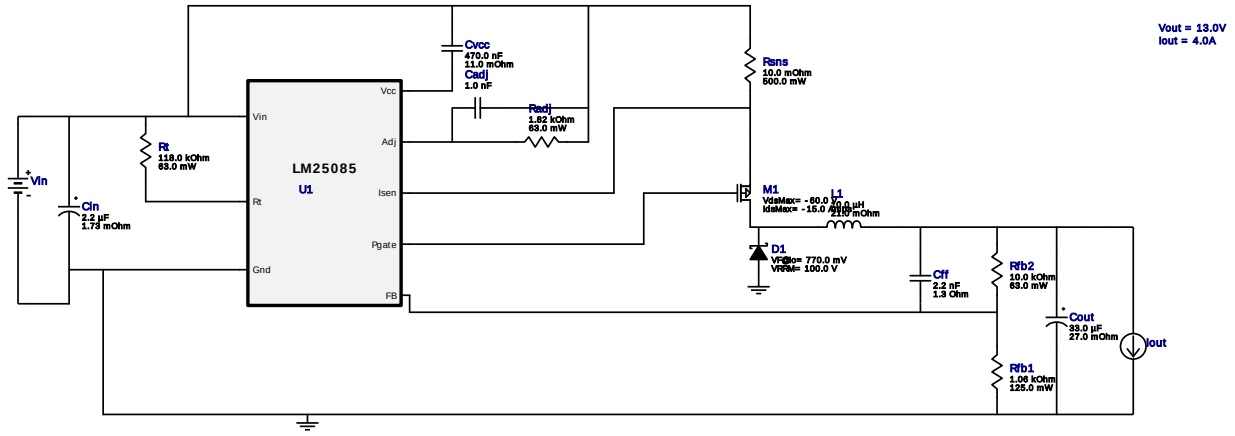
WEBENCH ® Design Report

VinMin = 33.0V
VinMax = 42.0V
Vout = 13.0V
Iout = 4.0A

Device = LM25085MY/NOPB
Topology = Buck
Created = 9/28/16 12:59:31 AM
BOM Cost = $2.98
BOM Count = 14
Total Pd = 4.1W

Design : 4806354/1 LM25085MY/NOPB
LM25085MY/NOPB 33.0V-42.0V to 13.00V @ 4.0A



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	GRM188R71E222KA01D Series= X7R	Cap= 2.2 nF ESR= 1.3 Ohm VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0603 5 mm²
3.	Cin	TDK	C3225X7R2A225K230AB Series= X7R	Cap= 2.2 uF ESR= 1.73 mOhm VDC= 100.0 V IRMS= 5.5932 A	1	$0.19	1210_250 15 mm²
4.	Cout	Panasonic	20SVPG33M Series= ?	Cap= 33.0 uF ESR= 27.0 mOhm VDC= 20.0 V IRMS= 3.0 A	1	$0.43	CAPSMT_62_B45 53 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	Vishay-Semiconductor	50WQ10FNPBF	VF@Io= 770.0 mV VRRM= 100.0 V	1	$0.83	DPAK 102 mm²
7.	L1	Bourns	SRR1208-100ML	L= 10.0 µH DCR= 21.0 mOhm	1	$0.37	SRR1208 216 mm²
8.	M1	Fairchild Semiconductor	FDD5614P	VdsMax= -60.0 V IdsMax= -15.0 Amps	1	$0.24	DPAK 102 mm²

