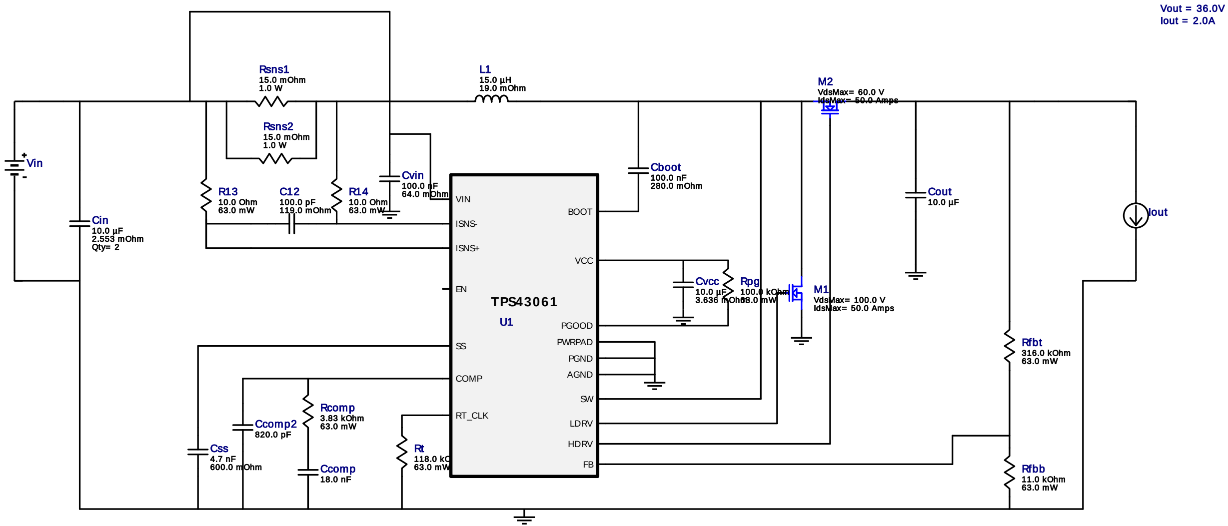
TEXAS INSTRUMENTS

WEBENCH® Design Report

VinMin = 14.0V
VinMax = 22.0V
Vout = 36.0V
Iout = 2.0A

Device = TPS43061RTER
Topology = Boost
Created = 9/23/16 8:26:04 PM
BOM Cost = $4.00
BOM Count = 23
Total Pd = 4.25W

Design : 4802695/1 TPS43061RTER
TPS43061RTER 14.0V-22.0V to 36.00V @ 2.0A

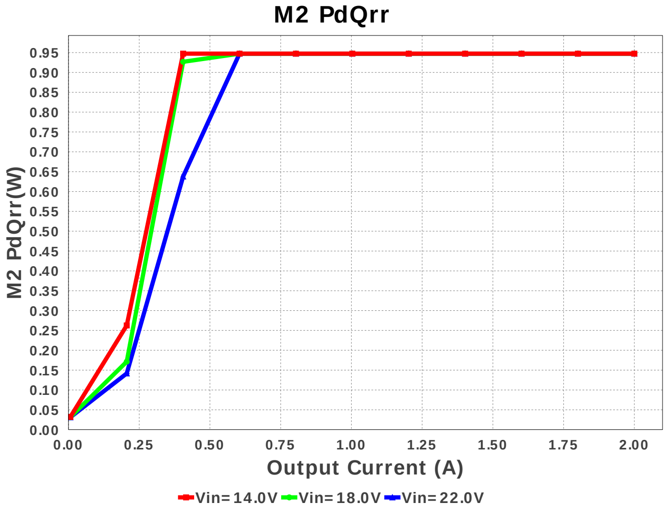


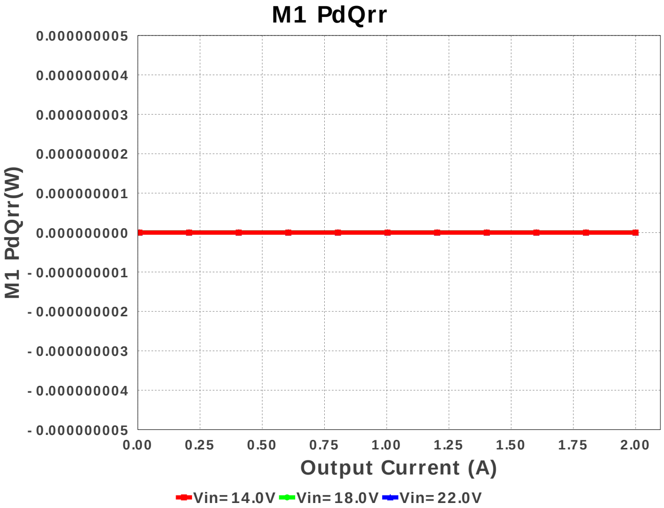
1. The pulse skip mode in the device has not been modeled. Efficiency and operational parameters of the model in pulse skip mode is not valid.

