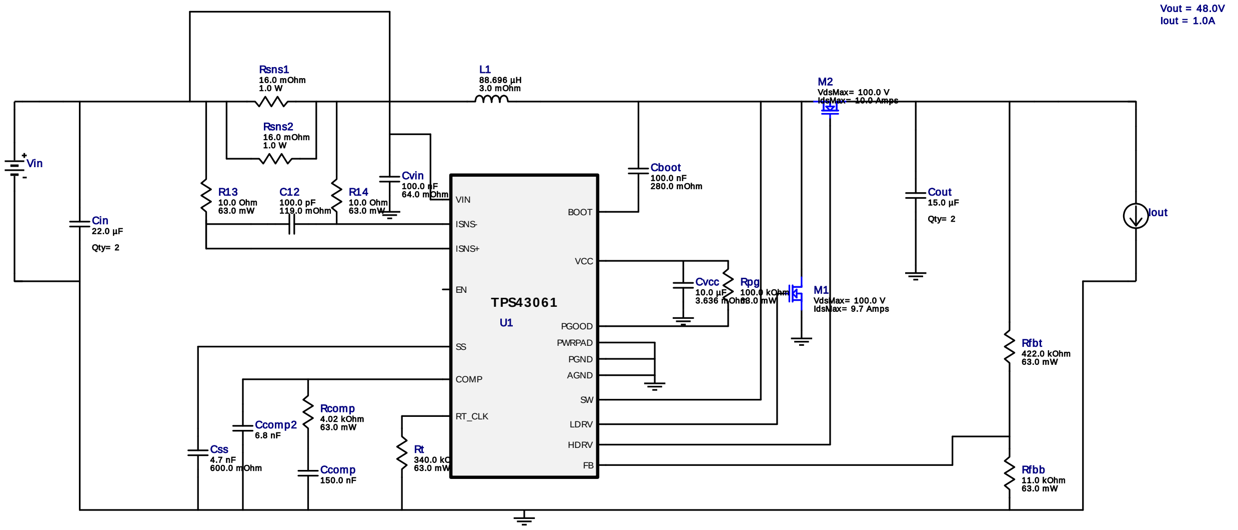
TEXAS INSTRUMENTS

WEBENCH ® Design Report

VinMin = 10.0V
VinMax = 25.0V
Vout = 48.0V
Iout = 1.0A

Device = TPS43061RTER
Topology = Boost
Created = 7/12/16 11:36:05 PM
BOM Cost = $0.00
BOM Count = 24
Total Pd = 3.34W

Design : 3893481/33 TPS43061RTER
TPS43061RTER 10.0V-25.0V to 48.00V @ 1.0A



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.

My Comments

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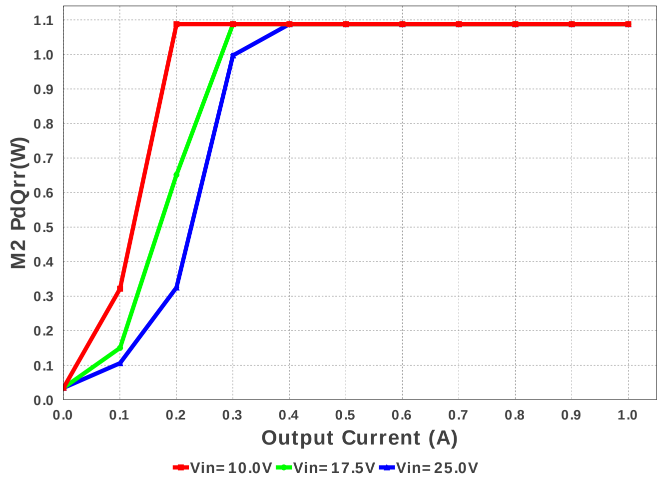
Electrical BOM

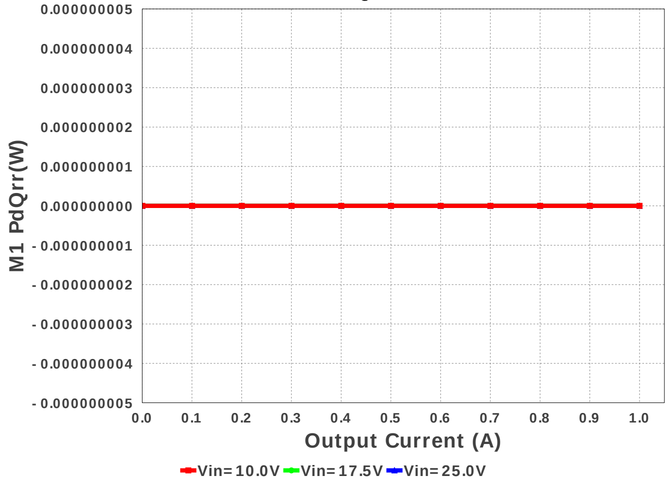
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	C12	AVX	06035A101JAT2A Series= C0G/NP0	Cap= 100.0 pF ESR= 119.0 mOhm VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0603 5 mm^2
2.	Cboot	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
3.	Ccomp	MuRata	GRM155R60J154KE01D Series= X5R	Cap= 150.0 nF VDC= 6.3 V IRMS= 0.0 A	1	$0.01	0402 3 mm^2
4.	Ccomp2	Yageo America	CC0805KRX7R9BB682 Series= X7R	Cap= 6.8 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
5.	Cin	MuRata	KCM55WR71J226MH01K Series= X7R	Cap= 22.0 uF VDC= 63.0 V IRMS= 0.0 A	2	$1.51	KCM55W 59 mm^2
6.	Cout	MuRata	KCM55WR72A156MH01K Series= X7R	Cap= 15.0 uF VDC= 100.0 V IRMS= 0.0 A	2	$1.51	KCM55W 59 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	CUSTOM	CUSTOM	L= 88.696 µH DCR= 3.0 mOhm	1	NA	CUSTOM 0 mm^2
11.	M1	Texas Instruments	CSD19537Q3	VdsMax= 100.0 V IdsMax= 9.7 Amps	1	$0.75	TRANS_NexFET_Q3 18 mm^2
12.	M2	Texas Instruments	CSD19534Q5A	VdsMax= 100.0 V IdsMax= 10.0 Amps	1	$0.68	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	CRCW04024K02FKED Series= CRCW..e3	Res= 4.02 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	CRCW0402422KFKED Series= CRCW..e3	Res= 422.0 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-R016-F-T1 Series= PRL1632	Res= 16.0 mOhm Power= 1.0 W Tolerance= 1.0%	1	$0.19	0612 11 mm^2
20.	Rsns2	Susumu Co Ltd	PRL1632-R016-F-T1 Series= PRL1632	Res= 16.0 mOhm Power= 1.0 W Tolerance= 1.0%	1	$0.19	0612 11 mm^2
21.	Rt	Vishay-Dale	CRCW0402340KFKED Series= CRCW..e3	Res= 340.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
22.	U1	Texas Instruments	TPS43061RTER	Switcher	1	$1.40	S-PVQFN-N16 17 mm^2