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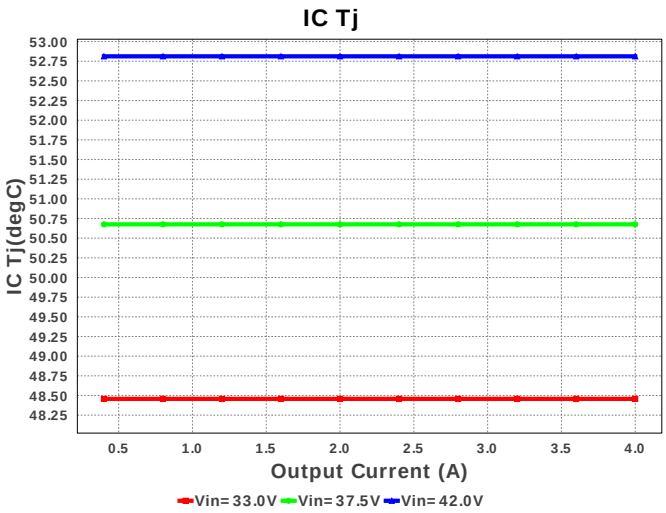
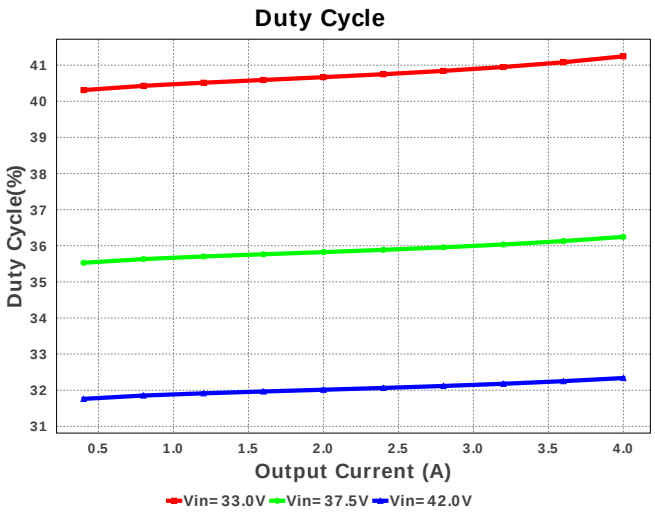
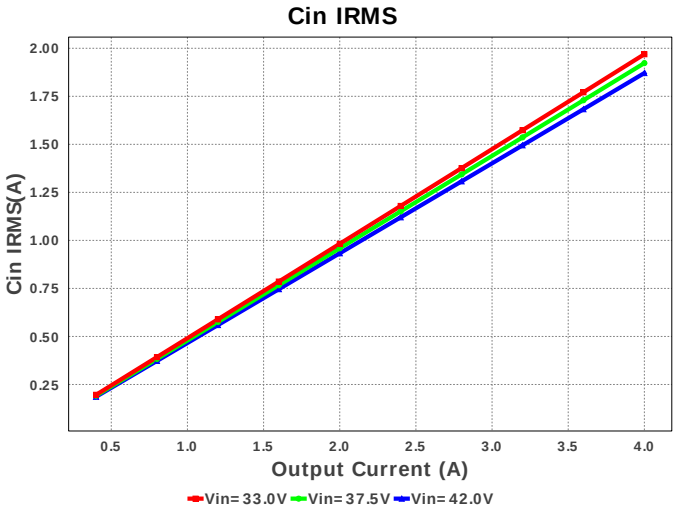
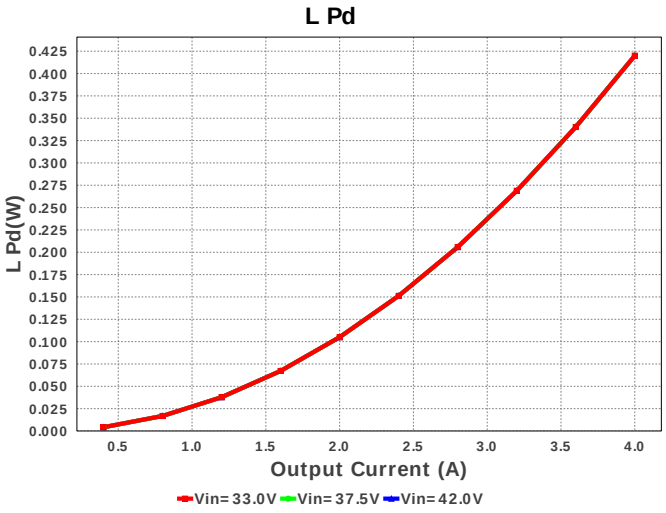
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
9.	Radj	Vishay-Dale	CRCW04021K82FKED Series= CRCW..e3	Res= 1.82 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
10.	Rfb1	Yageo America	RT0805BRD071K06L Series= RT0805	Res= 1.06 kOhm Power= 125.0 mW Tolerance= 0.1%	1	$0.04	0805 7 mm²
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	CRCW0402118KFKED Series= CRCW..e3	Res= 118.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
14.	U1	Texas Instruments	LM25085MY/NOPB	Switcher	1	$0.70	MUY08A 24 mm²









