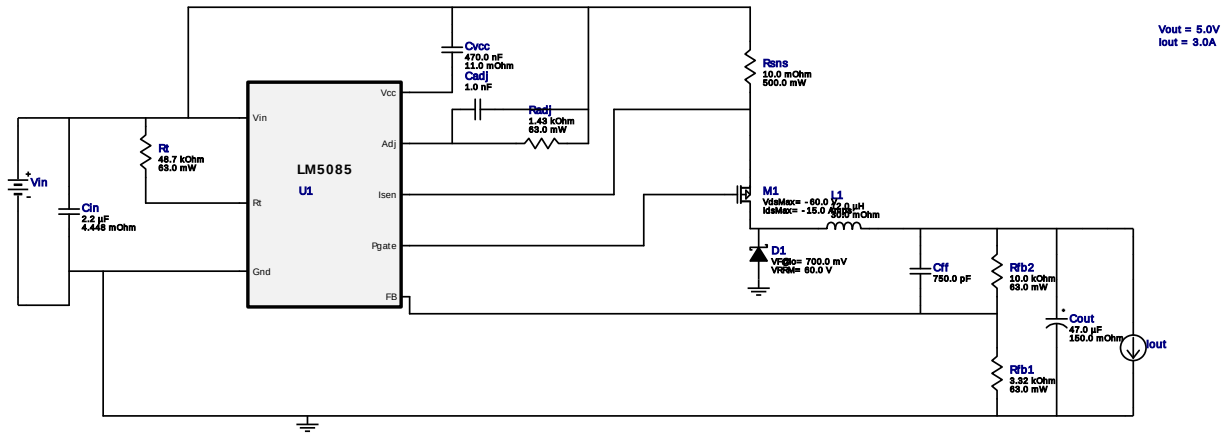
WEBENCH ® Design Report

VinMin = 18.0V
VinMax = 36.0V
Vout = 5.0V
Iout = 3.0A

Device = LM5085MY/NOPB
Topology = Buck
Created = 4/12/16 1:20:37 AM
BOM Cost = $2.36
BOM Count = 14
Total Pd = 2.32W

Design : 1542746/813 LM5085MY/NOPB
LM5085MY/NOPB 18.0V-36.0V to 5.00V @ 3.0A



Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cadj	Samsung Electro-Mechanics	CL21C102JBCNFNC Series= C0G/NP0	Cap= 1.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
2.	Cff	MuRata	GRM1555C1H751GA01D Series= C0G/NP0	Cap= 750.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.03	0402 3 mm²
3.	Cin	MuRata	GRM31CR71H225KA88L Series= X7R	Cap= 2.2 uF ESR= 4.448 mOhm VDC= 50.0 V IRMS= 2.2252 A	1	$0.08	1206_190 11 mm²
4.	Cout	Panasonic	6TPU47MSI Series= TPU	Cap= 47.0 uF ESR= 150.0 mOhm VDC= 6.3 V IRMS= 510.0 mA	1	$0.46	CAPSMT_6_S09 7 mm²
5.	Cvcc	AVX	0805YC474KAT2A Series= X7R	Cap= 470.0 nF ESR= 11.0 mOhm VDC= 16.0 V IRMS= 0.0 A	1	$0.02	0805 7 mm²
6.	D1	Diodes Inc.	B560C-13-F	VF@Io= 700.0 mV VRRM= 60.0 V	1	$0.17	SMC 83 mm²
7.	L1	Bourns	SDR1307-120ML	L= 12.0 µH DCR= 30.0 mOhm	1	$0.35	SDR1307 227 mm²
8.	M1	Fairchild Semiconductor	FDD5614P	VdsMax= -60.0 V IdsMax= -15.0 Amps	1	$0.24	DPAK 102 mm²
9.	Radj	Vishay-Dale	CRCW04021K43FKED Series= CRCW..e3	Res= 1.43 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²