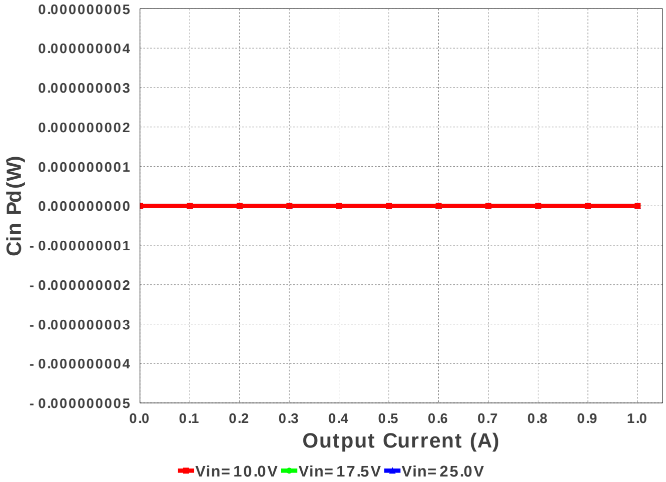
M2 PdQrr



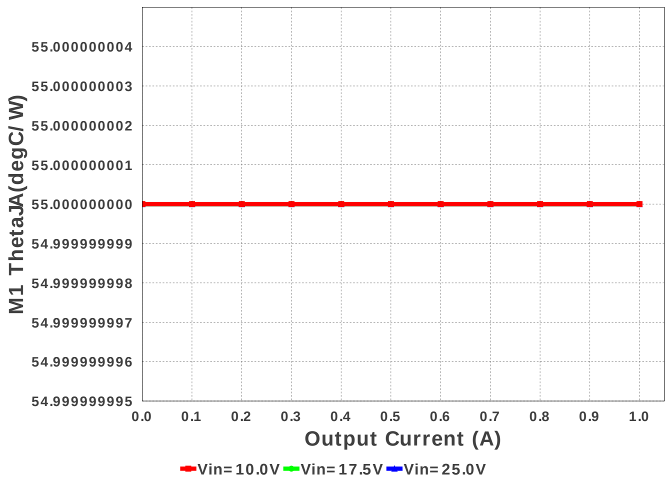
M1 PdQrr



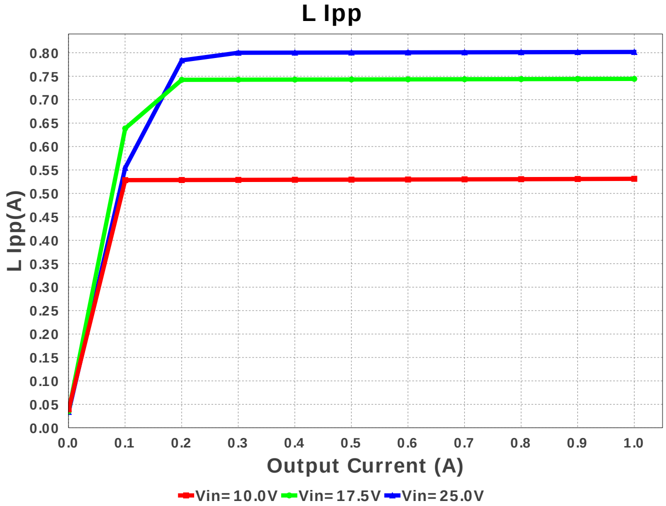
Cin Pd



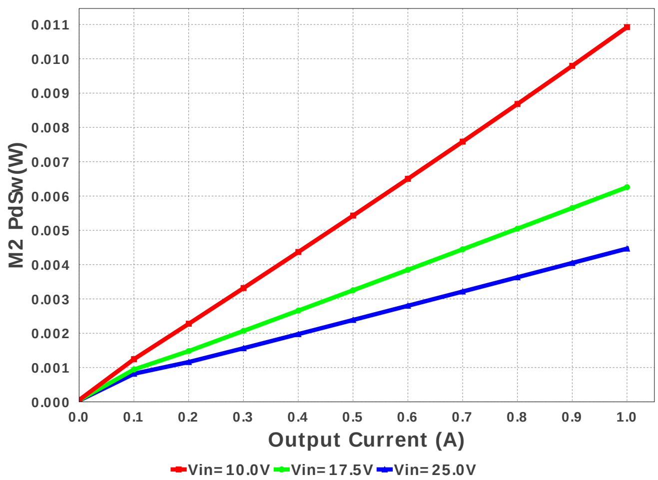
M1 ThetaJA

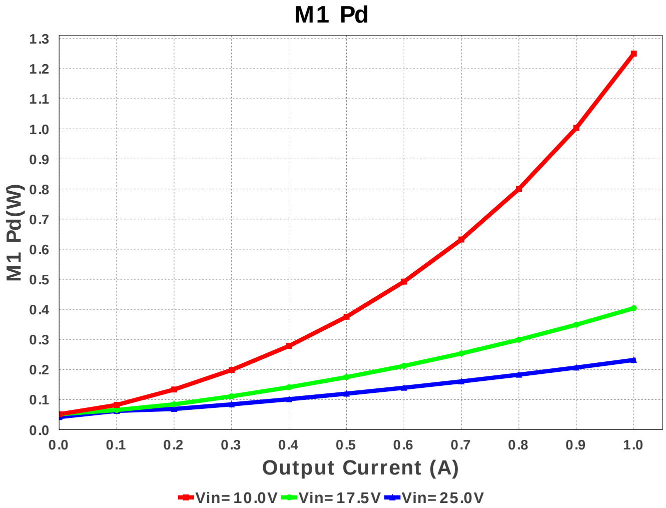


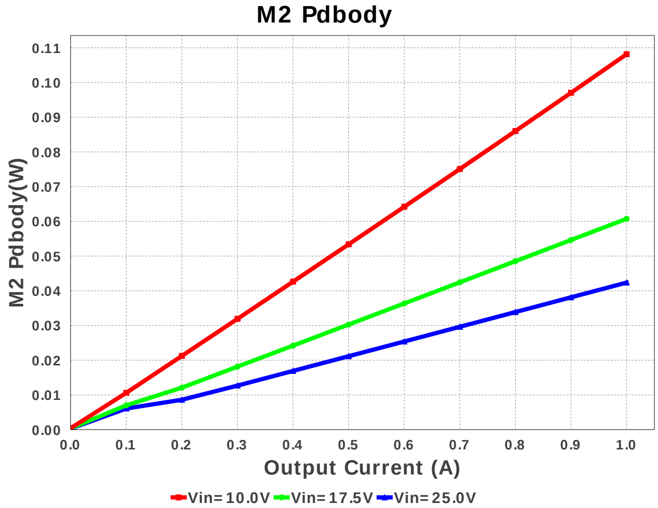
L Ipp

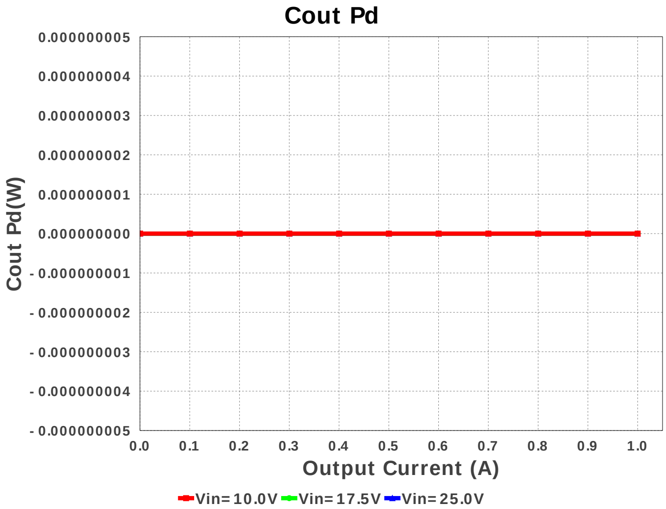


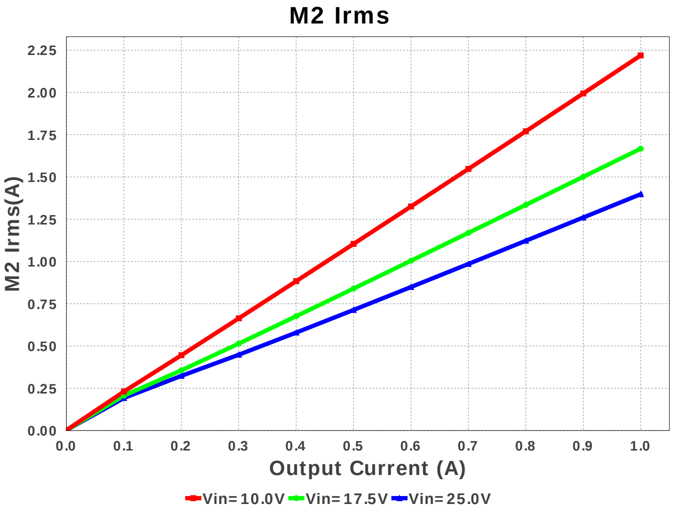
M2 PdSw

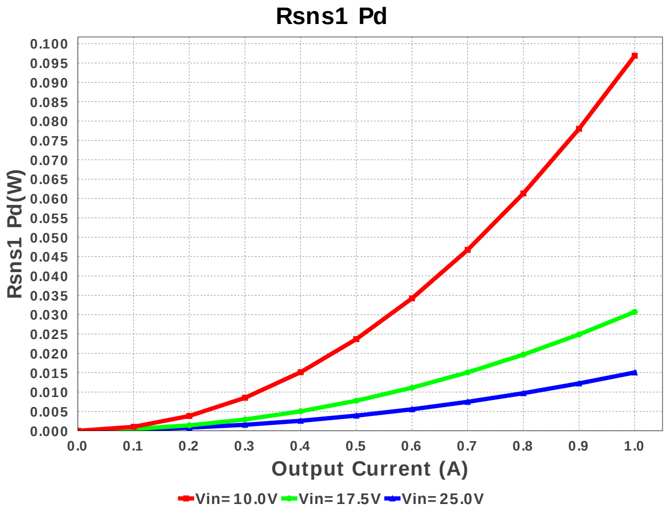


