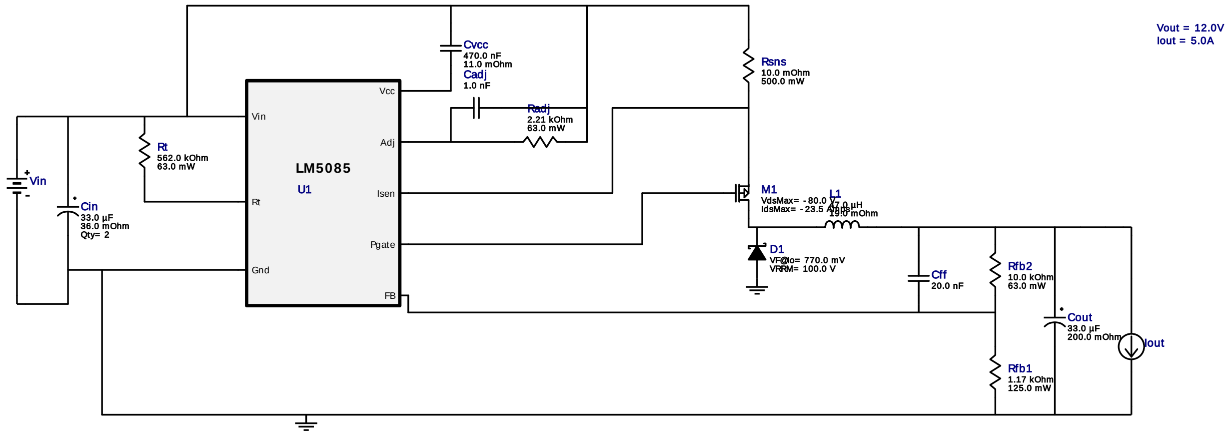
TEXAS INSTRUMENTS

WEBENCH ® Design Report

VinMin = 14.0V
VinMax = 50.0V
Vout = 12.0V
Iout = 5.0A

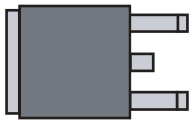
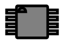
Device = LM5085MY/NOPB
Topology = Buck
Created = 9/13/16 6:16:03 AM
BOM Cost = $0.00
BOM Count = 15
Total Pd = 6.54W

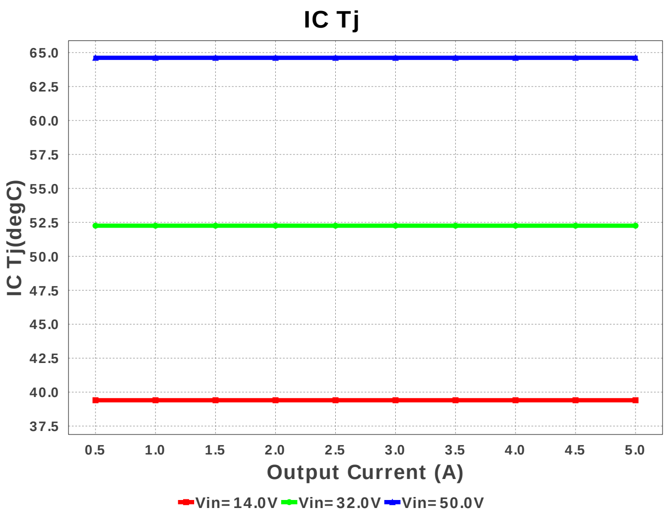
Design : 4509274/7 LM5085MY/NOPB
LM5085MY/NOPB 14.0V-50.0V to 12.00V @ 5.0A