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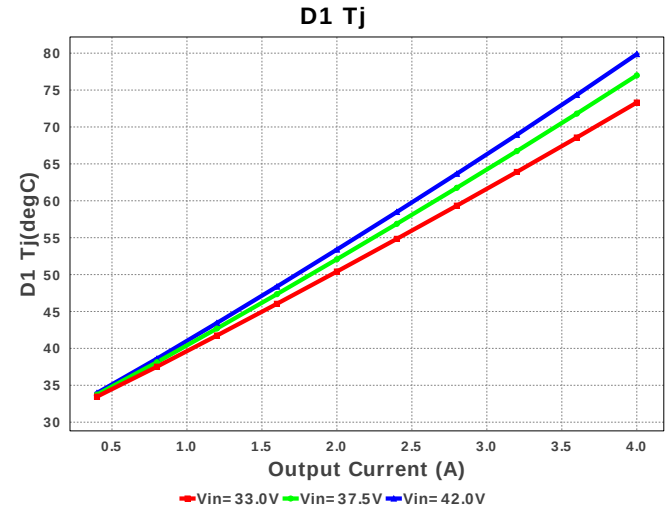

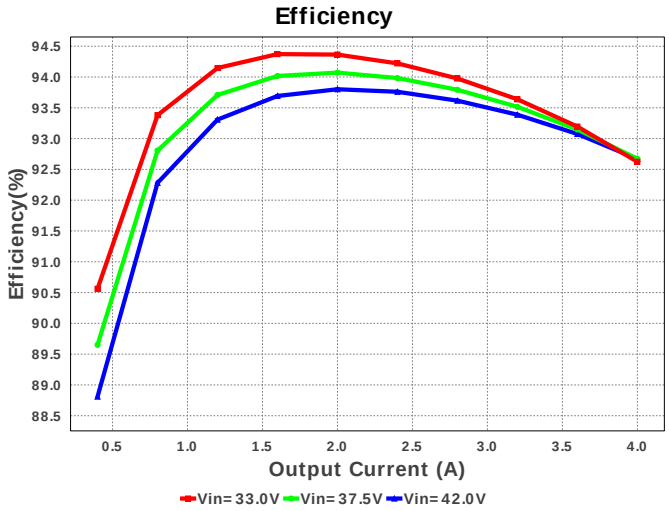

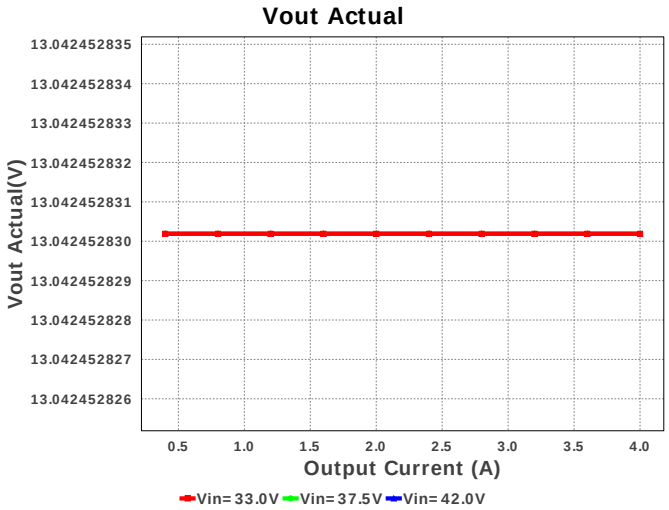

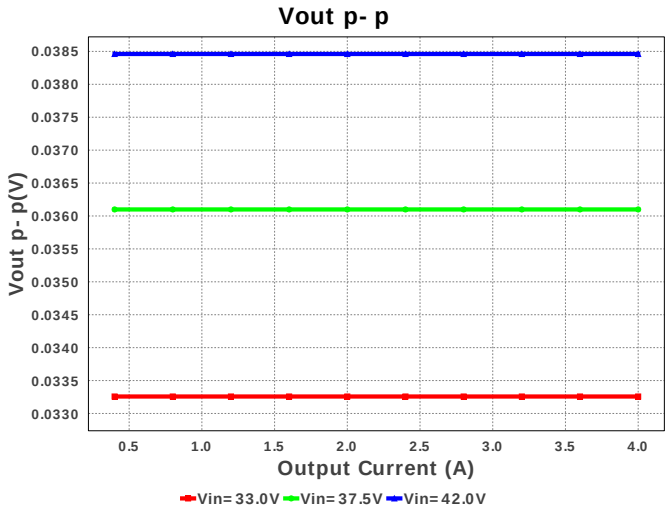