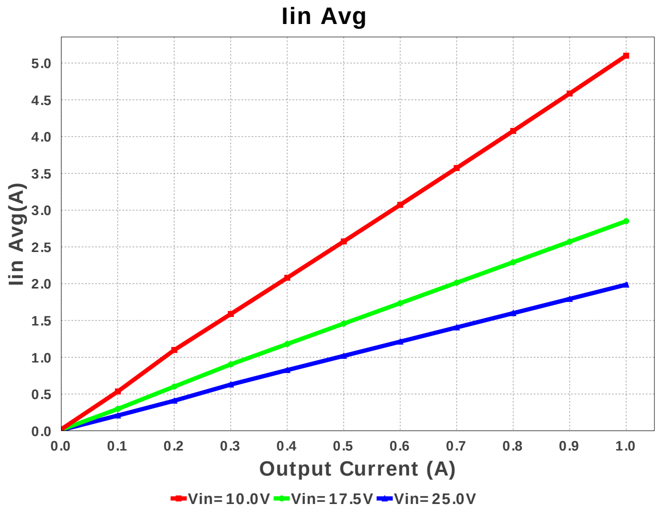

M1 Pd
M1 Pd(W)
1.3 1.2 1.1 1.0 0.9 0.8 0.7 0.6 0.5 0.4 0.3 0.2 0.1 0.0
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Output Current (A)
Vin=10.0V Vin=17.5V Vin=25.0V

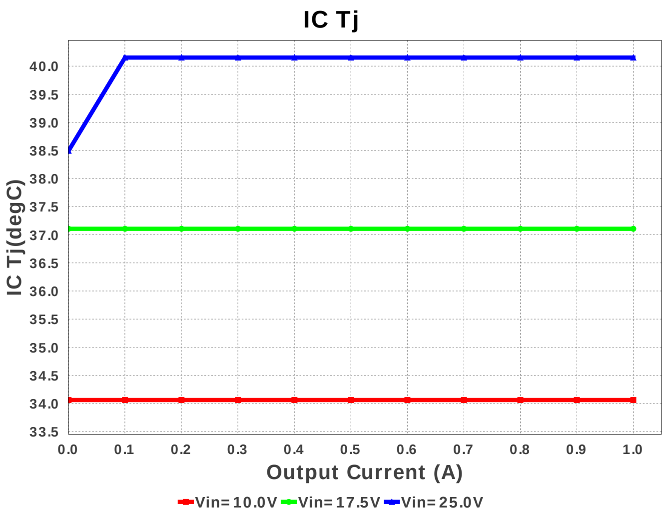

M2 Pdbody
M2 Pdbody(W)
0.11 0.10 0.09 0.08 0.07 0.06 0.05 0.04 0.03 0.02 0.01 0.00
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Output Current (A)
Vin=10.0V Vin=17.5V Vin=25.0V