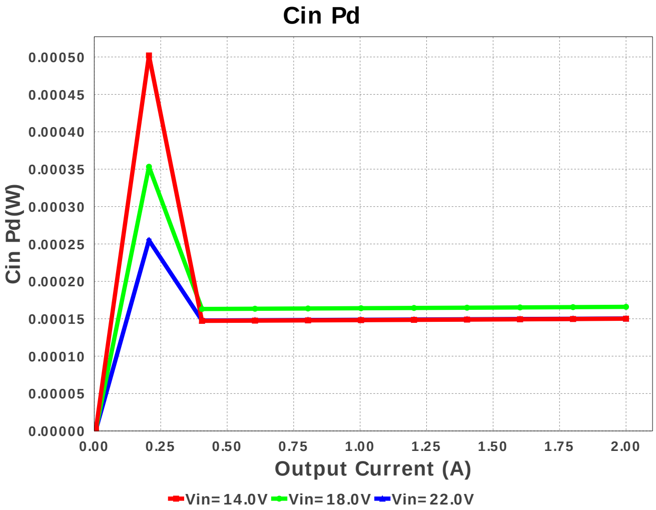
Electrical BOM

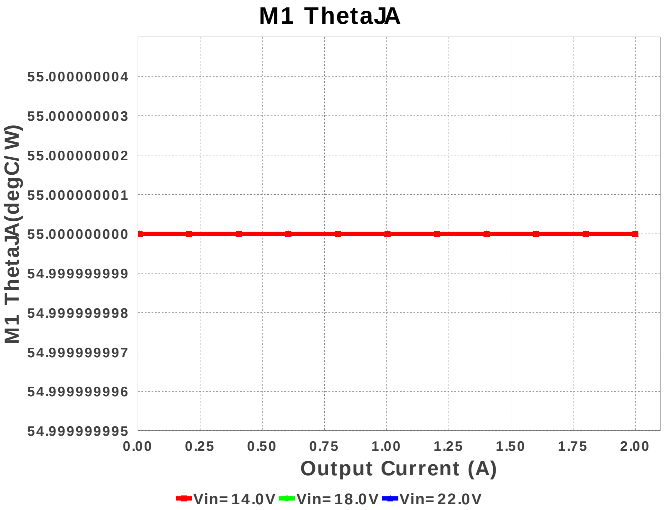
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	C12	AVX	06035A101JAT2A Series= C0G/NP0	Cap= 100.0 pF ESR= 119.0 mOhm VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0603 5 mm^2
2.	Cboot	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
3.	Ccomp	Yageo America	CC0805KRX7R9BB183 Series= X7R	Cap= 18.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
4.	Ccomp2	Yageo America	CC0805KRX7R9BB821 Series= X7R	Cap= 820.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
5.	Cin	TDK	C3216X6S1V106K Series= X6S	Cap= 10.0 uF ESR= 2.553 mOhm VDC= 35.0 V IRMS= 0.0 A	2	$0.14	1206 11 mm^2
6.	Cout	MuRata	GRM32ER71J106KA12L Series= X7R	Cap= 10.0 uF VDC= 63.0 V IRMS= 0.0 A	1	$0.27	1210_280 15 mm^2
7.	Css	MuRata	GRM188R71E472KA01D Series= X7R	Cap= 4.7 nF ESR= 600.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0603 5 mm^2
8.	Cvcc	MuRata	GRM188R61C106MA73D Series= X5R	Cap= 10.0 uF ESR= 3.636 mOhm VDC= 16.0 V IRMS= 2.8889 A	1	$0.07	0603 5 mm^2

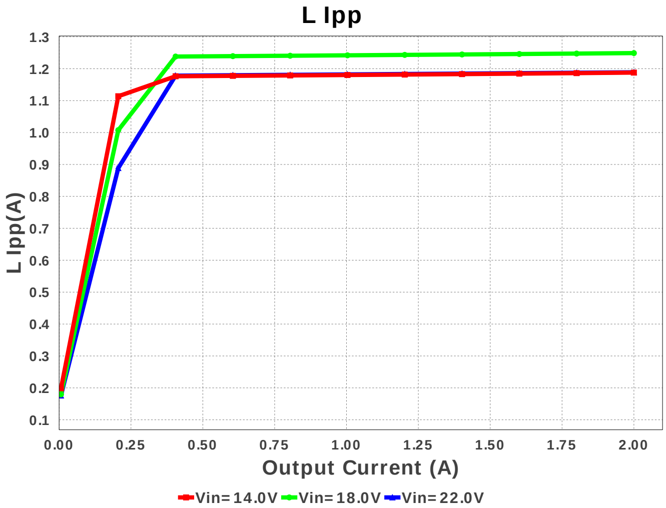
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
9.	Cvin	Kemet	C0805C104K5RACTU Series= X7R	Cap= 100.0 nF ESR= 64.0 mOhm VDC= 50.0 V IRMS= 1.64 A	1	$0.01	0805 7 mm^2
10.	L1	Coilcraft	MSS1210-153MEB	L= 15.0 µH DCR= 19.0 mOhm	1	$0.81	MSS1210 204 mm^2
11.	M1	Texas Instruments	CSD19537Q3	VdsMax= 100.0 V IdsMax= 50.0 Amps	1	$0.50	DQG0008A 18 mm^2
12.	M2	Texas Instruments	CSD18537NQ5A	VdsMax= 60.0 V IdsMax= 50.0 Amps	1	$0.31	TRANS_NexFET_Q5A 55 mm^2
13.	R13	Vishay-Dale	CRCW040210R0FKED Series= CRCW..e3	Res= 10.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
14.	R14	Vishay-Dale	CRCW040210R0FKED Series= CRCW..e3	Res= 10.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
15.	Rcomp	Vishay-Dale	CRCW04023K83FKED Series= CRCW..e3	Res= 3.83 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
16.	Rfbb	Vishay-Dale	CRCW040211K0FKED Series= CRCW..e3	Res= 11.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
17.	Rfbt	Vishay-Dale	CRCW0402316KFKED Series= CRCW..e3	Res= 316.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
18.	Rpg	Vishay-Dale	CRCW0402100KFKED Series= CRCW..e3	Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
19.	Rsns1	Susumu Co Ltd	PRL1632-R015-F-T1 Series= PRL1632	Res= 15.0 mOhm Power= 1.0 W Tolerance= 1.0%	1	$0.19	0612 11 mm^2
20.	Rsns2	Susumu Co Ltd	PRL1632-R015-F-T1 Series= PRL1632	Res= 15.0 mOhm Power= 1.0 W Tolerance= 1.0%	1	$0.19	0612 11 mm^2
21.	Rt	Vishay-Dale	CRCW0402118KFKED Series= CRCW..e3	Res= 118.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
22.	U1	Texas Instruments	TPS43061RTER	Switcher	1	$1.25	S-PVQFN-N16 17 mm^2

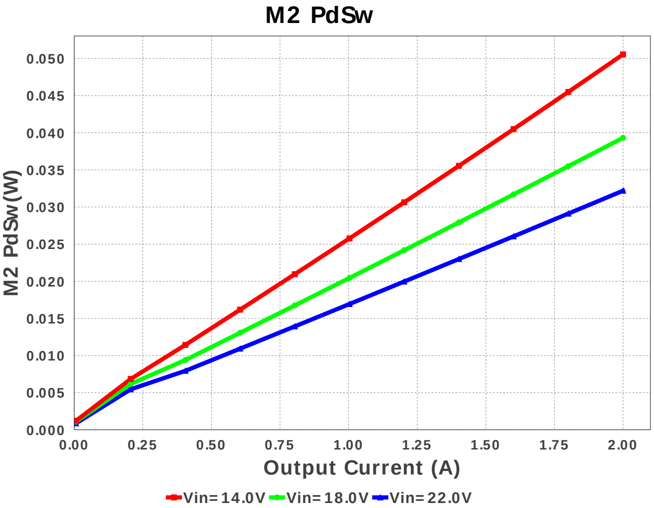

M2 PdQrr
M2 PdQrr(W)
0.95
0.90
0.85
0.80
0.75
0.70
0.65
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0.00 0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00
Output Current (A)
Vin=14.0V Vin=18.0V Vin=22.0V

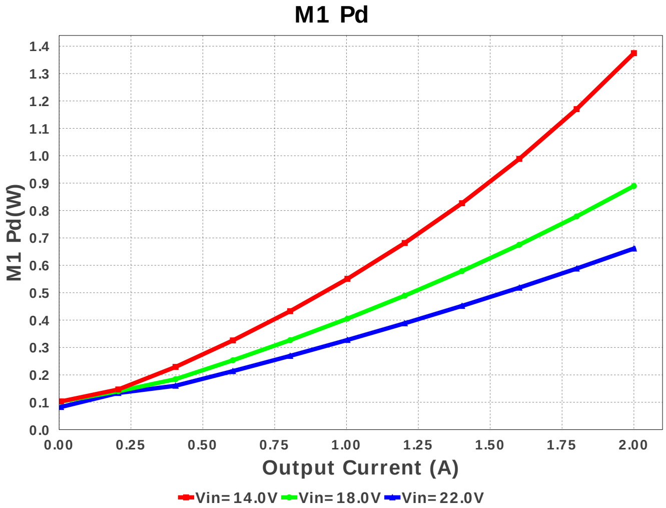

M1 PdQrr
M1 PdQrr(W)
0.000000005
0.000000004
0.000000003
0.000000002
0.000000001
0.000000000
-0.000000001
-0.000000002
-0.000000003
-0.000000004
-0.000000005
0.00 0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00
Output Current (A)
Vin=14.0V Vin=18.0V Vin=22.0V