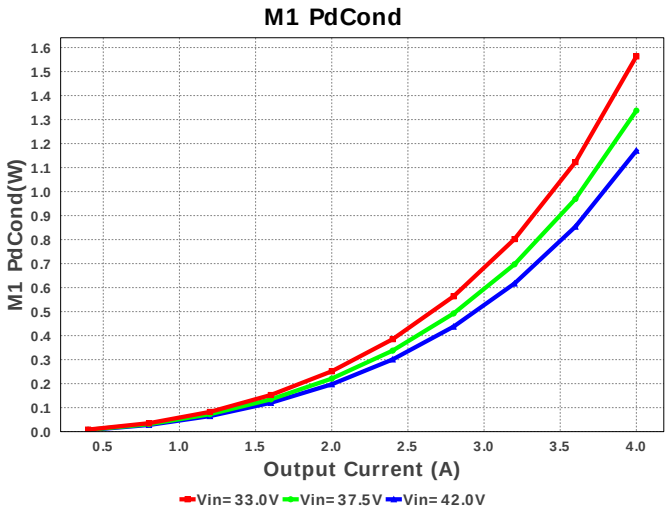

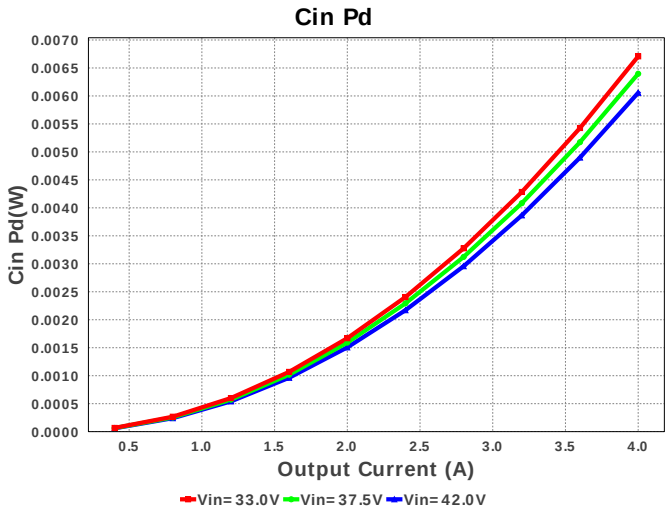

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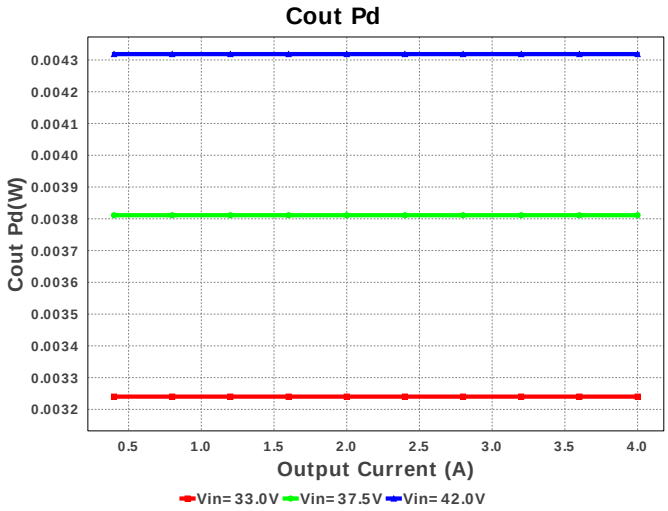
