Vout = 7.6V
Iout = 20.0A

Device = TPS40304DRCR
Topology = Buck
Created = 7/29/13 2:49:36 PM
BOM Cost = $4.56
Total Pd = 3.89W
Footprint = 557.0mm2
BOM Count = 25

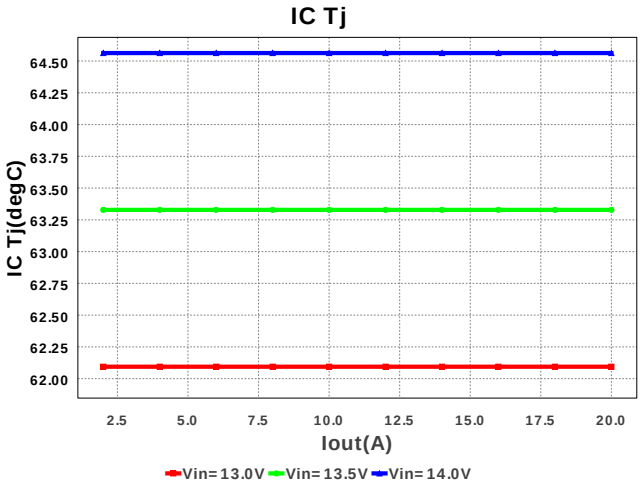
Design : 873485/9 TPS40304DRCR
TPS40304DRCR 13.0V-14.0V to 7.6V @ 20.0A

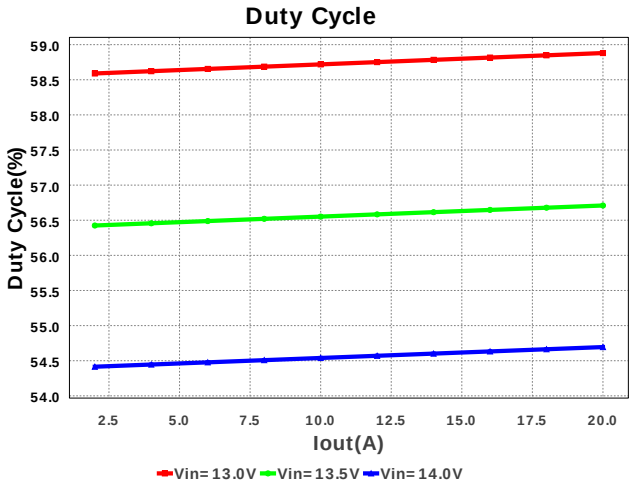


Electrical BOM

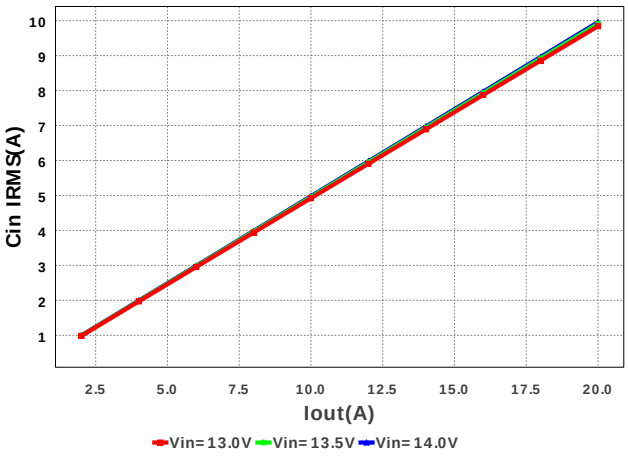
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbst	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 13mm2
2.	Cbyp	MuRata	GRM188R61A225KE34D Series= X5R	Cap= 2.2 µF VDC= 10.0 V IRMS= 0.0 A	1	$0.02	0603 10mm2
3.	Ccomp	Yageo America	CC0805KRX7R9BB562 Series= X7R	Cap= 5.6 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 13mm2
4.	Ccomp2	Yageo America	CC0805JRNP09BN121 Series= C0G/NP0	Cap= 120.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 13mm2
5.	Ccomp3	MuRata	GRM216R71E182KA01D Series= X7R	Cap= 1.8 nF VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 13mm2
6.	Cin	TDK	C3225X5R1E106K Series= X5R	Cap= 10.0 µF ESR= 15.0 mOhm VDC= 25.0 V IRMS= 3.0 A	4	$0.15	1210 23mm2
7.	Cout	MuRata	GRM32ER61C476ME15L Series= X5R	Cap= 47.0 µF ESR= 2.0 mOhm VDC= 16.0 V IRMS= 0.0 A	2	$0.20	1210 23mm2
8.	Css	MuRata	GRM033R71A332KA01D Series= X7R	Cap= 3.3 nF VDC= 10.0 V IRMS= 0.0 A	1	$0.01	0201 6mm2
9.	Cvcc	MuRata	GRM188R61E105KA12D Series= X5R	Cap= 1.0 µF VDC= 25.0 V IRMS= 0.0 A	1	$0.02	0603 10mm2
10.	Ds	ON Semiconductor	MBR0540T1G	VF@Io= 510.0 mV VRRM= 40.0 V	1	$0.06	SOD-123 22mm2