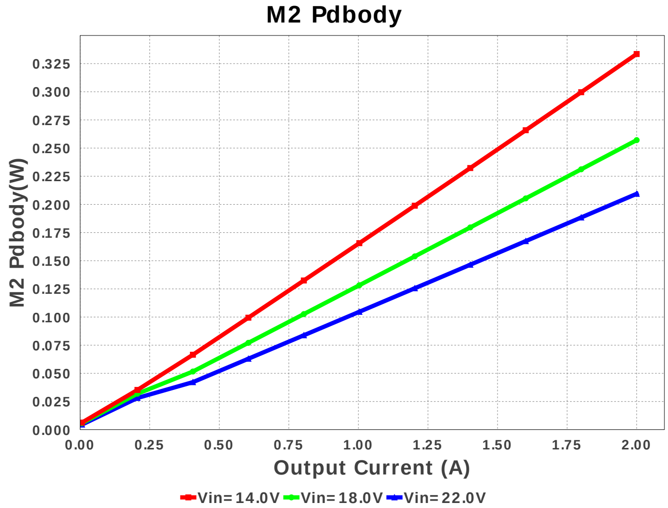

Cin Pd
Cin Pd(W)
0.00050
0.00045
0.00040
0.00035
0.00030
0.00025
0.00020
0.00015
0.00010
0.00005
0.00000
0.00 0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00
Output Current (A)
Vin=14.0V Vin=18.0V Vin=22.0V

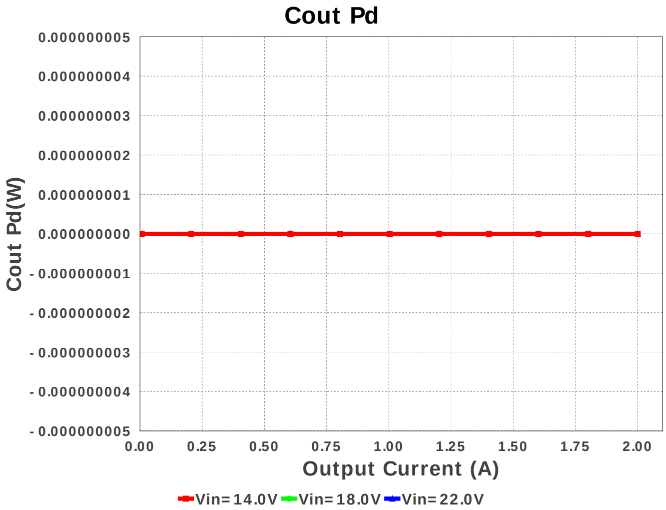

M1 ThetaJA
M1 ThetaJA(degC/W)
55.000000004
55.000000003
55.000000002
55.000000001
55.000000000
54.999999999
54.999999998
54.999999997
54.999999996
54.999999995
0.00 0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00
Output Current (A)
Vin=14.0V Vin=18.0V Vin=22.0V

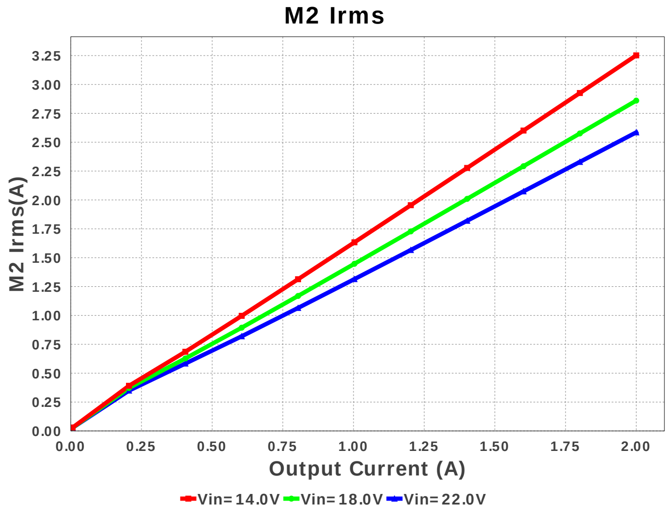

L Ipp
L Ipp(A)
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.00 0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00
Output Current (A)
Vin=14.0V Vin=18.0V Vin=22.0V

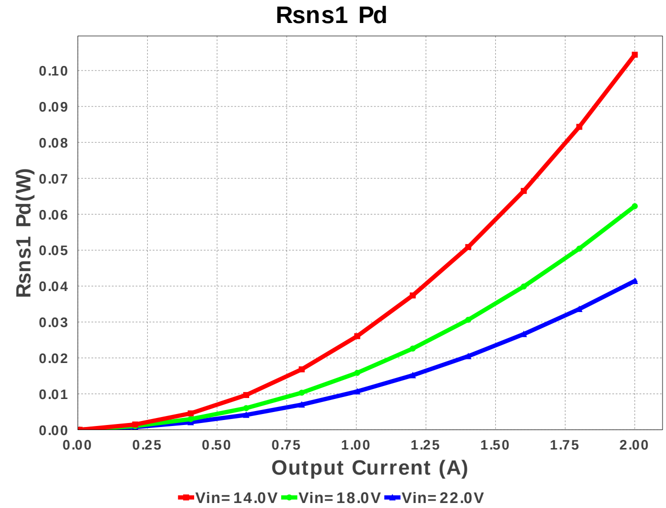

M2 PdSw
M2 PdSw(W)
0.050
0.045
0.040
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
0.00 0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00
Output Current (A)
Vin=14.0V Vin=18.0V Vin=22.0V