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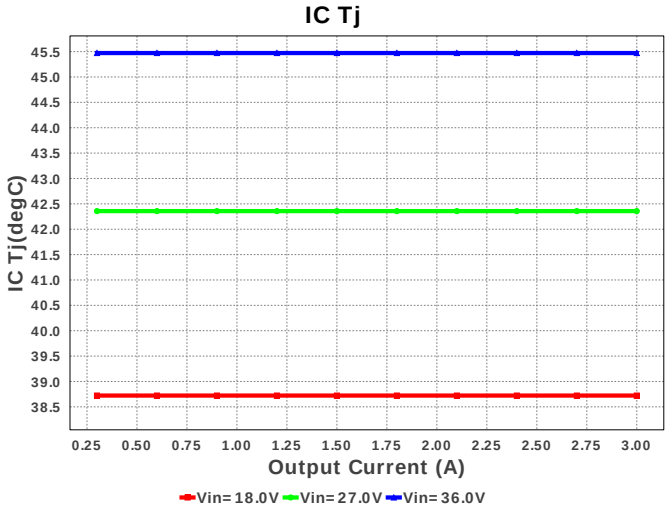
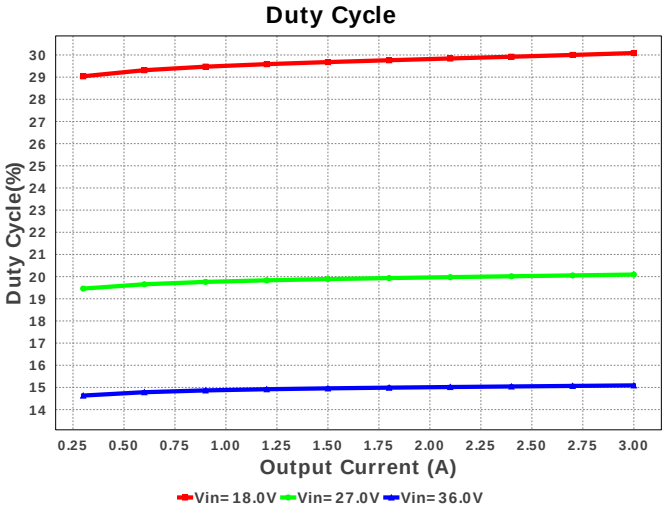
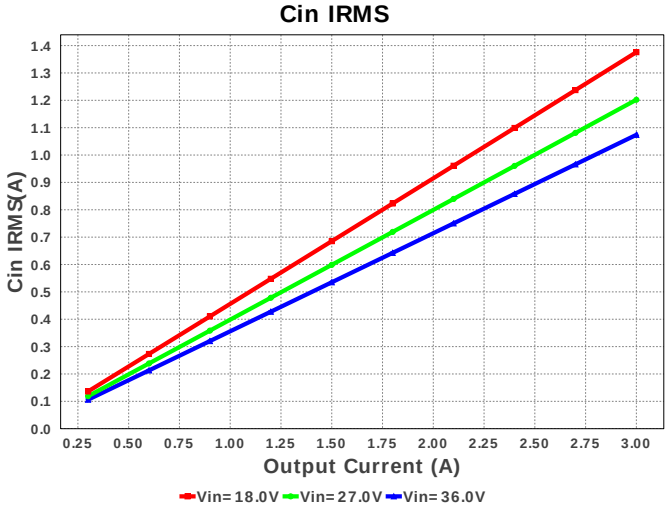
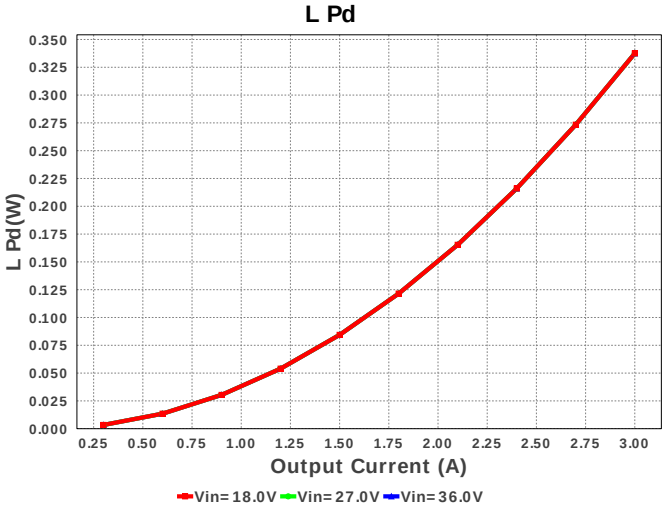
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	Rfb1	Vishay-Dale	CRCW04023K32FKED Series= CRCW..e3	Res= 3.32 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
11.	Rfb2	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
12.	Rsns	Stackpole Electronics Inc	CSR1206FK10L0 Series= ?	Res= 10.0 mOhm Power= 500.0 mW Tolerance= 1.0%	1	$0.11	1206 11 mm²
13.	Rt	Vishay-Dale	CRCW040248K7FKED Series= CRCW..e3	Res= 48.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
14.	U1	Texas Instruments	LM5085MY/NOPB	Switcher	1	$0.85	MUY08A 24 mm²