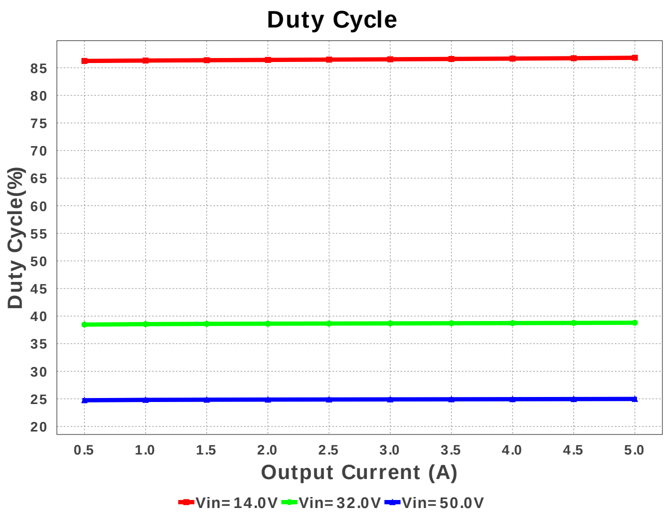


Electrical BOM

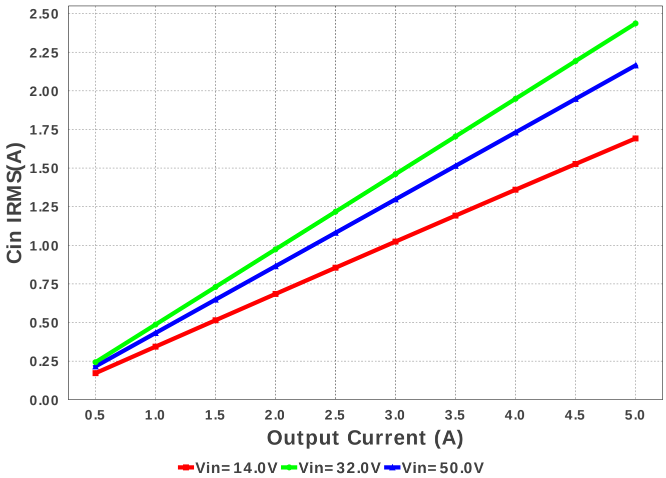
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cadj	Samsung Electro-Mechanics	CL21C102JBCNFNC Series= C0G/NP0	Cap= 1.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
2.	Cff	AVX	12065A202JAT2A Series= C0G/NP0	Cap= 20.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.09	1206 11 mm^2
3.	Cin	Panasonic	EEHZA1K330P Series= ?	Cap= 33.0 uF ESR= 36.0 mOhm VDC= 80.0 V IRMS= 1.7 A	2	NA	SM_RADIAL_10BMM 160 mm^2
4.	Cout	AVX	TPSD336K025R0200 Series= TPS	Cap= 33.0 uF ESR= 200.0 mOhm VDC= 25.0 V IRMS= 779.0 mA	1	$0.53	7343-31 59 mm^2
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 mm^2
6.	D1	Vishay-Semiconductor	50WQ10FNPBF	VF@Io= 770.0 mV VRRM= 100.0 V	1	$0.74	DPAK 102 mm^2
7.	L1	Bourns	PM2120-470K-RC	L= 47.0 µH DCR= 19.0 mOhm	1	$1.33	PM2120 890 mm^2

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
8.	M1	Vishay-Siliconix	SUM110P08-11L	VdsMax= -80.0 V IdsMax= -23.5 Amps	1	NA	 DDPAK 210 mm²
9.	Radj	Vishay-Dale	CRCW04022K21FKED Series= CRCW..e3	Res= 2.21 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
10.	Rfb1	Yageo America	RT0805BRD071K17L Series= RT0805	Res= 1.17 kOhm Power= 125.0 mW Tolerance= 0.1%	1	$0.05	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	CRCW0402562KFKED Series= CRCW..e3	Res= 562.0 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