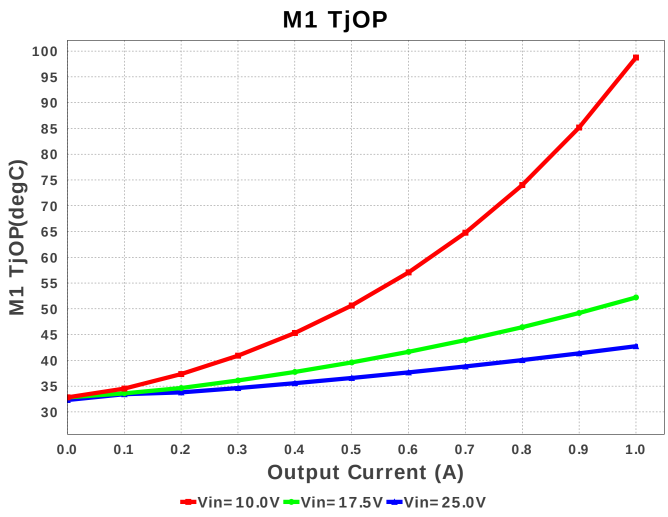

Cout Pd
Cout Pd(W)
0.000000005 0.000000004 0.000000003 0.000000002 0.000000001 0.000000000 -0.000000001 -0.000000002 -0.000000003 -0.000000004 -0.000000005
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Output Current (A)
Vin=10.0V Vin=17.5V Vin=25.0V

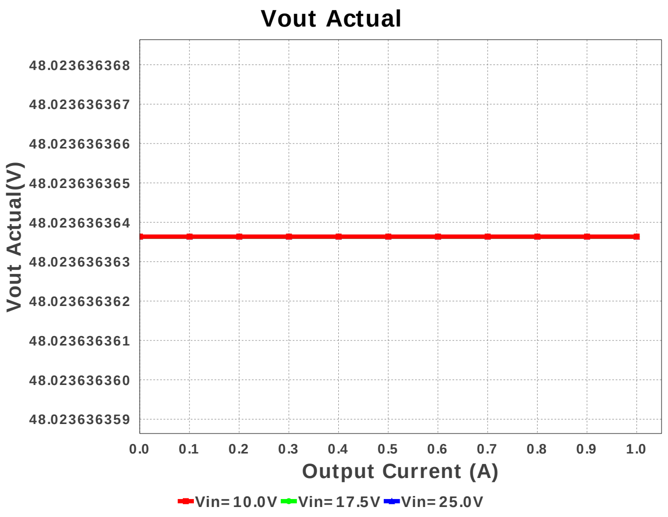

M2 Irms
M2 Irms(A)
2.25 2.00 1.75 1.50 1.25 1.00 0.75 0.50 0.25 0.00
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Output Current (A)
Vin=10.0V Vin=17.5V Vin=25.0V

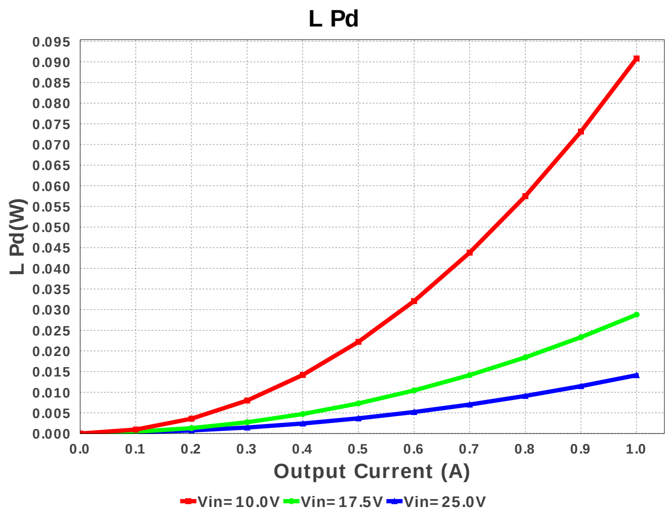

Rsns1 Pd
Rsns1 Pd(W)
0.100 0.095 0.090 0.085 0.080 0.075 0.070 0.065 0.060 0.055 0.050 0.045 0.040 0.035 0.030 0.025 0.020 0.015 0.010 0.005 0.000
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Output Current (A)
Vin=10.0V Vin=17.5V Vin=25.0V

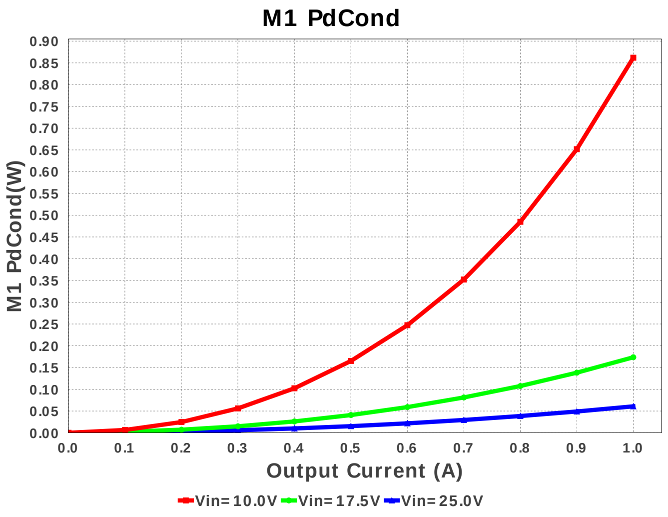

Iin Avg
Iin Avg(A)
5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Output Current (A)
Vin=10.0V Vin=17.5V Vin=25.0V