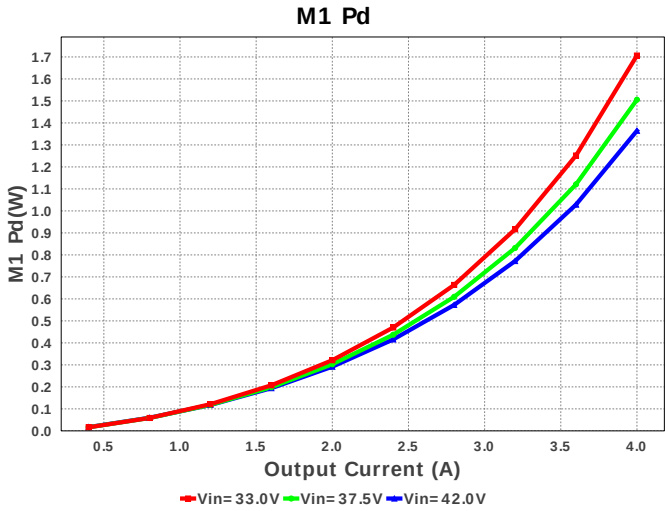
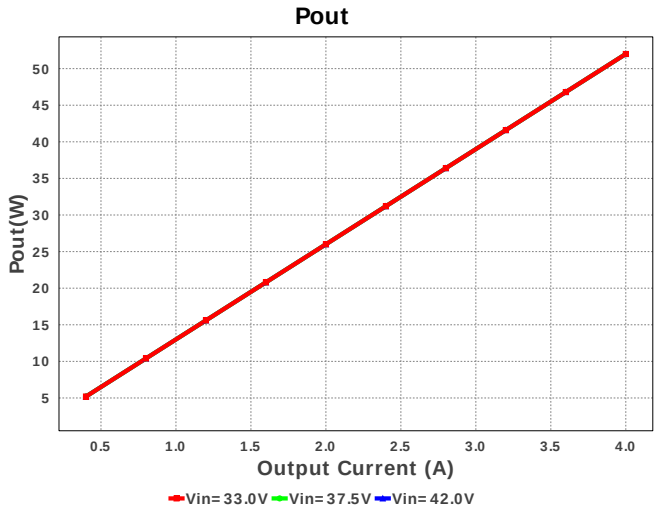
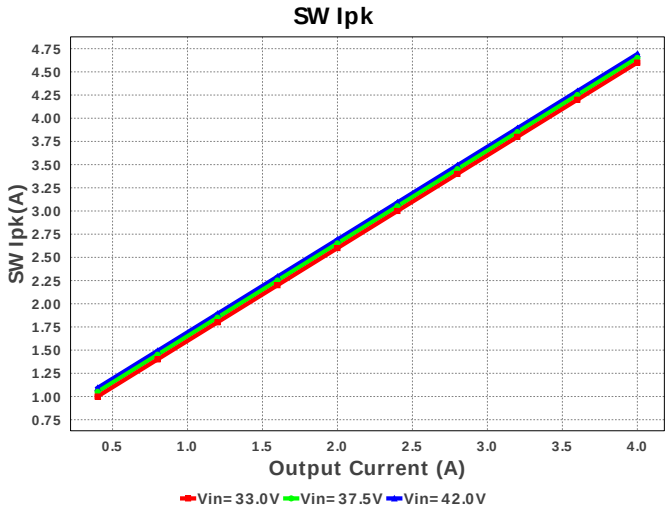
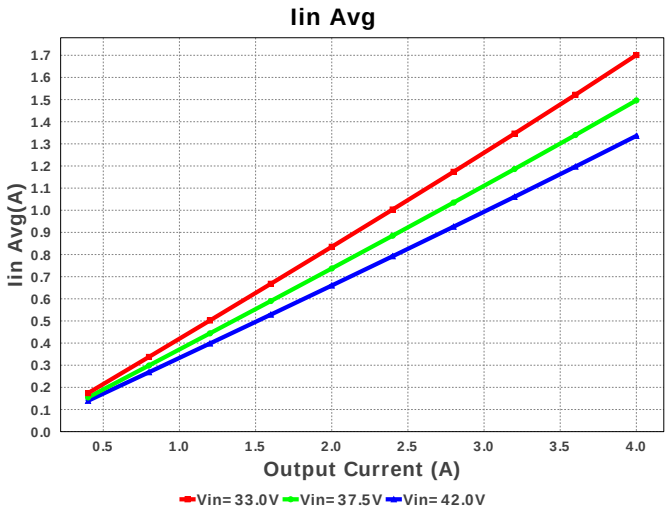
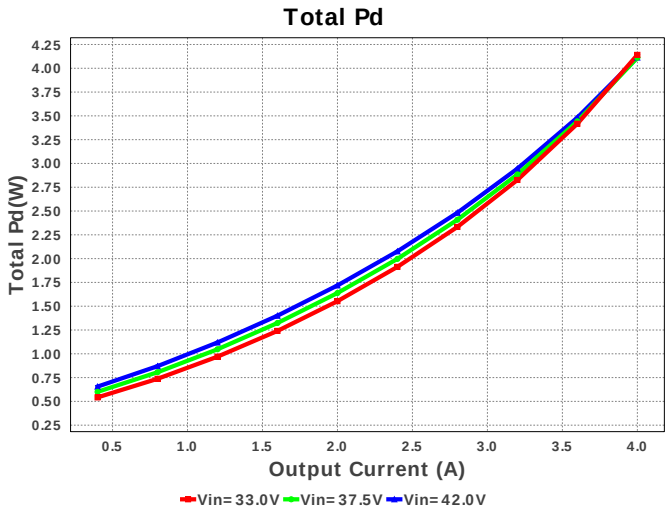