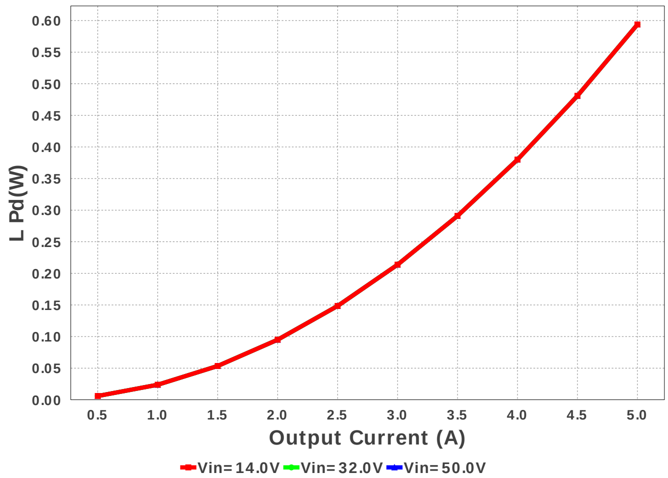




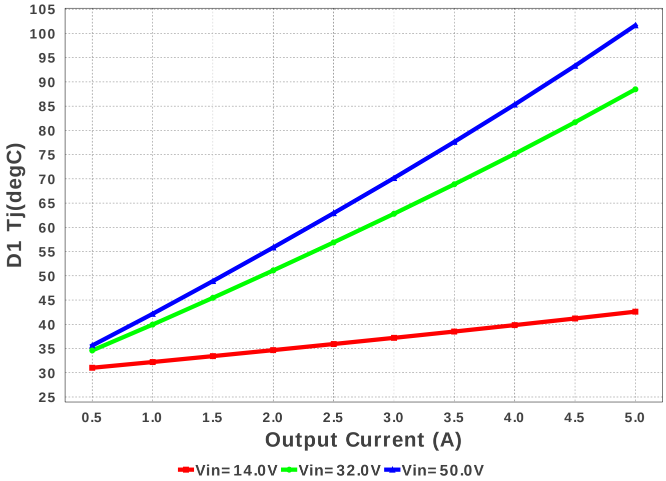
Cin IRMS



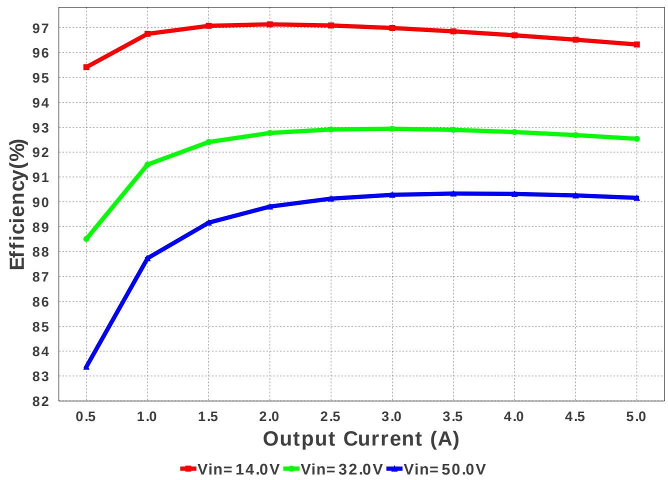
L Pd



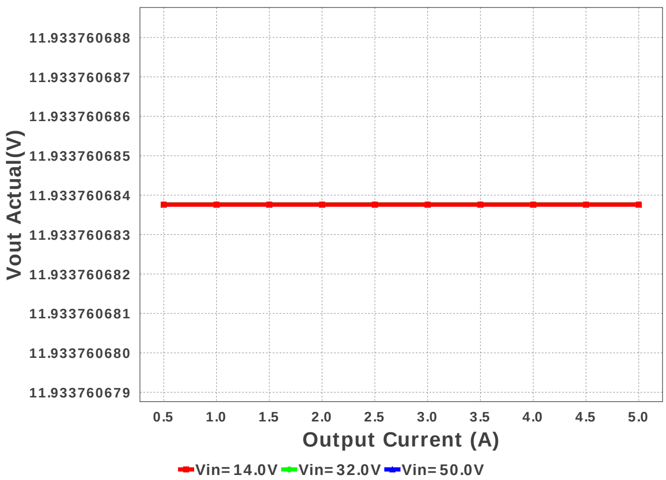
D1 Tj