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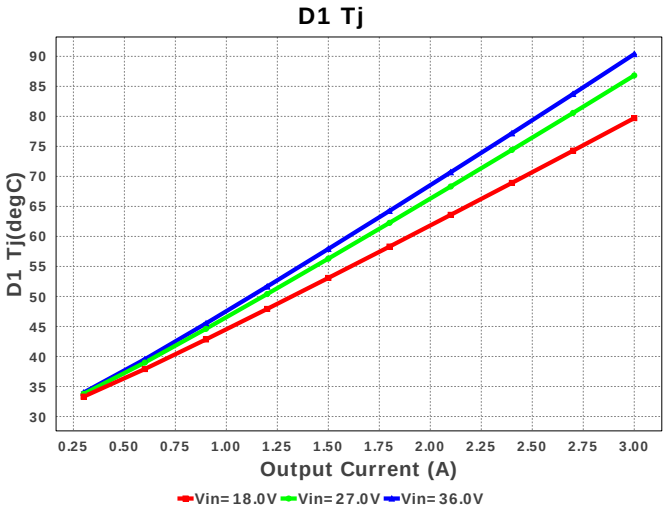

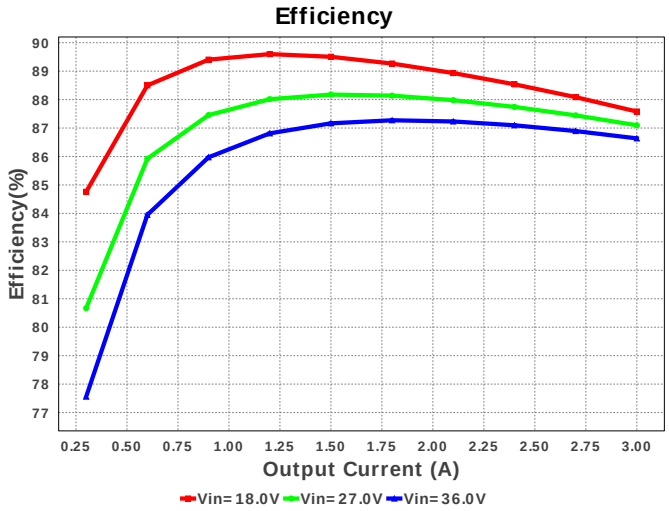

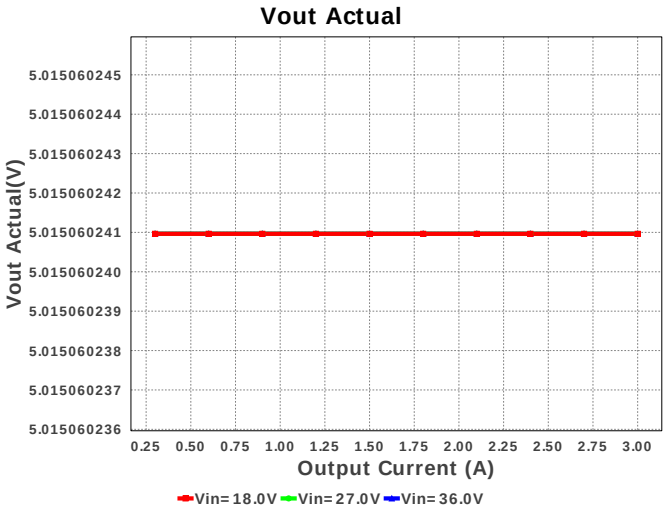

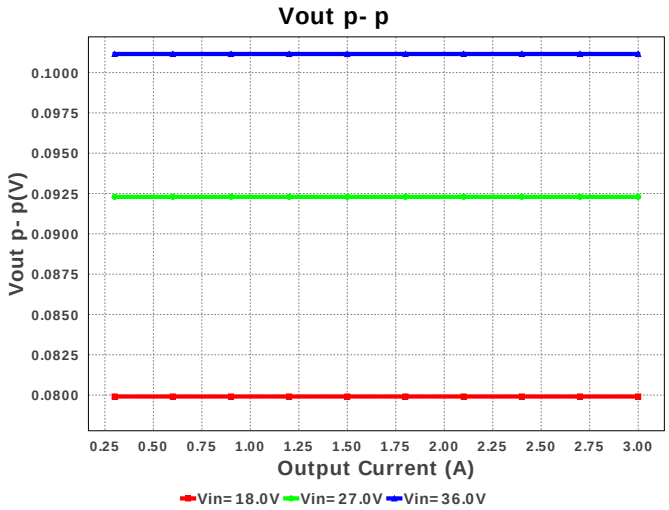