Cout Pd
Cout Pd(W)
0.0043
0.0042
0.0041
0.0040
0.0039
0.0038
0.0037
0.0036
0.0035
0.0034
0.0033
0.0032
0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0
Output Current (A)
Vin=33.0V Vin=37.5V Vin=42.0V

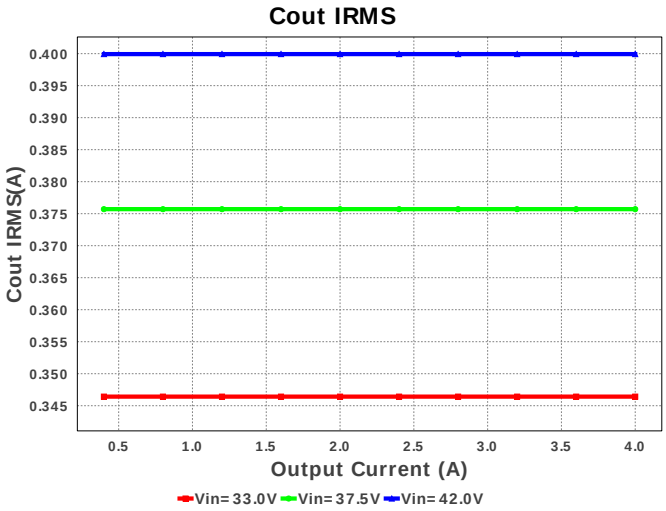

M1 Pd
M1 Pd(W)
1.7 1.6 1.5 1.4 1.3 1.2 1.1 1.0 0.9 0.8 0.7 0.6 0.5 0.4 0.3 0.2 0.1 0.0
0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0
Output Current (A)
Vin=33.0V Vin=37.5V Vin=42.0V

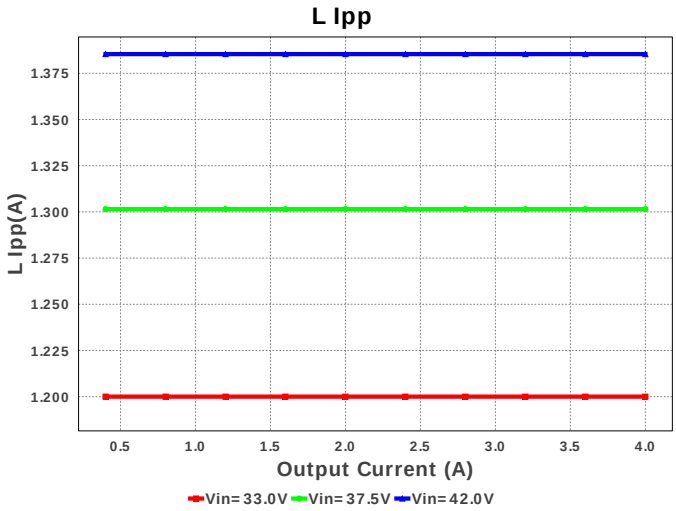

Pout
Pout(W)
50 45 40 35 30 25 20 15 10 5
0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0
Output Current (A)
Vin=33.0V Vin=37.5V Vin=42.0V