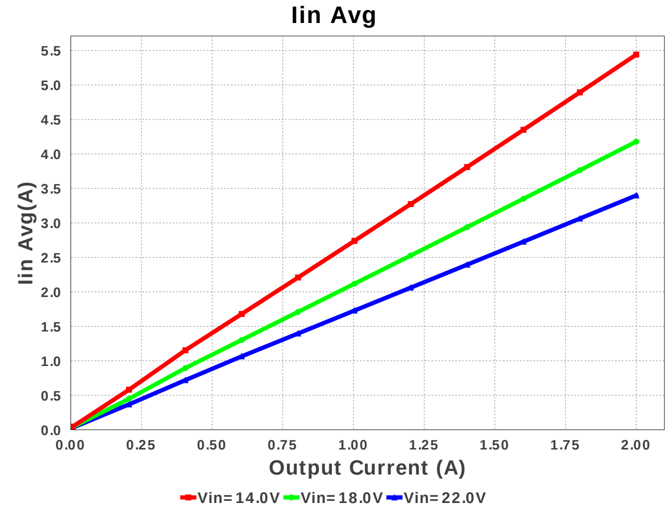

M1 Pd
M1 Pd(W)
Output Current (A)
Vin=14.0V Vin=18.0V Vin=22.0V


M2 Pdbody
M2 Pdbody(W)
Output Current (A)
Vin=14.0V Vin=18.0V Vin=22.0V

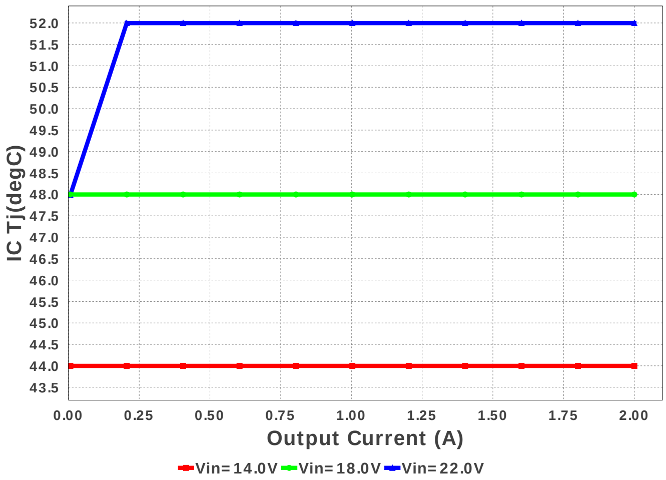

Cout Pd
Cout Pd(W)
Output Current (A)
Vin=14.0V Vin=18.0V Vin=22.0V


M2 Irms
M2 Irms(A)
Output Current (A)
Vin=14.0V Vin=18.0V Vin=22.0V

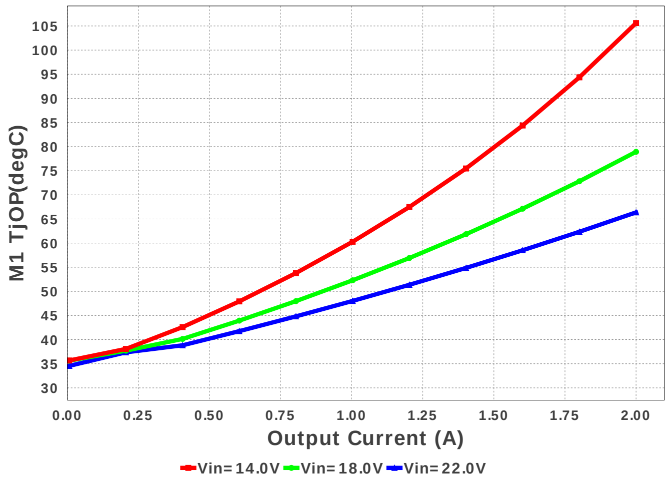

Rsns1 Pd
Rsns1 Pd(W)
Output Current (A)
Vin=14.0V Vin=18.0V Vin=22.0V


Iin Avg
Iin Avg(A)
Output Current (A)
Vin=14.0V Vin=18.0V Vin=22.0V

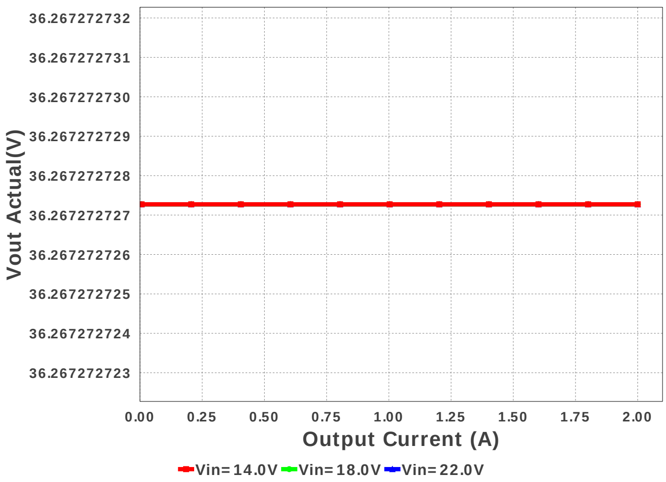
IC Tj



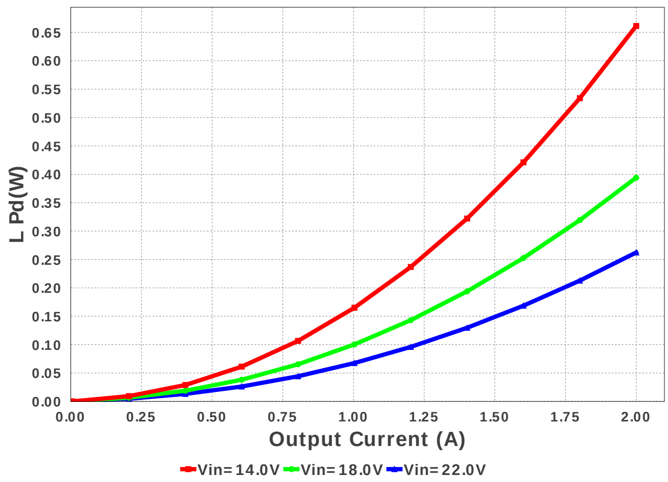
M1 TjOP



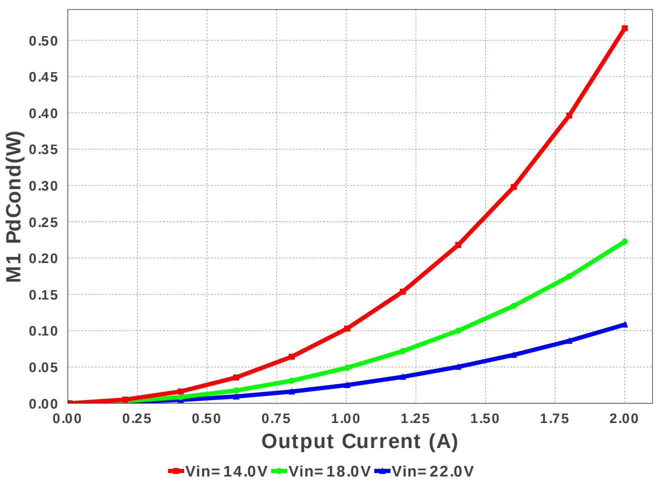
Vout Actual



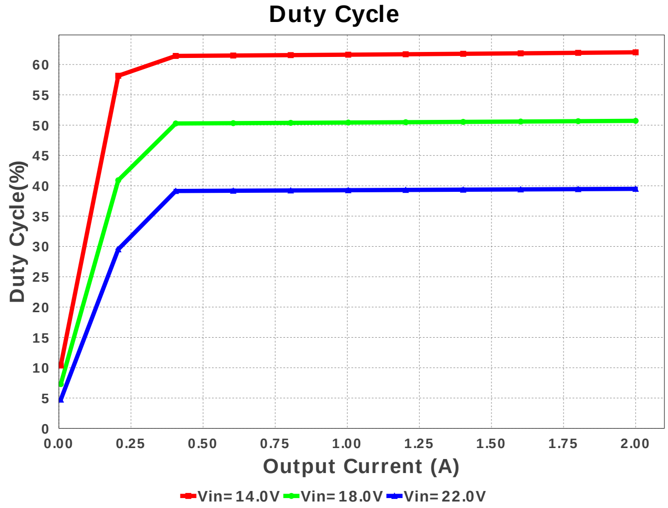
L Pd

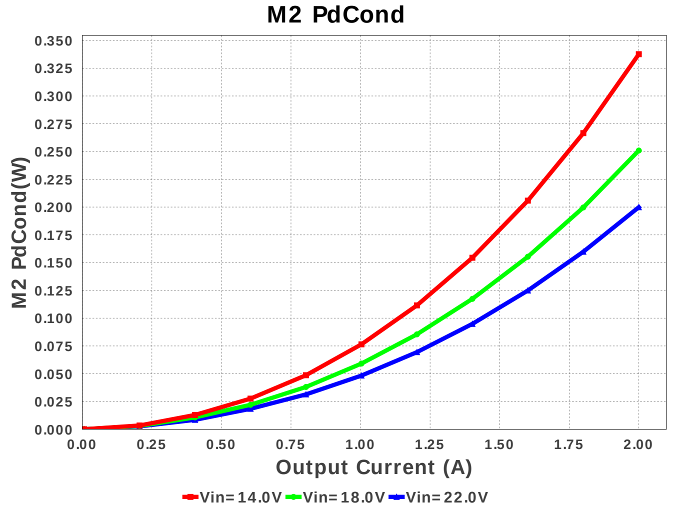


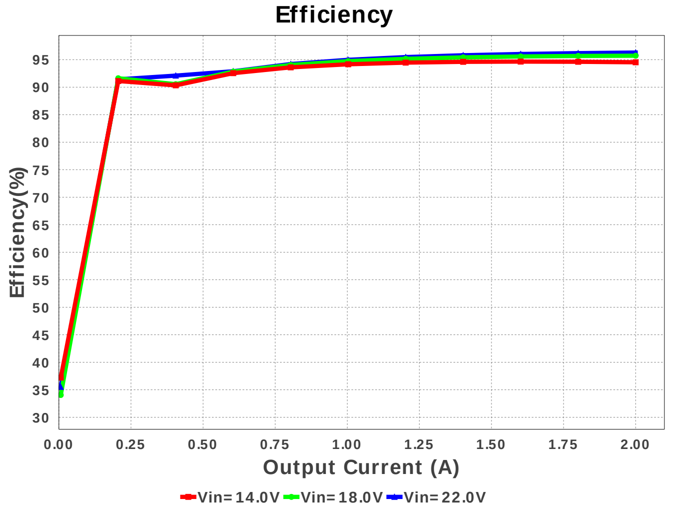
M1 PdCond

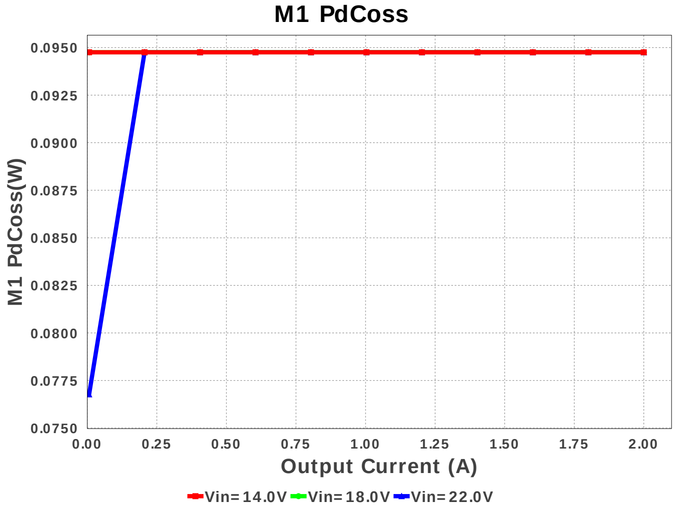


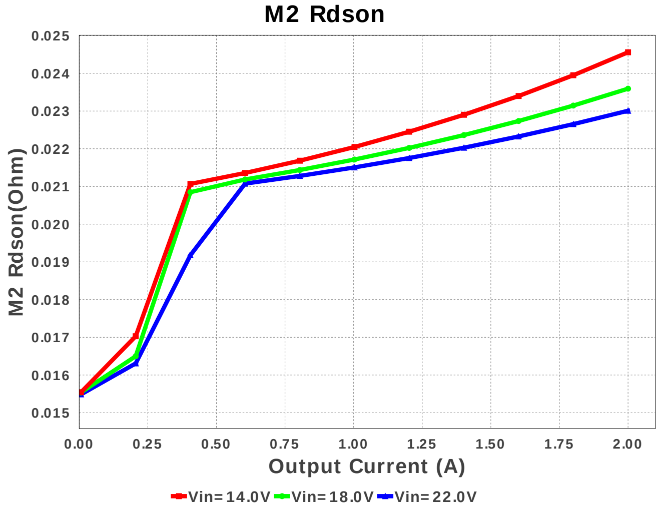
Duty Cycle

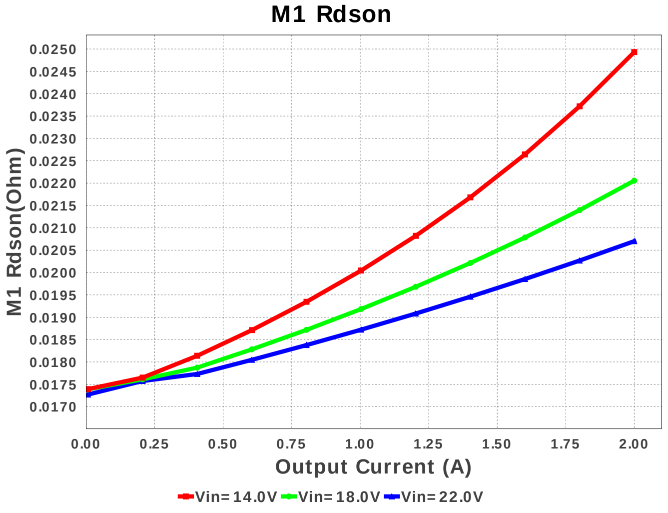


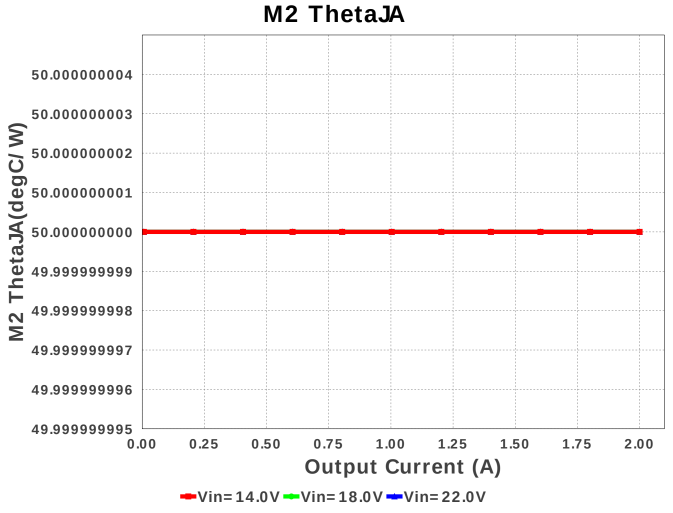

M2 PdCond
M2 PdCond(W)
Output Current (A)
Vin=14.0V Vin=18.0V Vin=22.0V

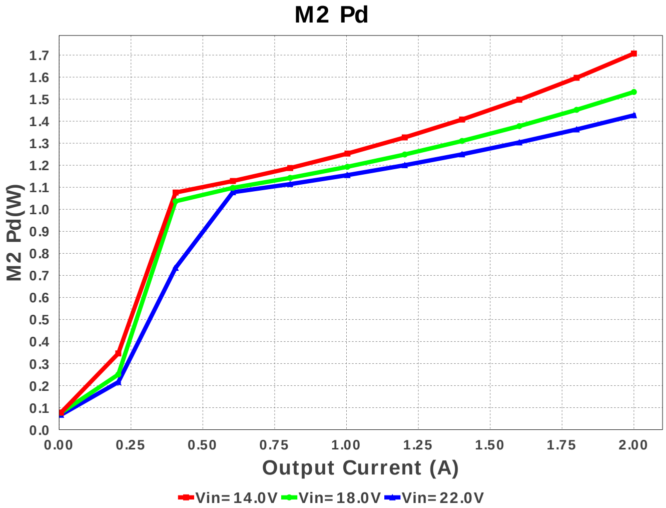

Efficiency
Efficiency(%)
Output Current (A)
Vin=14.0V Vin=18.0V Vin=22.0V

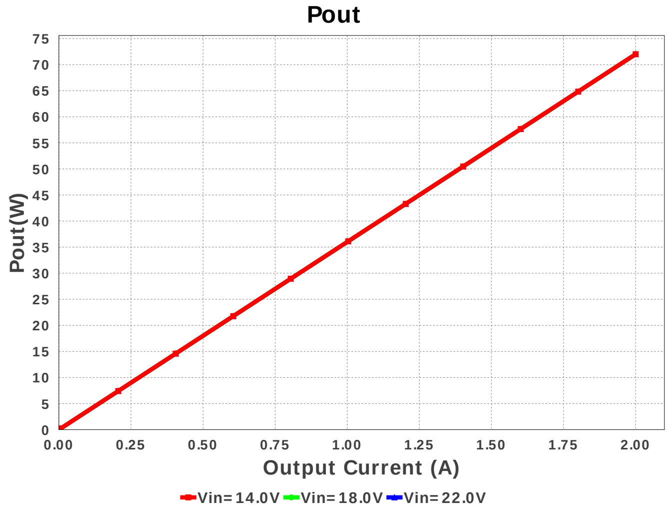