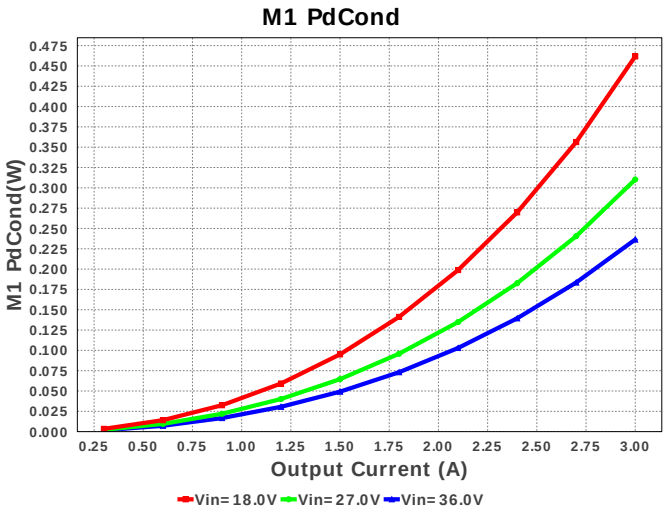

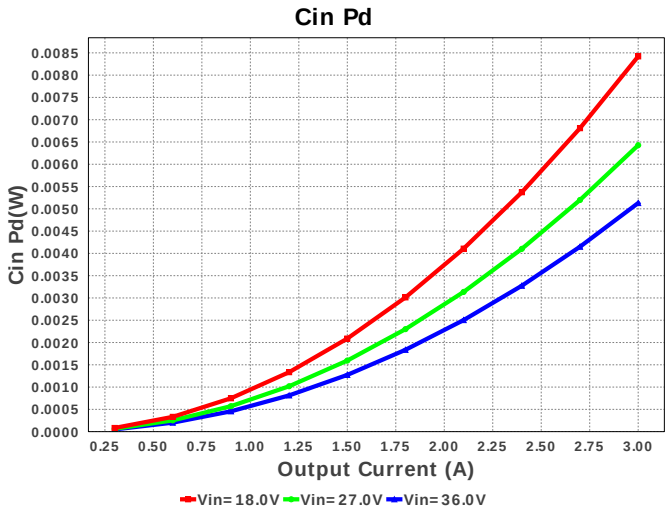

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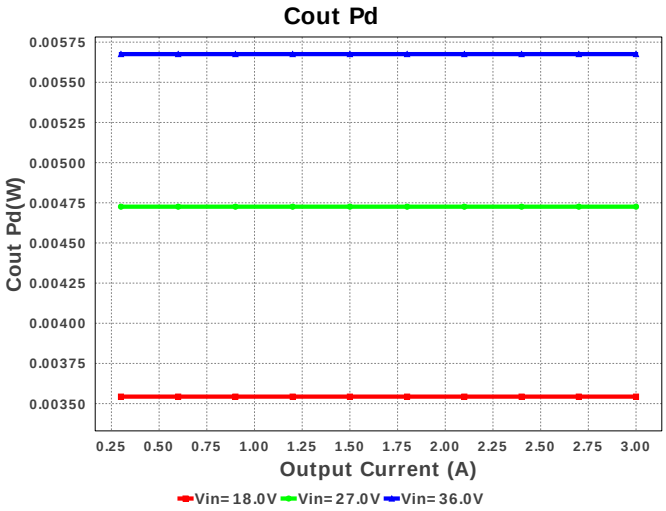