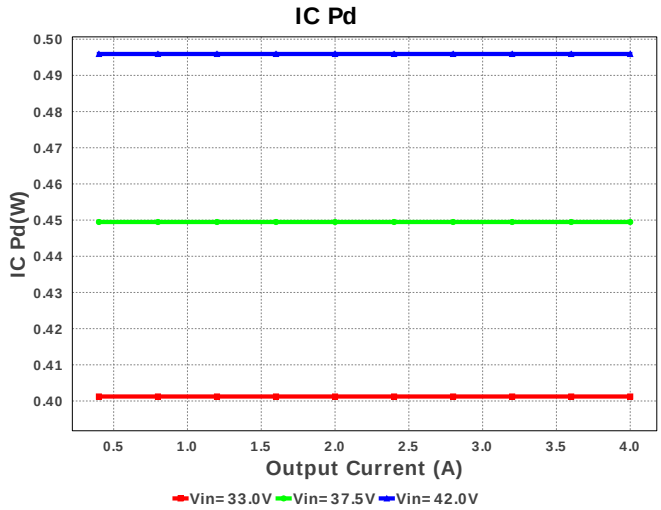

SW Ipk
SW Ipk(A)
4.75 4.50 4.25 4.00 3.75 3.50 3.25 3.00 2.75 2.50 2.25 2.00 1.75 1.50 1.25 1.00 0.75
0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0
Output Current (A)
Vin=33.0V Vin=37.5V Vin=42.0V

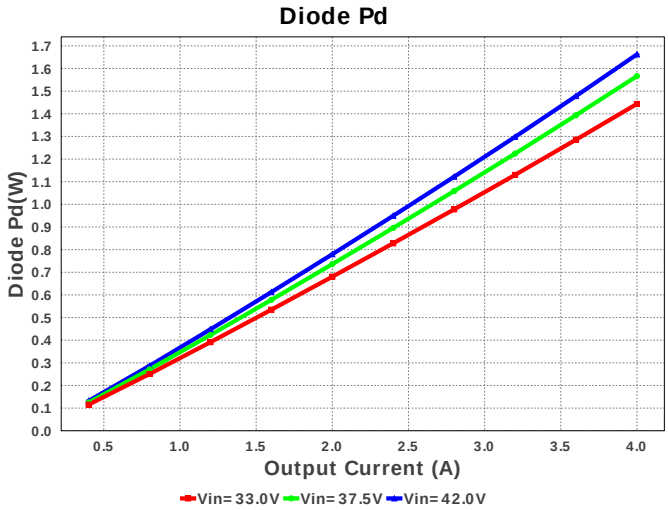

Iin Avg
Iin Avg(A)
1.7 1.6 1.5 1.4 1.3 1.2 1.1 1.0 0.9 0.8 0.7 0.6 0.5 0.4 0.3 0.2 0.1 0.0
0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0
Output Current (A)
Vin=33.0V Vin=37.5V Vin=42.0V

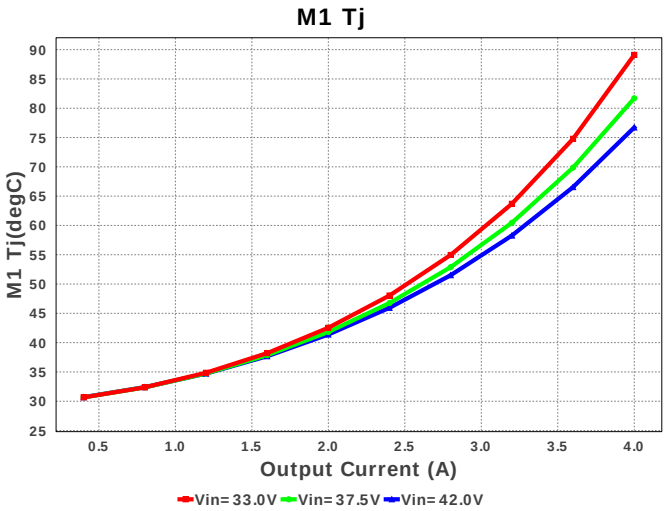

Total Pd
Total Pd(W)
4.25 4.00 3.75 3.50 3.25 3.00 2.75 2.50 2.25 2.00 1.75 1.50 1.25 1.00 0.75 0.50 0.25
0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0
Output Current (A)
Vin=33.0V Vin=37.5V Vin=42.0V