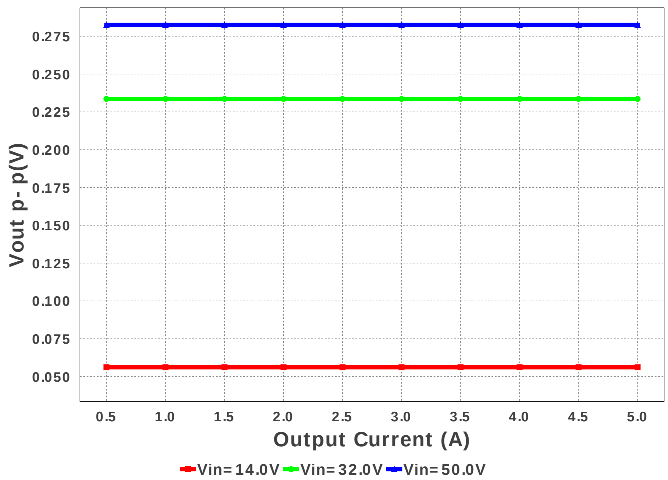
Efficiency

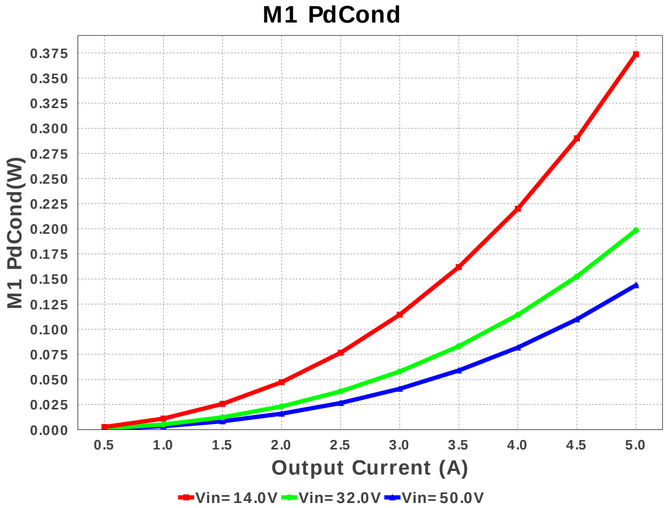


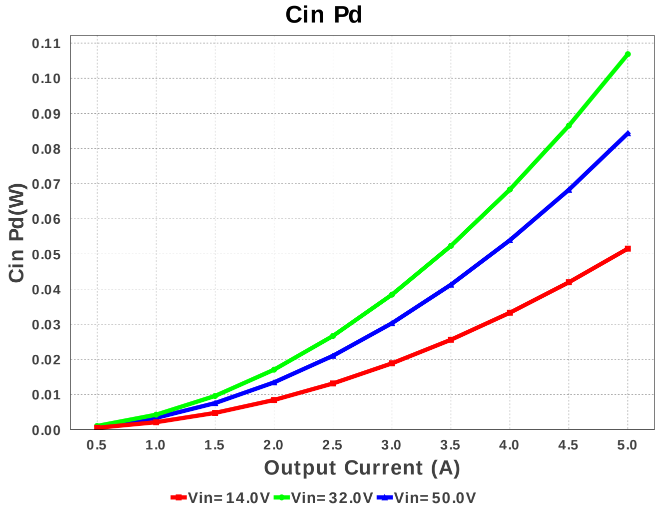
Vout Actual

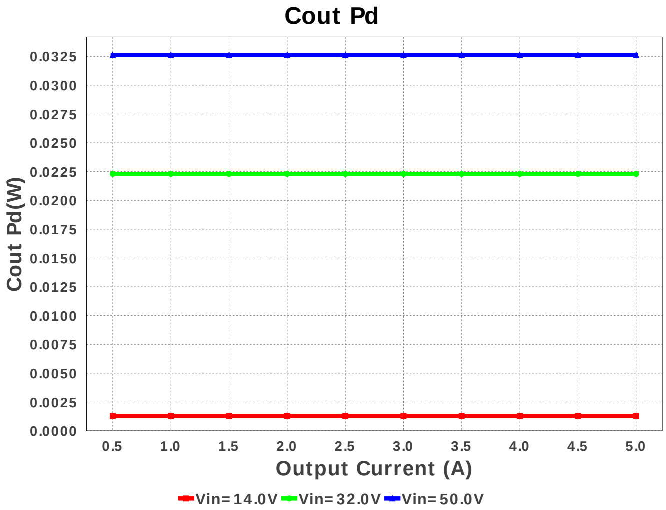