M1 PdCoss
M1 PdCoss(W)
Output Current (A)
Vin=14.0V Vin=18.0V Vin=22.0V

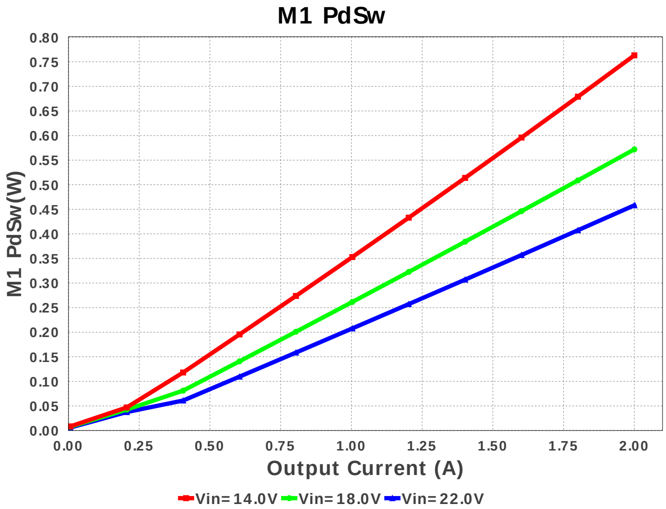

M2 Rdson
M2 Rdson(Ohm)
Output Current (A)
Vin=14.0V Vin=18.0V Vin=22.0V

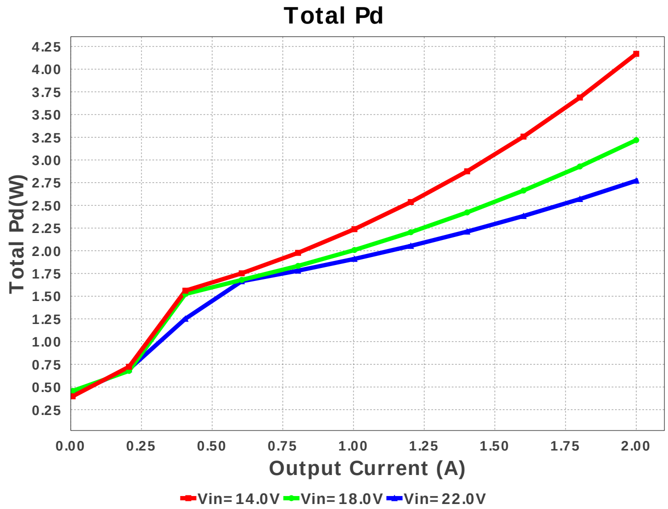

M1 Rdson
M1 Rdson(Ohm)
Output Current (A)
Vin=14.0V Vin=18.0V Vin=22.0V

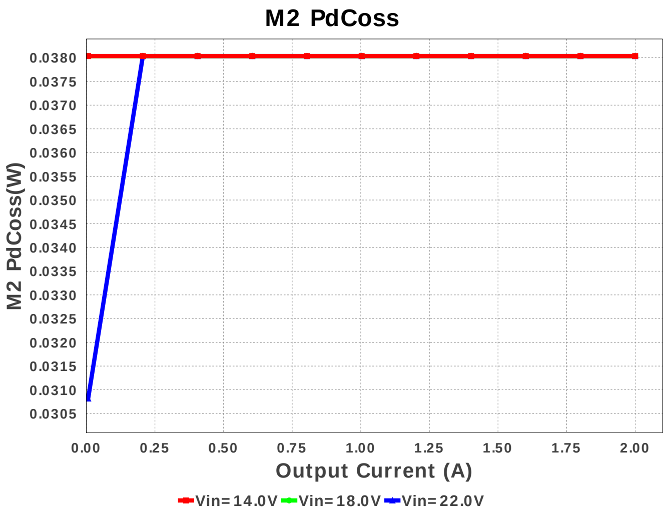

M2 ThetaJA
M2 ThetaJA(degC/W)
Output Current (A)
Vin=14.0V Vin=18.0V Vin=22.0V

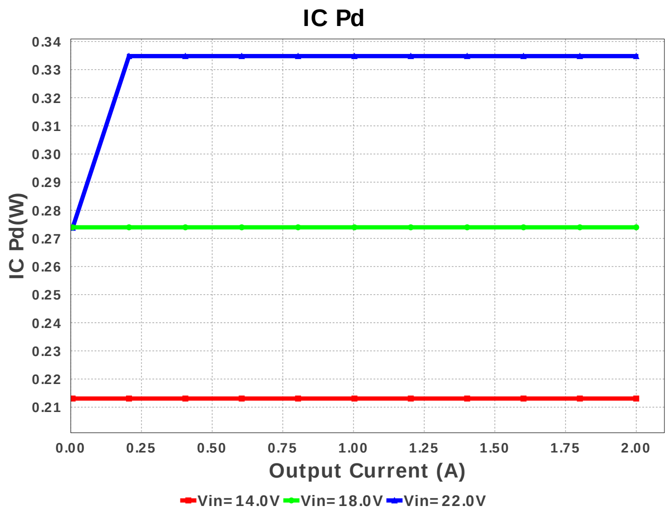

M2 Pd
M2 Pd(W)
Output Current (A)
Vin=14.0V Vin=18.0V Vin=22.0V

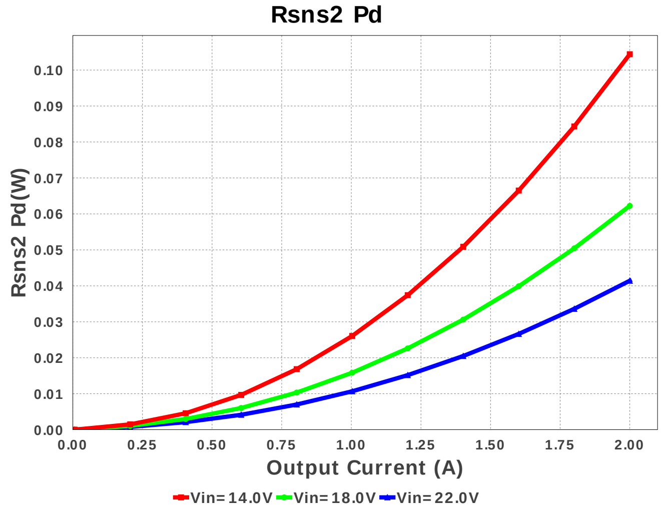

Pout
Pout(W)
Output Current (A)
Vin=14.0V Vin=18.0V Vin=22.0V

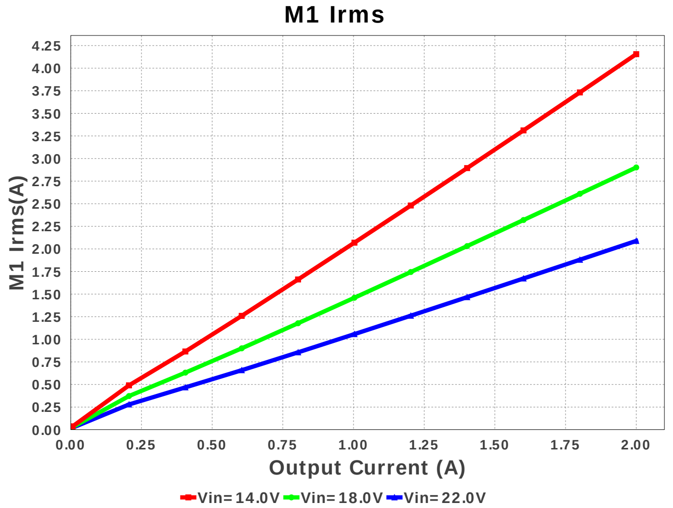

M1 PdSw
M1 PdSw(W)
Output Current (A)
Vin=14.0V Vin=18.0V Vin=22.0V

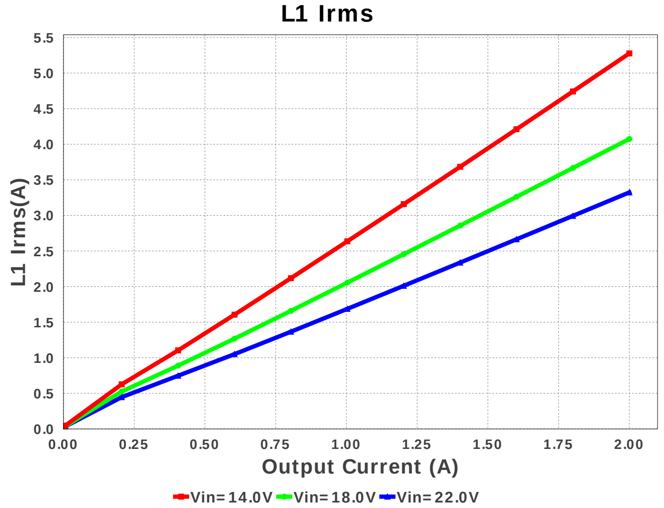

Total Pd
Total Pd(W)
Output Current (A)
Vin=14.0V Vin=18.0V Vin=22.0V

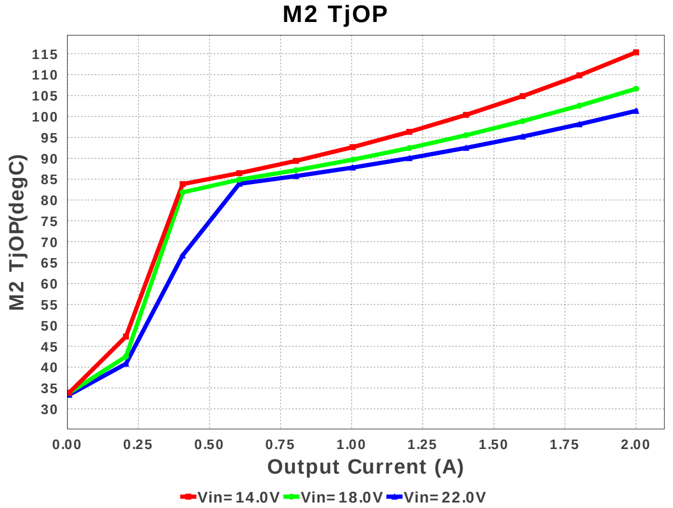

M2 PdCoss
M2 PdCoss(W)
Output Current (A)
Vin=14.0V Vin=18.0V Vin=22.0V

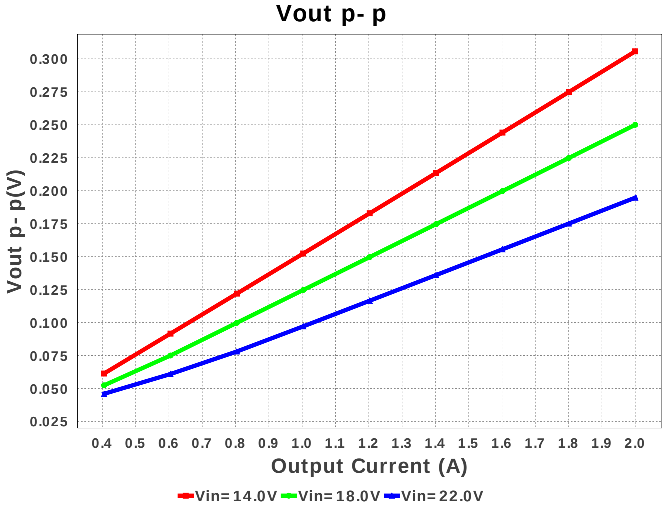

IC Pd
IC Pd(W)
Output Current (A)
Vin=14.0V Vin=18.0V Vin=22.0V

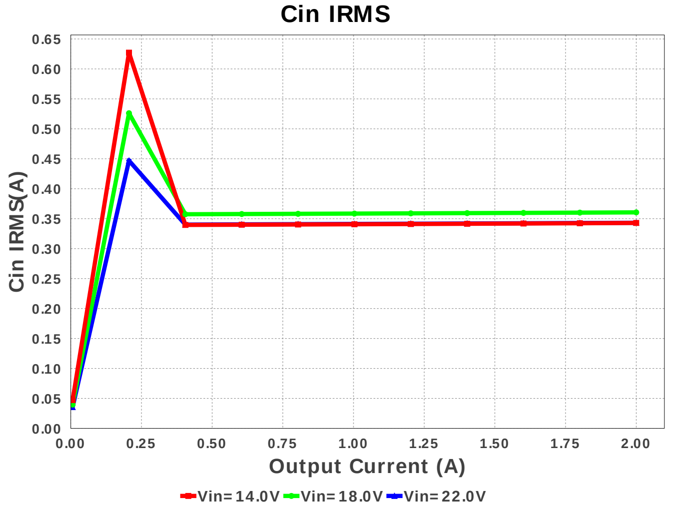

Rsns2 Pd
Rsns2 Pd(W)
Output Current (A)
Vin=14.0V Vin=18.0V Vin=22.0V

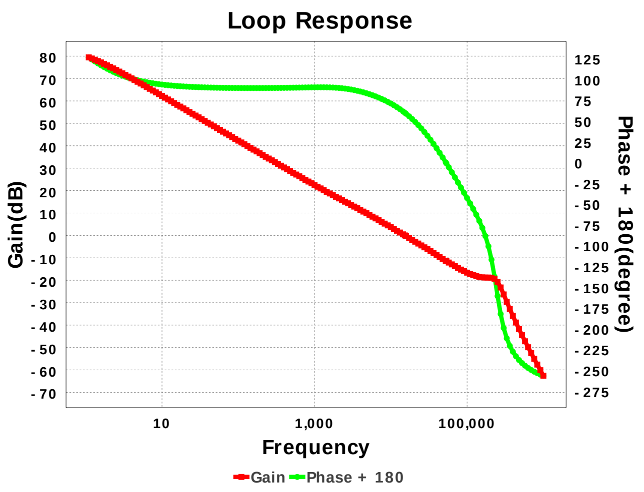

M1 Irms
M1 Irms(A)