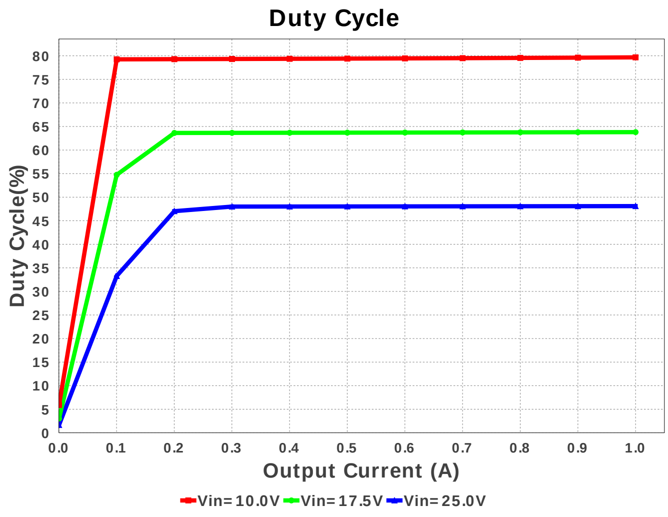

IC Tj
IC Tj(degC)
Output Current (A)
Vin=10.0V Vin=17.5V Vin=25.0V

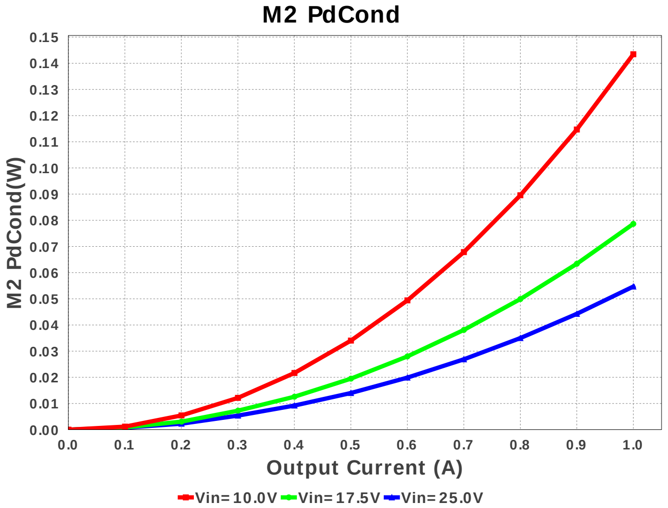

M1 TjOP
M1 TjOP(degC)
Output Current (A)
Vin=10.0V Vin=17.5V Vin=25.0V

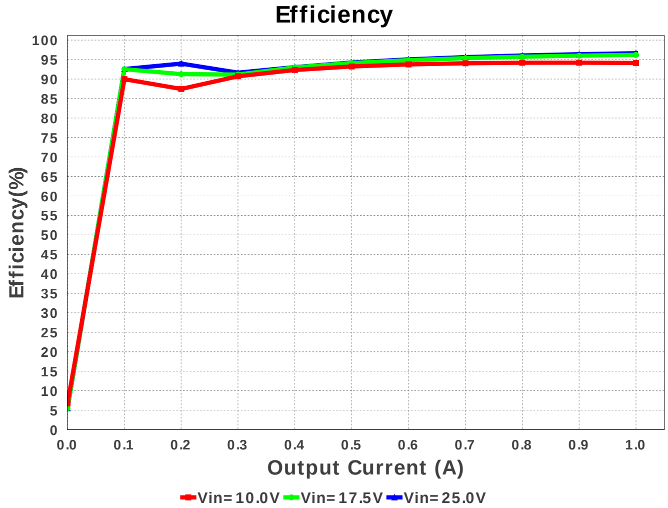

Vout Actual
Vout Actual(V)
Output Current (A)
Vin=10.0V Vin=17.5V Vin=25.0V

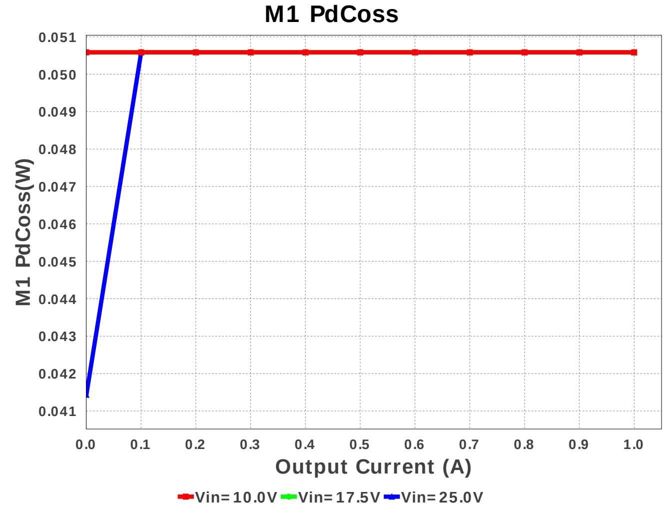

L Pd
L Pd(W)
Output Current (A)
Vin=10.0V Vin=17.5V Vin=25.0V

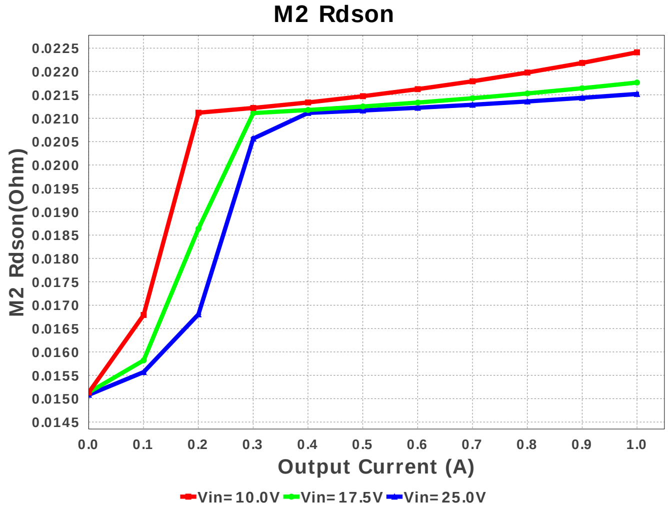

M1 PdCond
M1 PdCond(W)
Output Current (A)
Vin=10.0V Vin=17.5V Vin=25.0V

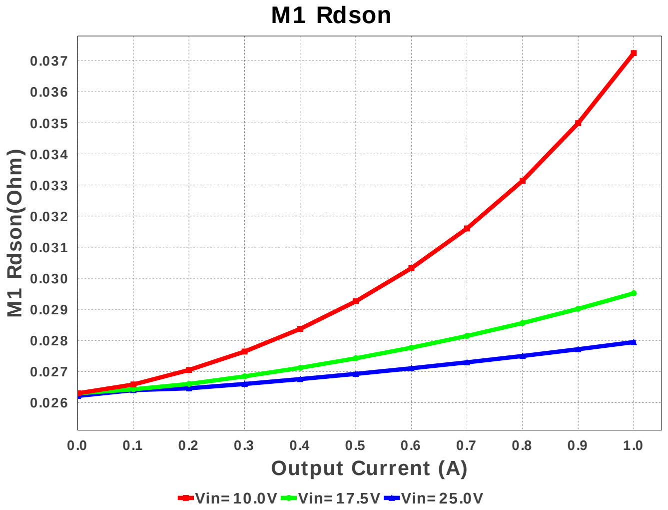

Duty Cycle
Duty Cycle(%)
Output Current (A)
Vin=10.0V Vin=17.5V Vin=25.0V

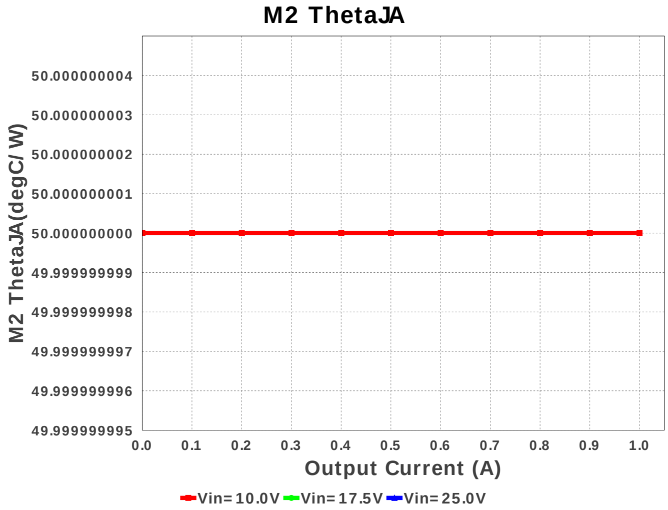

M2 PdCond
M2 PdCond(W)
Output Current (A)
Vin=10.0V Vin=17.5V Vin=25.0V


Efficiency
Efficiency(%)
Output Current (A)
Vin=10.0V Vin=17.5V Vin=25.0V

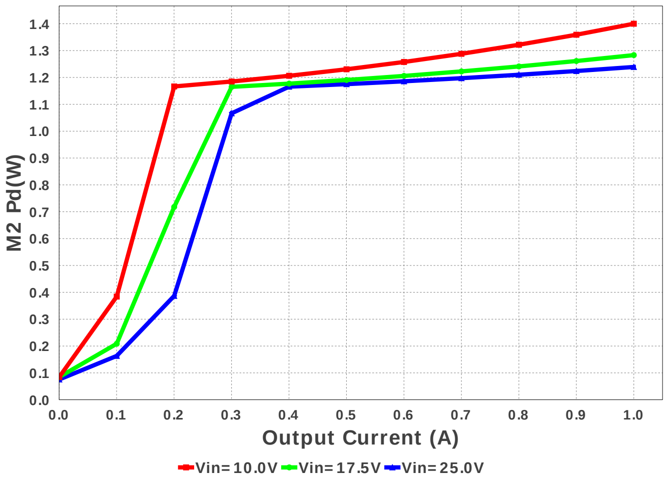

M1 PdCoss
M1 PdCoss(W)
Output Current (A)
Vin=10.0V Vin=17.5V Vin=25.0V


M2 Rdson
M2 Rdson(Ohm)
Output Current (A)
Vin=10.0V Vin=17.5V Vin=25.0V

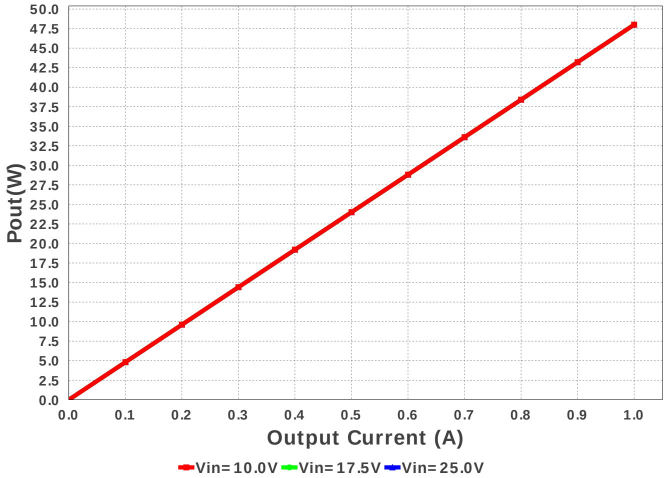

M1 Rdson
M1 Rdson(Ohm)
Output Current (A)
Vin=10.0V Vin=17.5V Vin=25.0V


M2 ThetaJA
M2 ThetaJA(degC/W)
Output Current (A)
Vin=10.0V Vin=17.5V Vin=25.0V

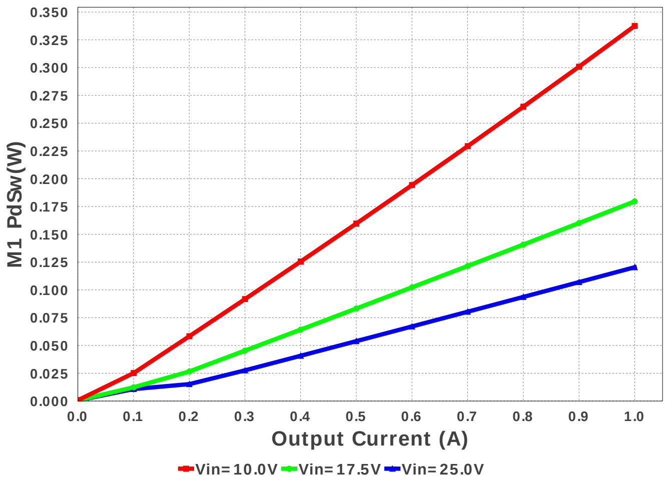
M2 Pd