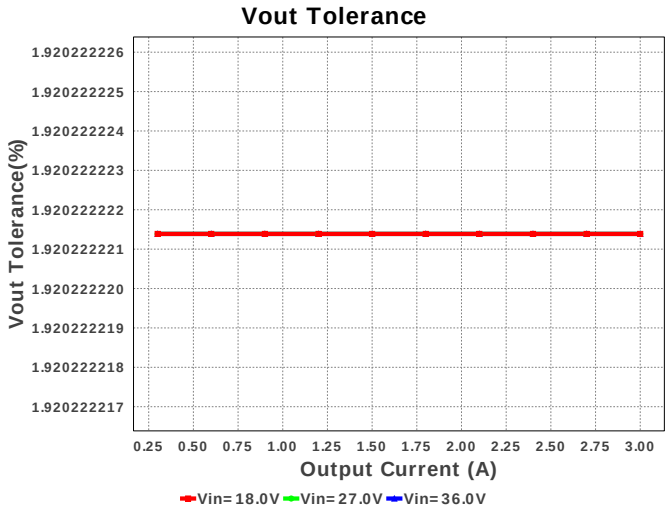
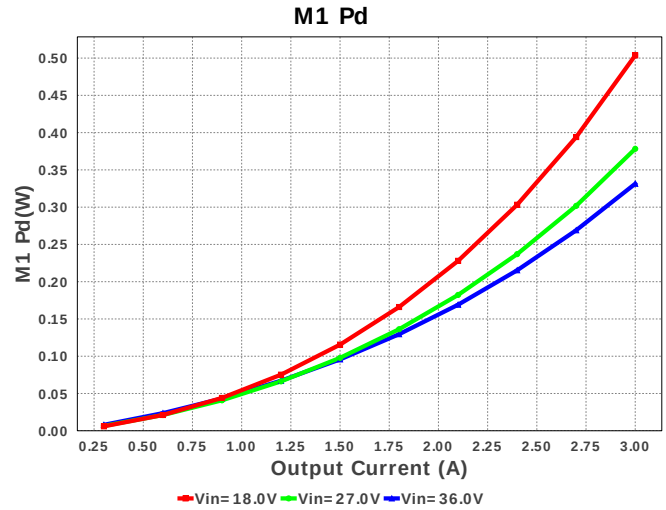
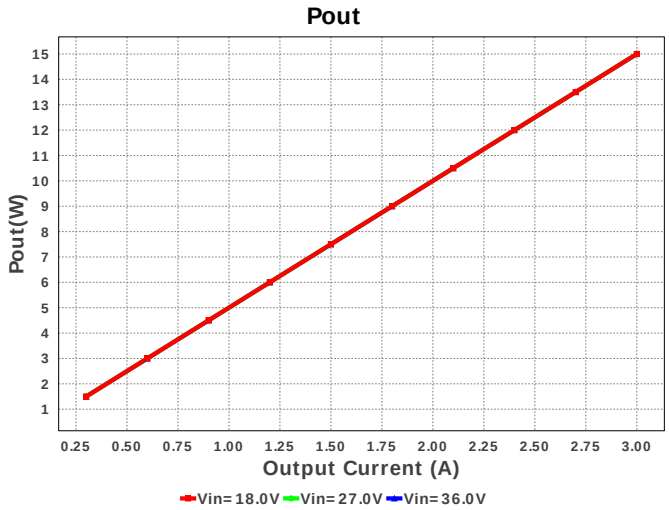
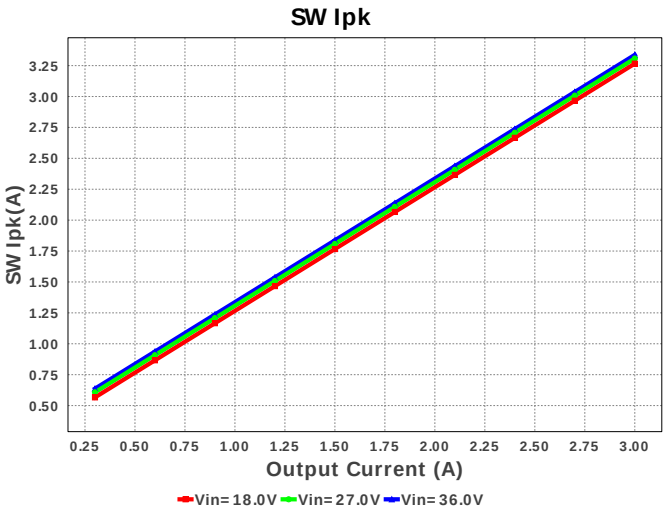
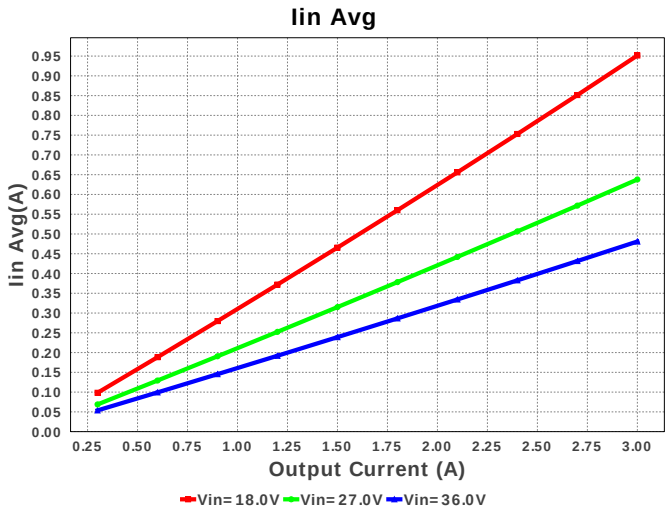