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
11.	L1	Coilcraft	XAL1010-102MEB	L= 1.0 µH DCR= 1.0 mOhm	1	$1.08	 XAL1010 160mm2
12.	M1	Texas Instruments	CSD16340Q3	VdsMax= 25.0 V IdsMax= 120.0 Amps	2	$0.44	 TRANS_NexFET_Q3 29mm2
13.	M2	Texas Instruments	CSD16340Q3	VdsMax= 25.0 V IdsMax= 60.0 Amps	1	$0.44	 TRANS_NexFET_Q3 29mm2
14.	Rcomp	Vishay-Dale	CRCW04023K24FKED Series= CRCW..e3	Res= 3.24 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 8mm2
15.	Rcomp2	Vishay-Dale	CRCW0402221RFKED Series= CRCW..e3	Res= 221.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 8mm2
16.	Rfbb	Vishay-Dale	CRCW0402866RFKED Series= CRCW..e3	Res= 866.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 8mm2
17.	Rfbt	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 8mm2
18.	Rpgood	Vishay-Dale	CRCW0402100KFKED Series= CRCW..e3	Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 8mm2
19.	Rs	Vishay-Dale	CRCW04023K57FKED Series= CRCW..e3	Res= 3.57 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 8mm2
20.	U1	Texas Instruments	TPS40304DRCR	Switcher	1	$0.95	 DRC 25mm2