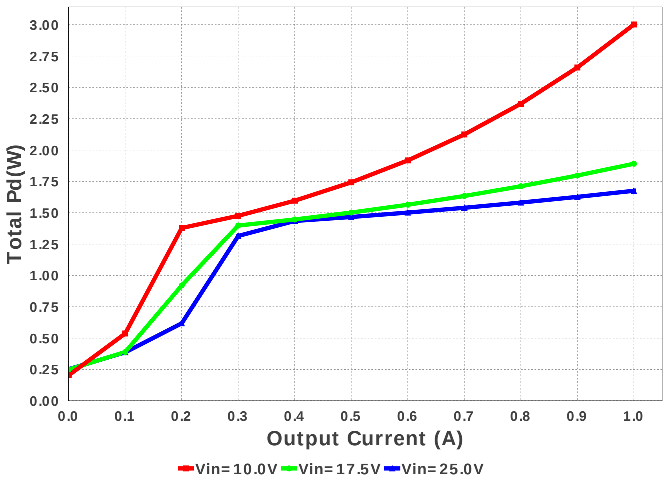
Pout



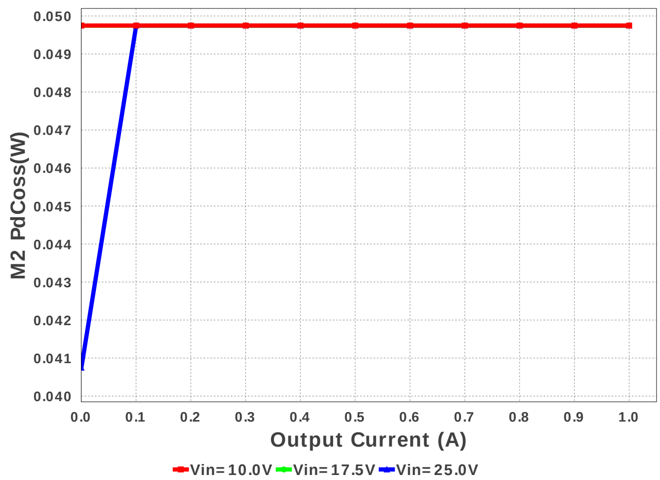
M1 PdSw



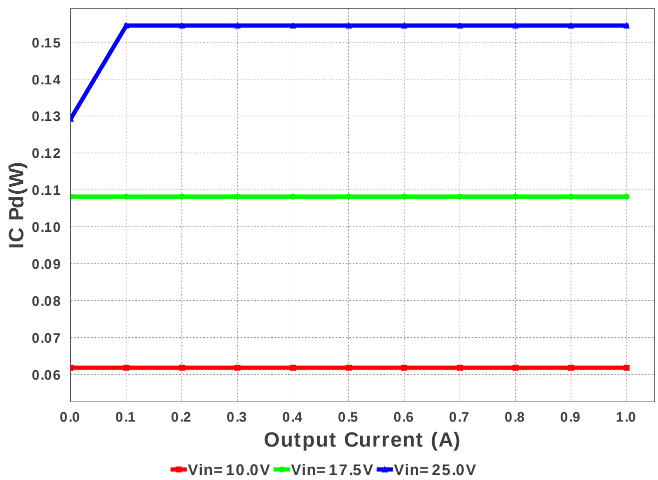
Total Pd

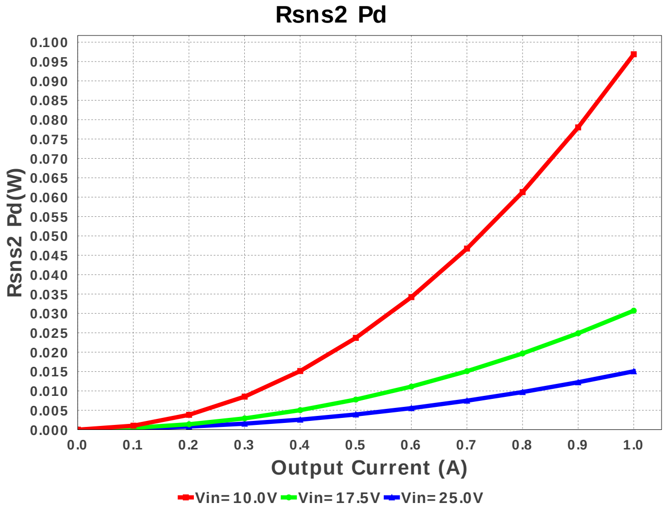


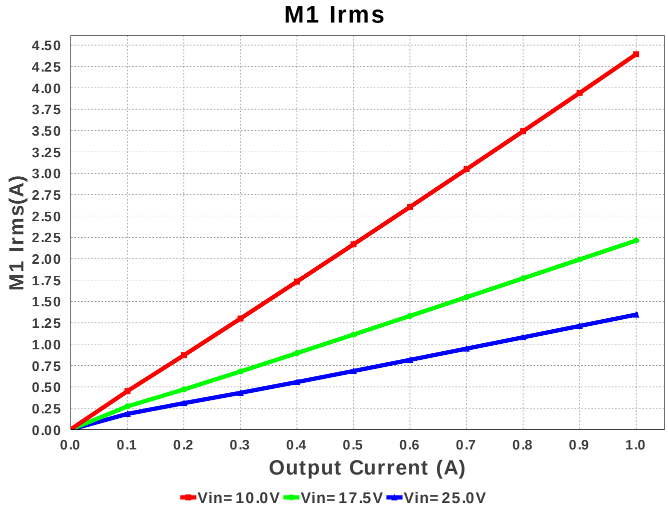
M2 PdCoss

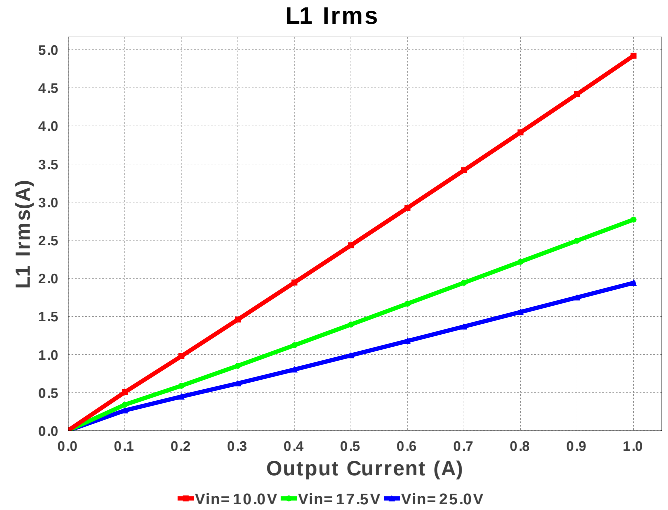


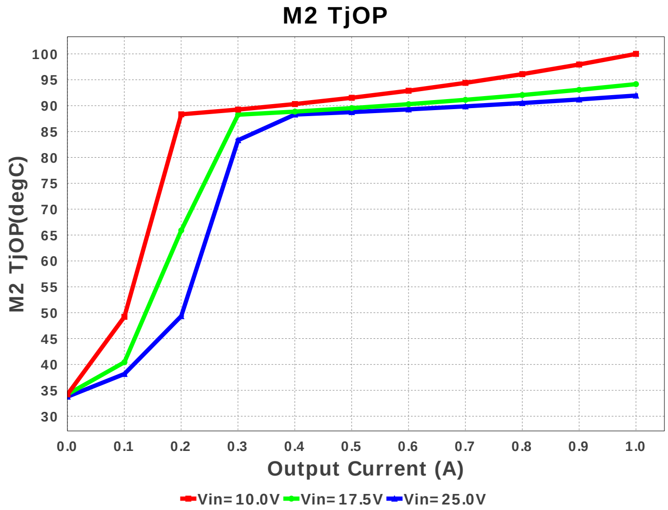
IC Pd

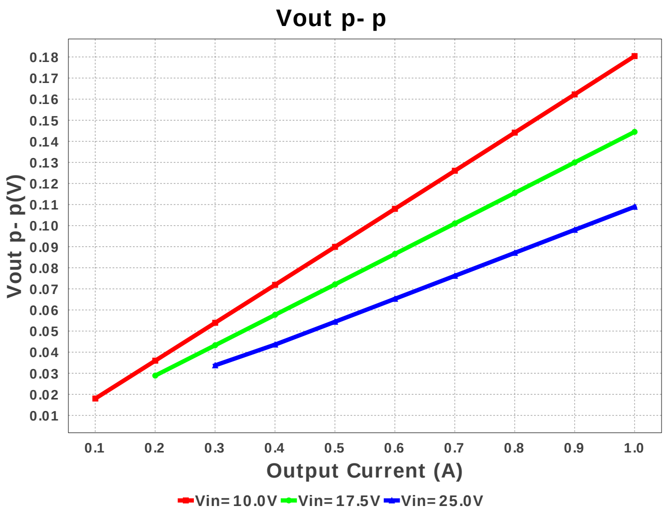


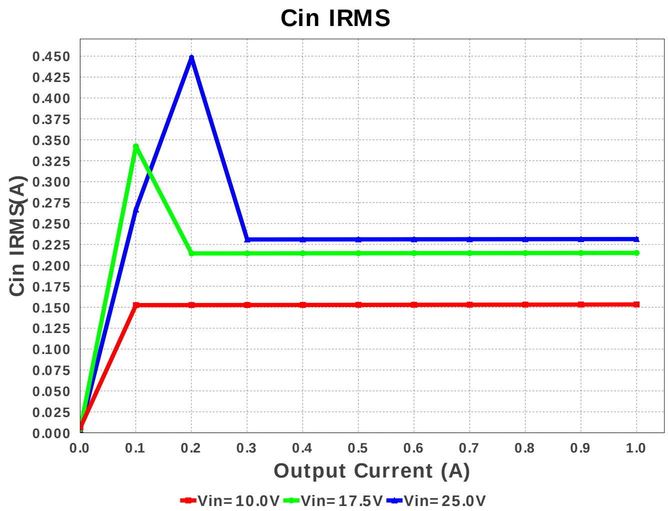

Rsns2 Pd
Rsns2 Pd(W)
Output Current (A)
Vin=10.0V
Vin=17.5V
Vin=25.0V

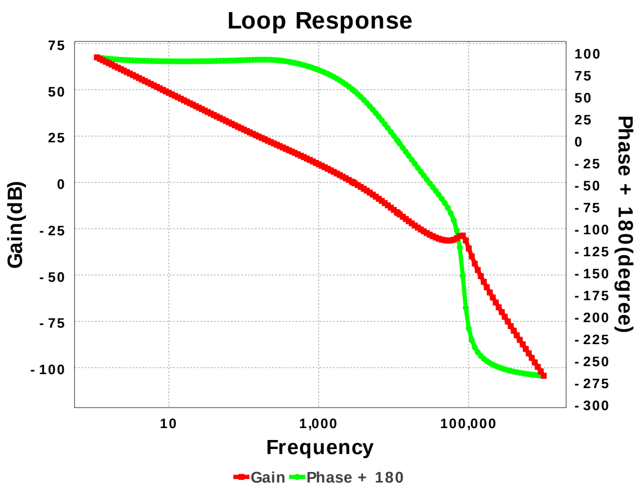

M1 Irms
M1 Irms(A)
Output Current (A)
Vin=10.0V
Vin=17.5V
Vin=25.0V


L1 Irms
L1 Irms(A)
Output Current (A)
Vin=10.0V
Vin=17.5V
Vin=25.0V


M2 TjOP
M2 TjOP(degC)
Output Current (A)
Vin=10.0V
Vin=17.5V
Vin=25.0V


Vout p- p
Vout p- p(V)
Output Current (A)
Vin=10.0V
Vin=17.5V
Vin=25.0V


Cin IRMS
Cin IRMS(A)
Output Current (A)
Vin=10.0V
Vin=17.5V
Vin=25.0V



Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	153.333 mA	Current	Input capacitor RMS ripple current
2.	Iin Avg	5.134 A	Current	Average input current
3.	L Ipp	531.16 mA	Current	Peak-to-peak inductor ripple current
4.	L1 Irms	4.922 A	Current	Inductor ripple current
5.	M1 Irms	4.394 A	Current	MOSFET RMS ripple current
6.	M2 Irms	2.219 A	Current	MOSFET RMS ripple current
7.	BOM Count	24	General	Total Design BOM count