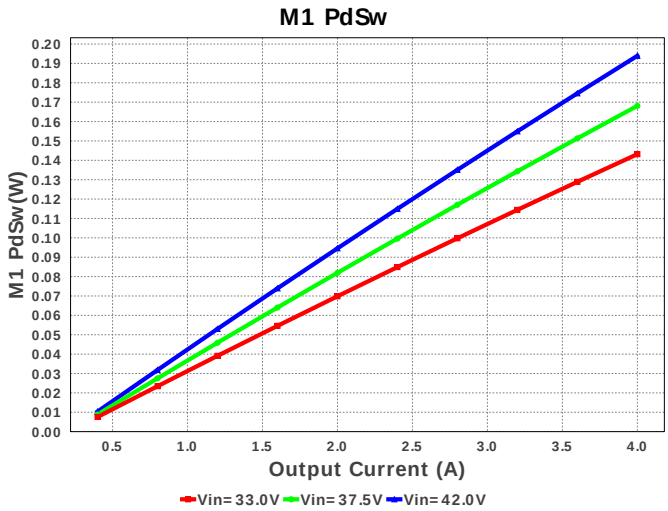












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	1.871 A	Current	Input capacitor RMS ripple current
2.	Cout IRMS	399.928 mA	Current	Output capacitor RMS ripple current
3.	Iin Avg	1.336 A	Current	Average input current
4.	L Ipp	1.385 A	Current	Peak-to-peak inductor ripple current
5.	SW Ipk	4.693 A	Current	Peak switch current
6.	BOM Count	14	General	Total Design BOM count
7.	FootPrint	556.0 mm^2	General	Total Foot Print Area of BOM components
8.	Frequency	586.529 kHz	General	Switching frequency
9.	IC Tolerance	25.0 mV	General	IC Feedback Tolerance
10.	Mode	CCM	General	Conduction Mode
11.	Pout	52.0 W	General	Total output power

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#	Name	Value	Category	Description
12.	Total BOM	$2.98	General	Total BOM Cost
13.	D1 Tj	79.876 degC	Op_Point	D1 junction temperature
14.	Vout Actual	13.042 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
15.	Vout OP	13.0 V	Op_Point	Operational Output Voltage
16.	Duty Cycle	32.334 %	Op_point	Duty cycle
17.	Efficiency	92.687 %	Op_point	Steady state efficiency
18.	IC Tj	52.812 degC	Op_point	IC junction temperature
19.	ICThetaJA	46.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
20.	IOUT_OP	4.0 A	Op_point	Iout operating point
21.	M1 Tj	76.716 degC	Op_point	M1 MOSFET junction temperature
22.	VIN_OP	42.0 V	Op_point	Vin operating point
23.	Vout p-p	38.461 mV	Op_point	Peak-to-peak output ripple voltage
24.	Cin Pd	6.056 mW	Power	Input capacitor power dissipation
25.	Cout Pd	4.318 mW	Power	Output capacitor power dissipation
26.	Diode Pd	1.663 W	Power	Diode power dissipation
27.	IC Pd	495.916 mW	Power	IC power dissipation
28.	L Pd	420.0 mW	Power	Inductor power dissipation
29.	M1 Pd	1.354 W	Power	M1 MOSFET total power dissipation
30.	M1 PdCond	1.16 W	Power	M1 MOSFET conduction losses
31.	M1 PdSw	193.934 mW	Power	M1 MOSFET switching losses
32.	Total Pd	4.103 W	Power	Total Power Dissipation
33.	Vout Tolerance	3.016 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	4.0	Maximum Output Current
2.	VinMax	42.0	Maximum input voltage
3.	VinMin	33.0	Minimum input voltage
4.	Vout	13.0	Output Voltage
5.	base_pn	LM25085	Base Product 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 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. **LM25085** Product Folder : http://www.ti.com/product/LM25085 : contains the data sheet and other resources.

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