Cout Pd
Cout Pd(W)
0.00575
0.00550
0.00525
0.00500
0.00475
0.00450
0.00425
0.00400
0.00375
0.00350
0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00 2.25 2.50 2.75 3.00
Output Current (A)
Vin=18.0V Vin=27.0V Vin=36.0V

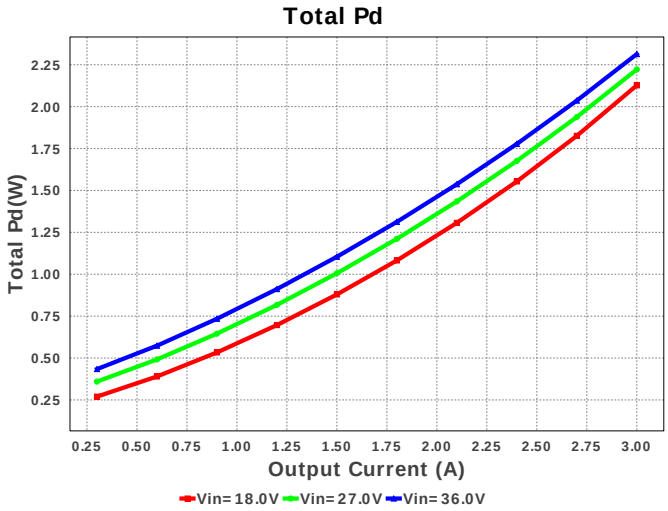

Vout Tolerance
Vout Tolerance(%)
1.920222226
1.920222225
1.920222224
1.920222223
1.920222222
1.920222221
1.920222220
1.920222219
1.920222218
1.920222217
0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00 2.25 2.50 2.75 3.00
Output Current (A)
Vin=18.0V Vin=27.0V Vin=36.0V

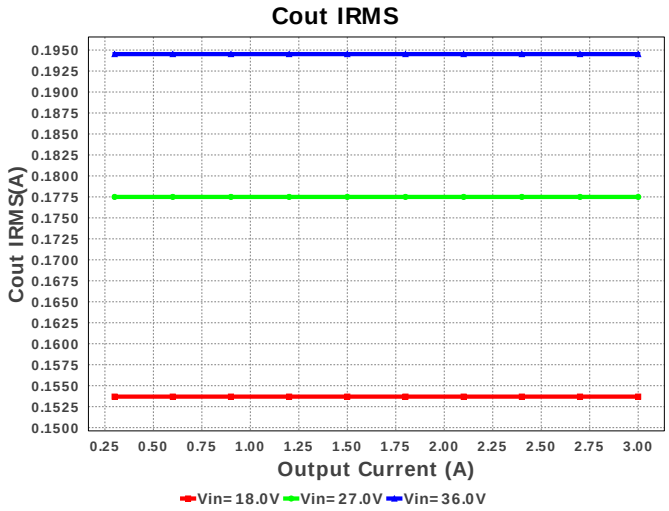

M1 Pd
M1 Pd(W)
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00 2.25 2.50 2.75 3.00
Output Current (A)
Vin=18.0V Vin=27.0V Vin=36.0V

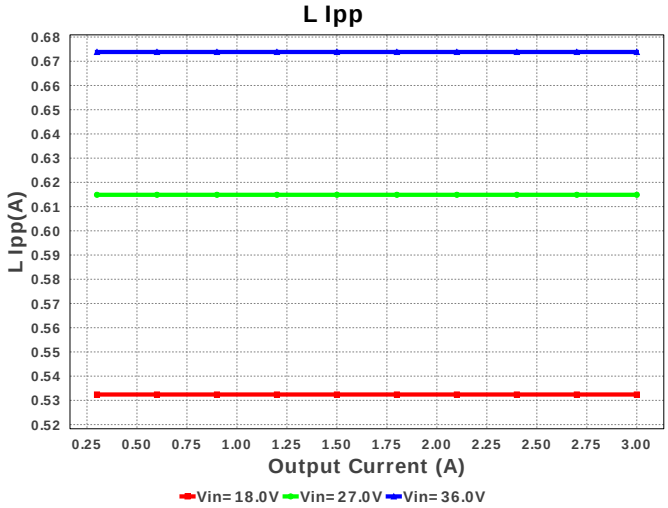

Pout
Pout(W)
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00 2.25 2.50 2.75 3.00
Output Current (A)
Vin=18.0V Vin=27.0V Vin=36.0V