8.	FootPrint	807.0 mm^2	General	Total Foot Print Area of BOM components
9.	Frequency	169.118 kHz	General	Switching frequency
10.	M1 Rdson	37.247 mOhm	General	Drain-Source On-resistance
11.	M1 ThetaJA	55.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
12.	M2 Rdson	24.287 mOhm	General	Drain-Source On-resistance
13.	M2 ThetaJA	50.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
14.	Pout	48.0 W	General	Total output power
15.	Total BOM	$0.0	General	Total BOM Cost
16.	Low Freq Gain	60.798 dB	Op_Point	Gain at 10Hz
17.	Vout Actual	48.024 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
18.	Vout OP	48.0 V	Op_Point	Operational Output Voltage
19.	Cross Freq	1.241 kHz	Op_point	Bode plot crossover frequency
20.	Duty Cycle	79.674 %	Op_point	Duty cycle
21.	Efficiency	93.491 %	Op_point	Steady state efficiency
22.	Gain Marg	-9.122 dB	Op_point	Bode Plot Gain Margin
23.	IC Tj	34.061 degC	Op_point	IC junction temperature
24.	ICThetaJA	65.7 degC/W	Op_point	IC junction-to-ambient thermal resistance
25.	IOUT_OP	1.0 A	Op_point	Iout operating point
26.	M1 TjOP	98.775 degC	Op_point	M1 MOSFET junction temperature
27.	M2 TjOP	116.968 degC	Op_point	MOSFET junction temperature
28.	Phase Marg	58.165 deg	Op_point	Bode Plot Phase Margin
29.	VIN_OP	10.0 V	Op_point	Vin operating point
30.	Vout p-p	180.417 mV	Op_point	Peak-to-peak output ripple voltage