Output Current (A)
Vin=14.0V Vin=18.0V Vin=22.0V


L1 Irms
L1 Irms(A)
Output Current (A)
Vin=14.0V Vin=18.0V Vin=22.0V


M2 TjOP
M2 TjOP(degC)
Output Current (A)
Vin=14.0V Vin=18.0V Vin=22.0V


Vout p-p
Vout p-p(V)
Output Current (A)
Vin=14.0V Vin=18.0V Vin=22.0V


Cin IRMS
Cin IRMS(A)
Output Current (A)
Vin=14.0V Vin=18.0V Vin=22.0V



Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	342.9 mA	Current	Input capacitor RMS ripple current
2.	Iin Avg	5.446 A	Current	Average input current
3.	L Ipp	1.188 A	Current	Peak-to-peak inductor ripple current
4.	L1 Irms	5.277 A	Current	Inductor ripple current
5.	M1 Irms	4.155 A	Current	MOSFET RMS ripple current
6.	M2 Irms	3.252 A	Current	MOSFET RMS ripple current
7.	BOM Count	23	General	Total Design BOM count
8.	FootPrint	415.0 mm^2	General	Total Foot Print Area of BOM components
9.	Frequency	487.288 kHz	General	Switching frequency
10.	M1 Rdson	24.932 mOhm	General	Drain-Source On-resistance
11.	M1 ThetaJA	55.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
12.	M2 Rdson	24.997 mOhm	General	Drain-Source On-resistance
13.	M2 ThetaJA	50.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
14.	Mode	CCM	General	Conduction Mode
15.	Pout	72.0 W	General	Total output power
16.	Total BOM	$4.0	General	Total BOM Cost