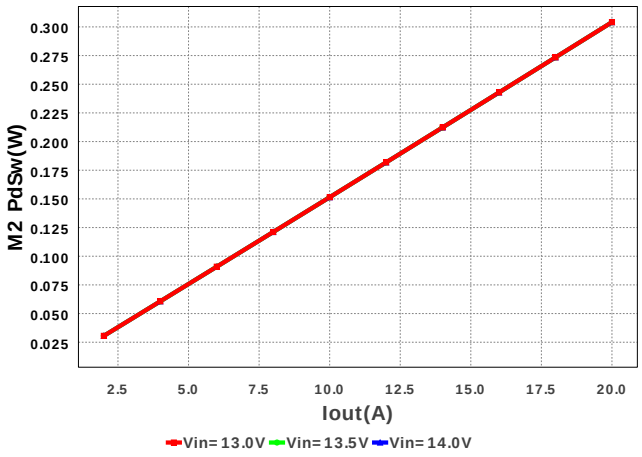




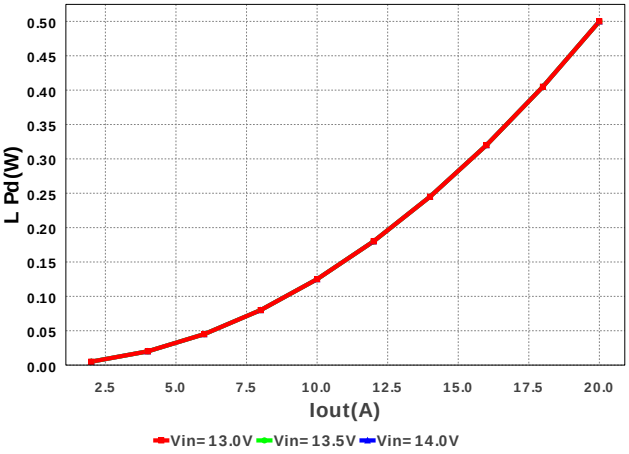
Cin IRMS



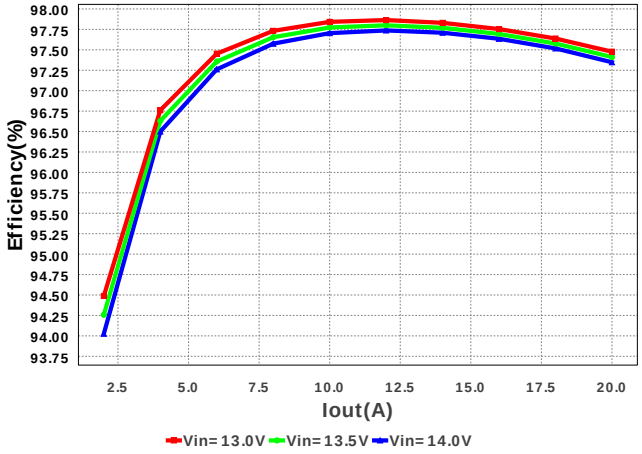
M2 PdSw



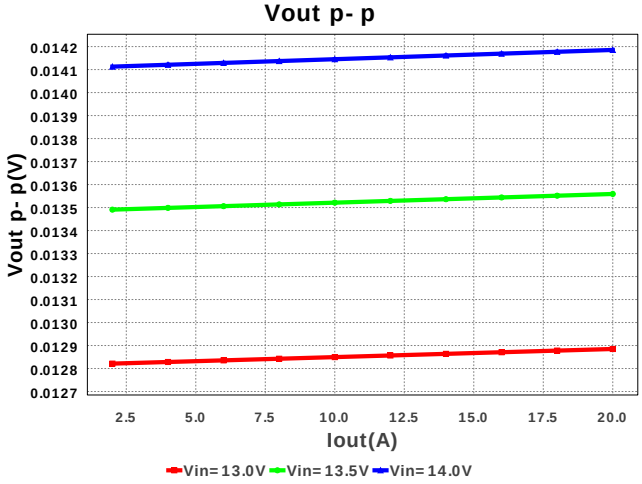
L Pd



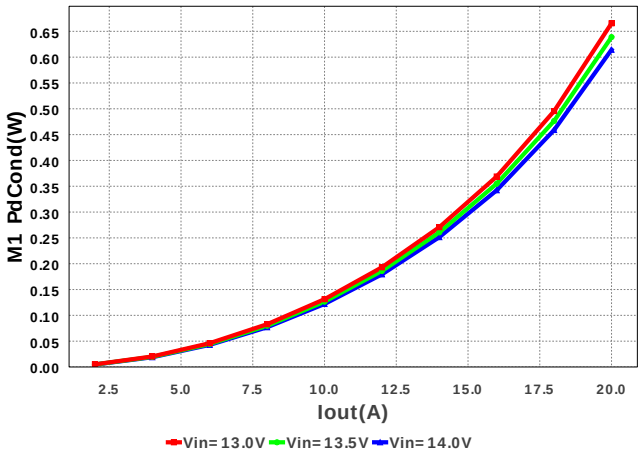
Efficiency



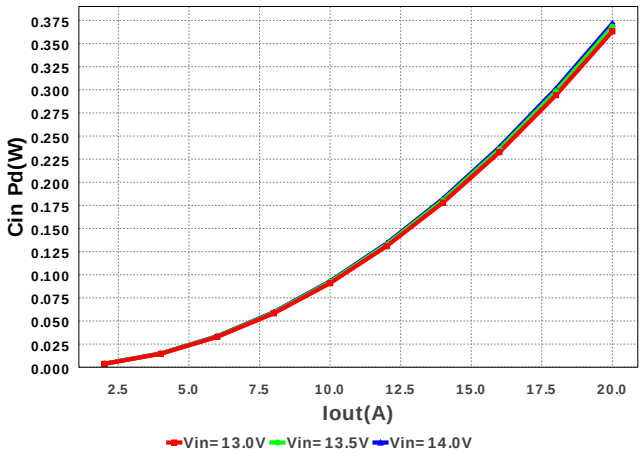
Vout p- p



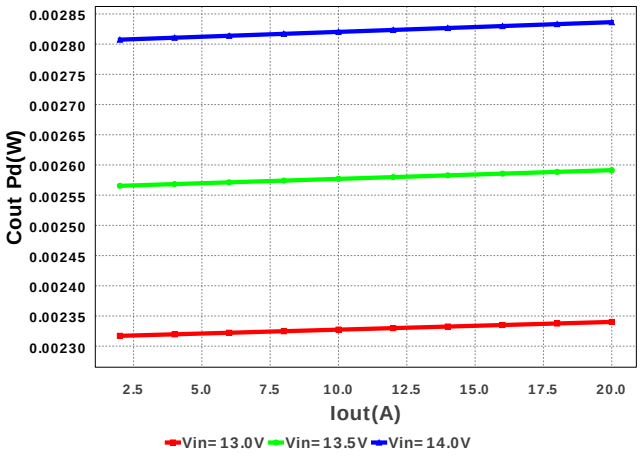
M1 PdCond



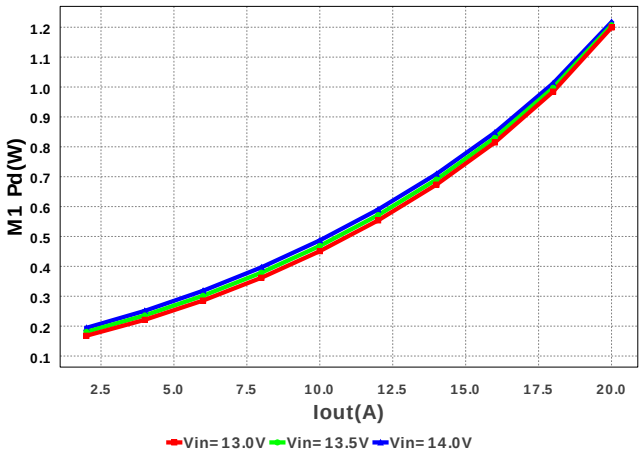
Cin Pd



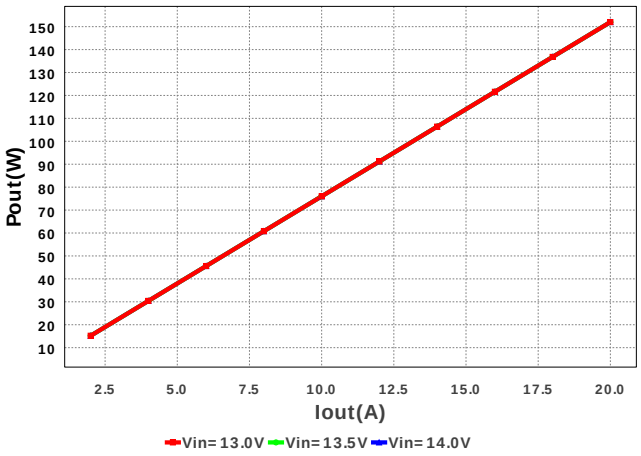
Cout Pd



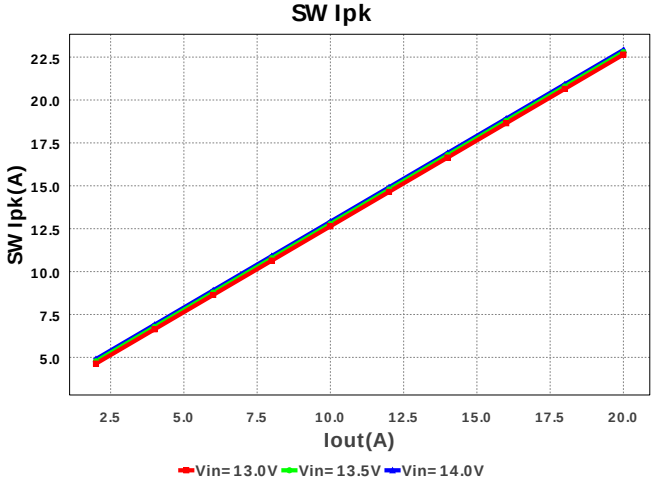
M1 Pd



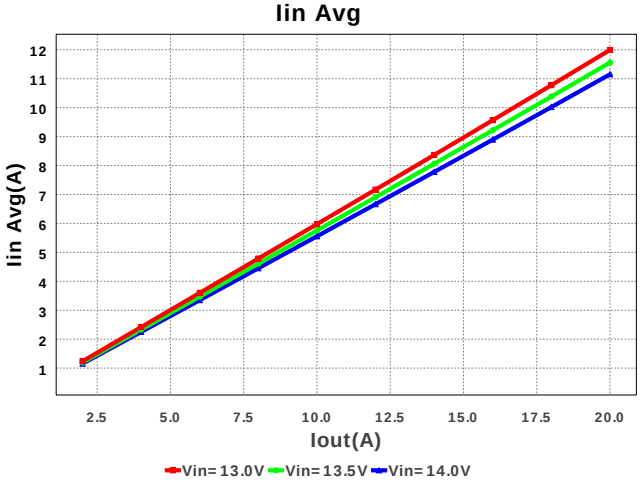