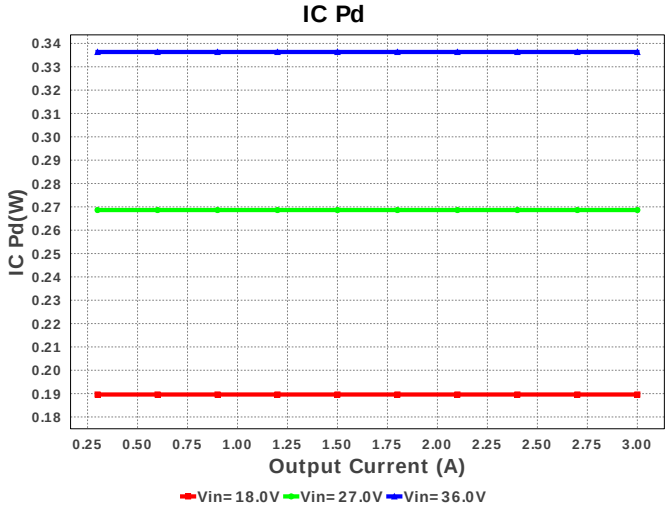

SW Ipk
SW Ipk(A)
3.25
3.00
2.75
2.50
2.25
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00 2.25 2.50 2.75 3.00
Output Current (A)
Vin=18.0V Vin=27.0V Vin=36.0V

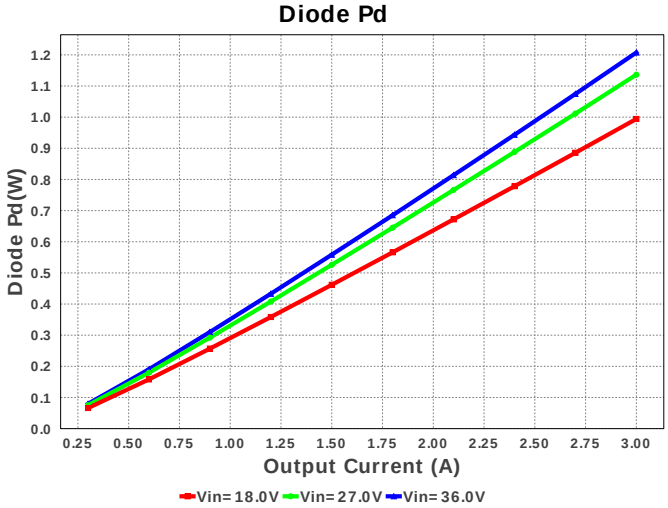

Iin Avg
Iin Avg(A)
0.95
0.90
0.85
0.80
0.75
0.70
0.65
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00 2.25 2.50 2.75 3.00
Output Current (A)
Vin=18.0V Vin=27.0V Vin=36.0V