17.	Low Freq Gain	76.839 dB	Op_Point	Gain at 10Hz
18.	Vout Actual	36.267 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
19.	Vout OP	36.0 V	Op_Point	Operational Output Voltage
20.	Cross Freq	10.073 kHz	Op_point	Bode plot crossover frequency
21.	Duty Cycle	62.017 %	Op_point	Duty cycle
22.	Efficiency	94.428 %	Op_point	Steady state efficiency
23.	Gain Marg	-8.698 dB	Op_point	Bode Plot Gain Margin
24.	IC Tj	43.998 degC	Op_point	IC junction temperature
25.	ICThetaJA	65.7 degC/W	Op_point	IC junction-to-ambient thermal resistance
26.	IOUT_OP	2.0 A	Op_point	Iout operating point
27.	M1 TjOP	105.604 degC	Op_point	M1 MOSFET junction temperature
28.	M2 TjOP	119.32 degC	Op_point	MOSFET junction temperature
29.	Phase Marg	58.216 deg	Op_point	Bode Plot Phase Margin
30.	VIN_OP	14.0 V	Op_point	Vin operating point
31.	Vout p-p	305.682 mV	Op_point	Peak-to-peak output ripple voltage
32.	Cin Pd	150.092 µW	Power	Input capacitor power dissipation
33.	Cout Pd	0.0 W	Power	Output capacitor power dissipation
34.	IC Pd	213.061 mW	Power	IC power dissipation
35.	L Pd	661.26 mW	Power	Inductor power dissipation
36.	M1 Pd	1.375 W	Power	MOSFET power dissipation
37.	M1 PdCond	516.59 mW	Power	M1 MOSFET conduction losses