Pout

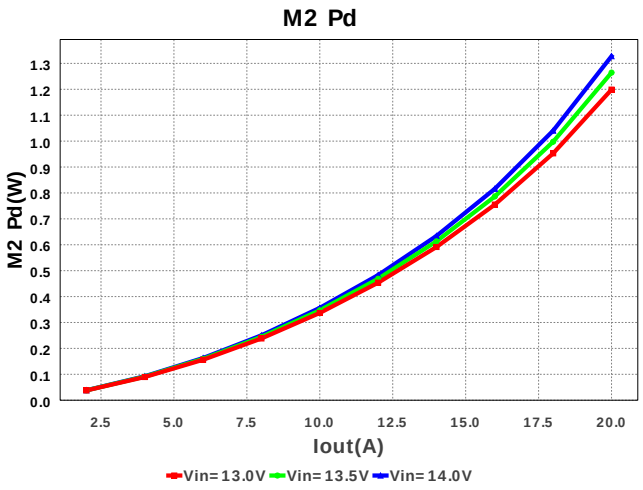


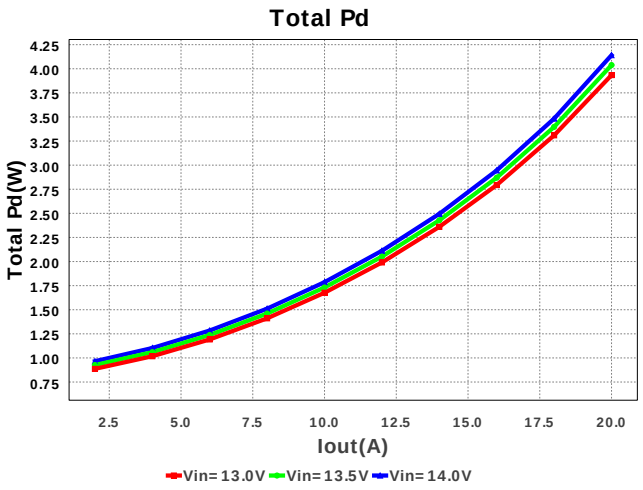
SW Ipk

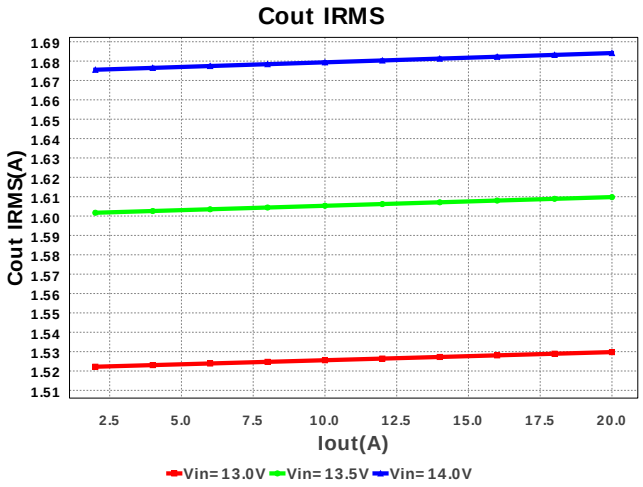


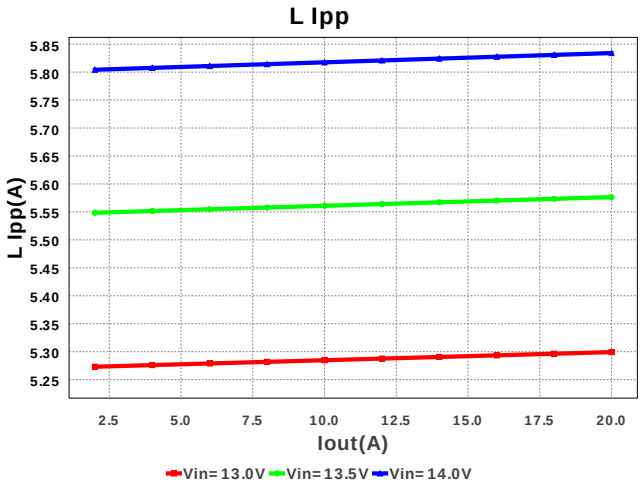
Iin Avg

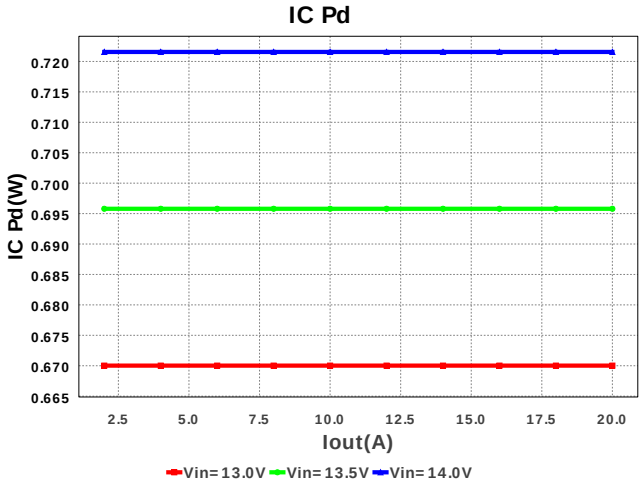


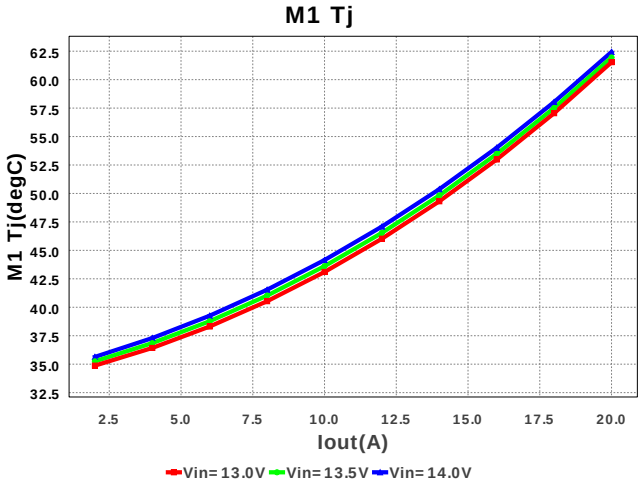


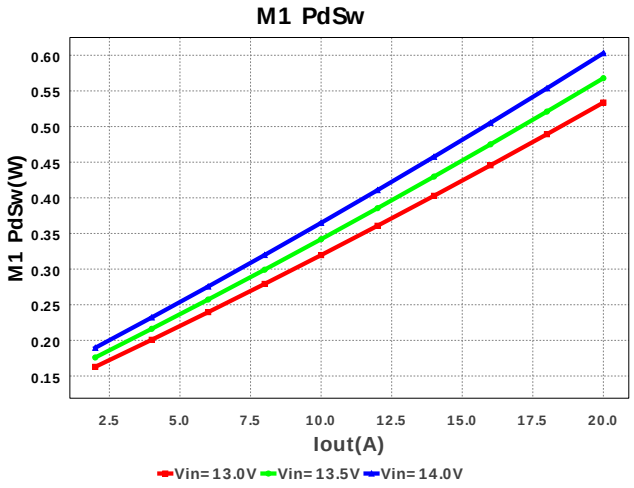


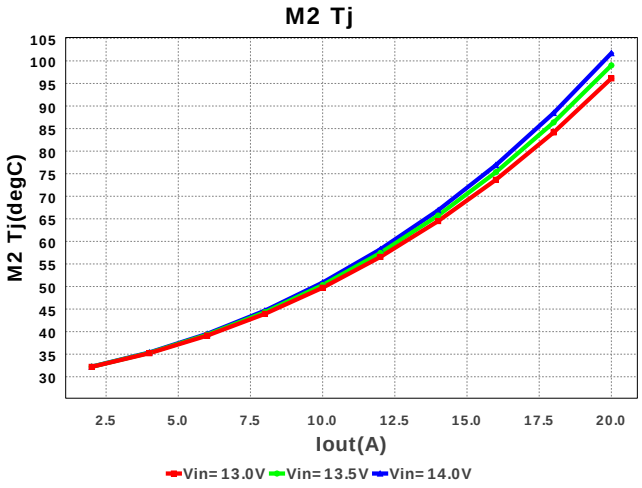


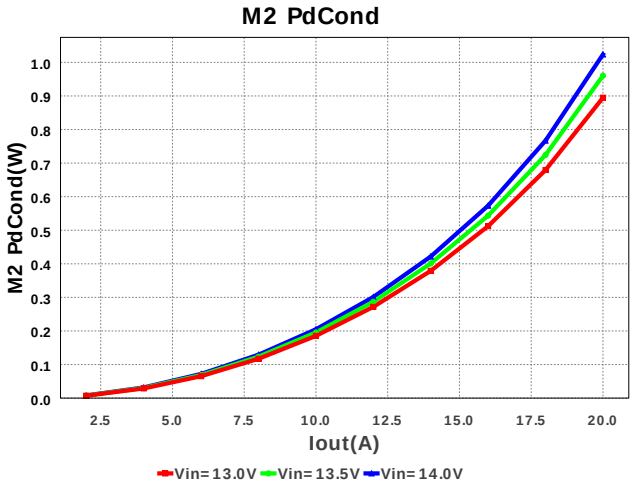


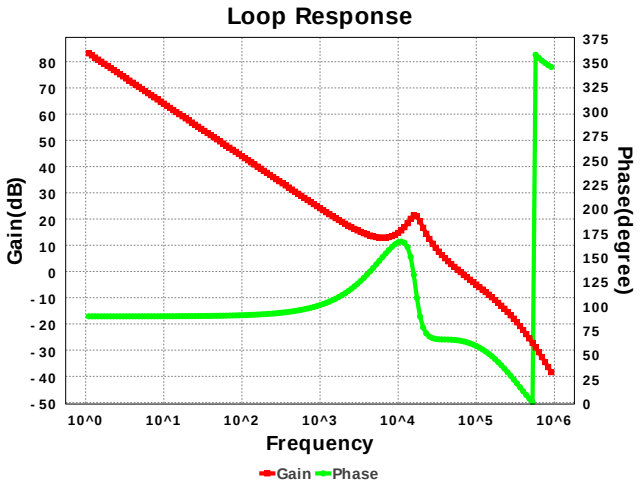












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	9.956 A	Current	Input capacitor RMS ripple current