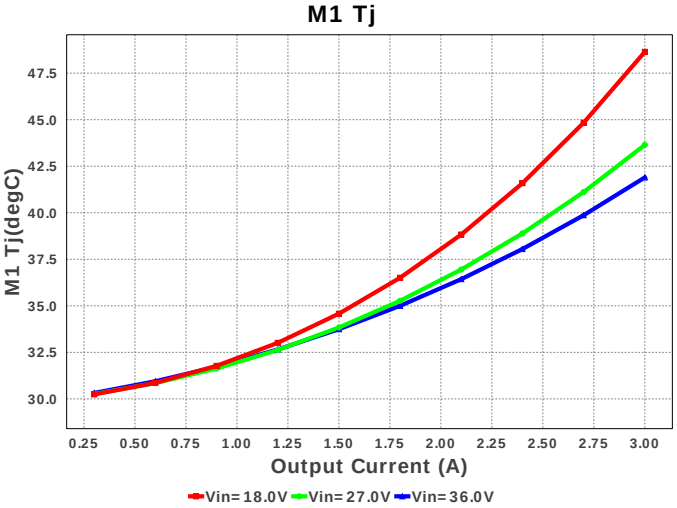












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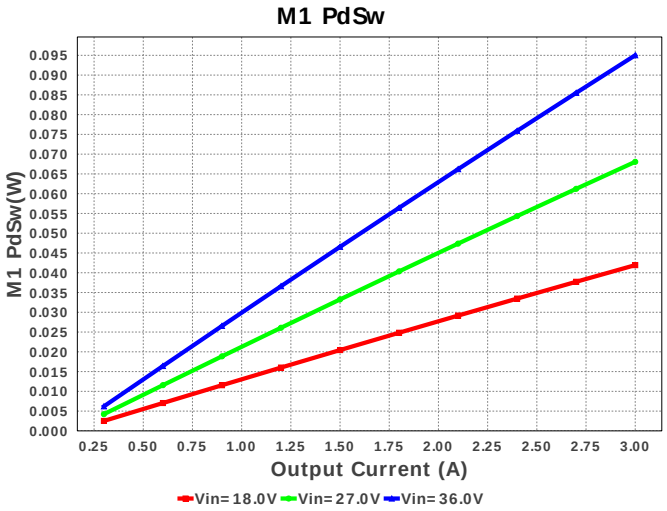

Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	1.074 A	Current	Input capacitor RMS ripple current
2.	Cout IRMS	194.518 mA	Current	Output capacitor RMS ripple current
3.	Iin Avg	480.97 mA	Current	Average input current
4.	L Ipp	673.83 mA	Current	Peak-to-peak inductor ripple current
5.	SW Ipk	3.337 A	Current	Peak switch current
6.	BOM Count	14	General	Total Design BOM count
7.	FootPrint	492.0 mm^2	General	Total Foot Print Area of BOM components
8.	Frequency	446.821 kHz	General	Switching frequency
9.	IC Tolerance	25.0 mV	General	IC Feedback Tolerance
10.	Pout	15.0 W	General	Total output power
11.	Total BOM	$2.36	General	Total BOM Cost
12.	D1 Tj	90.377 degC	Op_Point	D1 junction temperature
13.	Vout Actual	5.015 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
14.	Vout OP	5.0 V	Op_Point	Operational Output Voltage
15.	Duty Cycle	15.092 %	Op_point	Duty cycle
16.	Efficiency	86.63 %	Op_point	Steady state efficiency
17.	IC Tj	45.472 degC	Op_point	IC junction temperature
18.	ICThetaJA	46.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
19.	IOUT_OP	3.0 A	Op_point	Iout operating point
20.	M1 Tj	41.898 degC	Op_point	M1 MOSFET junction temperature
21.	VIN_OP	36.0 V	Op_point	Vin operating point
22.	Vout p-p	101.154 mV	Op_point	Peak-to-peak output ripple voltage
23.	Cin Pd	5.13 mW	Power	Input capacitor power dissipation
24.	Cout Pd	5.676 mW	Power	Output capacitor power dissipation
25.	Diode Pd	1.208 W	Power	Diode power dissipation
26.	IC Pd	336.34 mW	Power	IC power dissipation
27.	L Pd	337.5 mW	Power	Inductor power dissipation
28.	M1 Pd	332.889 mW	Power	M1 MOSFET total power dissipation
29.	M1 PdCond	237.872 mW	Power	M1 MOSFET conduction losses
30.	M1 PdSw	95.017 mW	Power	M1 MOSFET switching losses
31.	Total Pd	2.315 W	Power	Total Power Dissipation
32.	Vout Tolerance	1.92 %		Vout Tolerance based on IC Tolerance and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	3.0	Maximum Output Current
2.	VinMax	36.0	Maximum input voltage
3.	VinMin	18.0	Minimum input voltage
4.	Vout	5.0	Output Voltage
5.	base_pn	LM5085	Texas Instruments Base Part Number
6.	source	DC	Input Source Type
7.	ta	30.0	Ambient temperature

Design Assistance

1. For a Constant On Time device to be stable, we need to provide a ripple at the feedback comparator. There are various methods to implement the ripple. Depending on the circuit complexity vs. the allowable ripple, we have three options to choose from. The simplest option, 'Low Complexity', would require only a high ESR cap at the output. This means that the BOM count will be small, but the output voltage ripple will be quite large. The 'optimal solution' would require a feed-forward cap in parallel with the upper feedback resistor to AC couple the ripple to

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the feedback node. This increases the BOM count slightly, but now we have more control over the output voltage ripple. If the output voltage requirement is very tight, then the best option is to go for the 'Low Output Ripple' solution. In this option we can go with very low ESR output caps and have very good control over the output voltage ripple

2. LM5085 Product Folder : http://www.ti.com/product/LM5085 : contains the data sheet and other resources.

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