38.	M1 PdCoss	94.753 mW	Power	M1 MOSFET Coss Losses
39.	M1 PdQrr	0.0 W	Power	M1 MOSFET switching losses
40.	M1 PdSw	763.27 mW	Power	M1 MOSFET switching losses
41.	M2 Pd	1.786 W	Power	MOSFET power dissipation
42.	M2 PdCond	343.665 mW	Power	M2 MOSFET conduction losses
43.	M2 PdCoss	38.034 mW	Power	M2 MOSFET Coss Losses
44.	M2 PdQrr	1.021 W	Power	Synchronous Boost High Side Reverse Recovery
45.	M2 PdSw	50.551 mW	Power	M2 MOSFET switching losses
46.	M2 Pdbody	333.553 mW	Power	Power dissipation through lower FET
47.	Rsns1 Pd	104.409 mW	Power	Rsns1 Power Dissipation
48.	Rsns2 Pd	104.409 mW	Power	Rsns2 Power Dissipation
49.	Total Pd	4.249 W	Power	Total Power Dissipation
50.	Vout Tolerance	4.041 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	2.0	Maximum Output Current
2.	VinMax	22.0	Maximum input voltage
3.	VinMin	14.0	Minimum input voltage
4.	Vout	36.0	Output Voltage
5.	base_pn	TPS43061	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	30.0	Ambient temperature

Design Assistance

1. Feature Highlights: Low Quiescent Current Boost Controller, Wide Vin Range 4.5V to 38V Vin, 58V Vout, 5.5V Gate Drive optimized for Low Qg NexFETs Thermal Shutdown

2. **TPS43061** Product Folder : http://www.ti.com/product/TPS43061 : contains the data sheet and other resources.