2.	Cout IRMS	1.684 A	Current	Output capacitor RMS ripple current
3.	Iin Avg	11.135 A	Current	Average input current
4.	L Ipp	5.834 A	Current	Peak-to-peak inductor ripple current
5.	SW Ipk	22.917 A	Current	Peak switch current
6.	BOM Count	25	General	Total Design BOM count
7.	FootPrint	557.0 mm2	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.	Mode	CCM	General	Conduction Mode
11.	Pout	152.0 W	General	Total output power
12.	Total BOM	$4.56	General	Total BOM Cost
13.	Cross Freq	61.679 kHz	Op_point	Bode plot crossover frequency
14.	Duty Cycle	54.694 %	Op_point	Duty cycle
15.	Efficiency	97.507 %	Op_point	Steady state efficiency
16.	IC Tj	64.563 degC	Op_point	IC junction temperature
17.	IOUT_OP	20.0 A	Op_point	Iout operating point
18.	M1 Tj	62.433 degC	Op_point	M1 MOSFET junction temperature
19.	M2 Tj	101.71 degC	Op_point	M2 MOSFET junction temperature
20.	Phase Marg	65.055 deg	Op_point	Bode Plot Phase Margin
21.	VIN_OP	14.0 V	Op_point	Vin operating point
22.	Vout p-p	14.185 mV	Op_point	Peak-to-peak output ripple voltage
23.	Cin Pd	371.694 mW	Power	Input capacitor power dissipation