31.	Cin Pd	0.0 W	Power	Input capacitor power dissipation
32.	Cout Pd	0.0 W	Power	Output capacitor power dissipation
33.	IC Pd	61.809 mW	Power	IC power dissipation
34.	L Pd	90.858 mW	Power	Inductor power dissipation
35.	M1 Pd	1.25 W	Power	MOSFET power dissipation
36.	M1 PdCond	862.294 mW	Power	M1 MOSFET conduction losses
37.	M1 PdCoss	50.585 mW	Power	M1 MOSFET Coss Losses
38.	M1 PdQrr	0.0 W	Power	M1 MOSFET switching losses
39.	M1 PdSw	337.581 mW	Power	M1 MOSFET switching losses
40.	M2 Pd	1.739 W	Power	MOSFET power dissipation
41.	M2 PdCond	155.487 mW	Power	M2 MOSFET conduction losses
42.	M2 PdCoss	49.748 mW	Power	M2 MOSFET Coss Losses
43.	M2 PdQrr	1.415 W	Power	Synchronous Boost High Side Reverse Recovery
44.	M2 PdSw	10.925 mW	Power	M2 MOSFET switching losses
45.	M2 Pdbody	108.165 mW	Power	Power dissipation through lower FET
46.	Rsns1 Pd	96.915 mW	Power	Rsns1 Power Dissipation
47.	Rsns2 Pd	96.915 mW	Power	Rsns2 Power Dissipation
48.	Total Pd	3.342 W	Power	Total Power Dissipation
49.	Vout Tolerance	4.058 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	1.0	Maximum Output Current
2.	VinMax	25.0	Maximum input voltage
3.	VinMin	10.0	Minimum input voltage
4.	Vout	48.0	Output Voltage
5.	base_pn	TPS43061	Texas Instruments Base Part 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.