24.	Cout Pd	2.836 mW	Power	Output capacitor power dissipation
25.	IC Pd	721.56 mW	Power	IC power dissipation
26.	L Pd	500.0 mW	Power	Inductor power dissipation
27.	M1 Pd	1.118 W	Power	M1 MOSFET total power dissipation
28.	M1 PdCond	514.744 mW	Power	M1 MOSFET conduction losses
29.	M1 PdSw	602.936 mW	Power	M1 MOSFET switching losses
30.	M2 Pd	1.173 W	Power	M2 MOSFET total power dissipation
31.	M2 PdCond	868.846 mW	Power	M2 MOSFET conduction losses
32.	M2 PdSw	304.098 mW	Power	M2 MOSFET switching losses

#	Name	Value	Category	Description
33.	Total Pd	3.886 W	Power	Total Power Dissipation

Design Inputs

#	Name	Value	Description
1.	Iout	20.0 A	Maximum Output Current
2.	Iout1	20.0 Amps	Output Current #1
3.	VinMax	14.0 V	Maximum input voltage
4.	VinMin	13.0 V	Minimum input voltage
5.	Vout	7.6 V	Output Voltage
6.	Vout1	7.6 Volt	Output Voltage #1
7.	base_pn	TPS40304	Base Product Number
8.	source	DC	Input Source Type
9.	Ta	30.0 degC	Ambient temperature

Design Assistance

1. **TPS40304** Product Folder : http://www.ti.com/product/tps40304 : contains the data sheet and other resources.