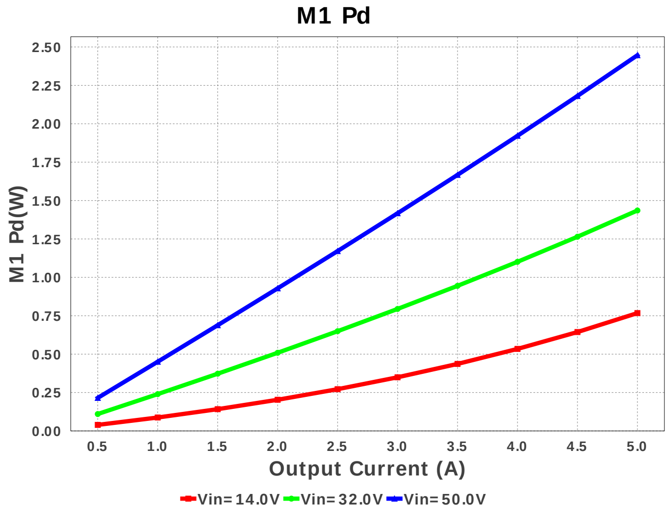
Vout p- p

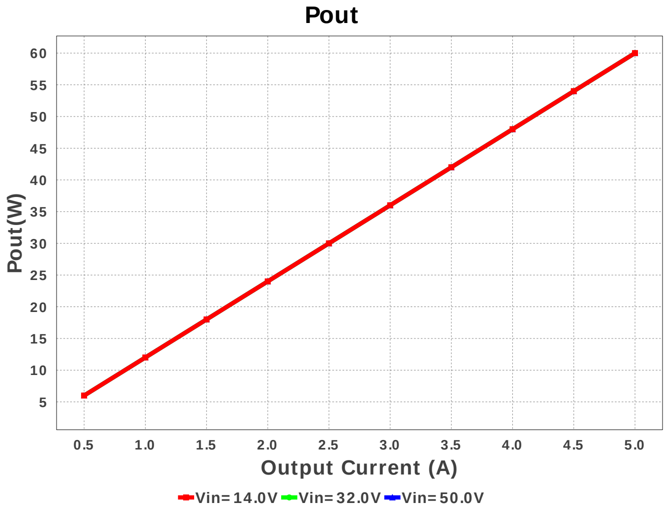


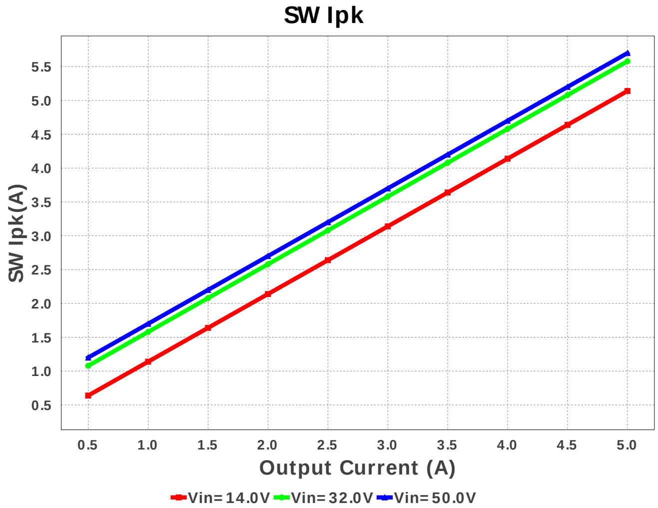

M1 PdCond
M1 PdCond(W)
Output Current (A)
Vin=14.0V Vin=32.0V Vin=50.0V

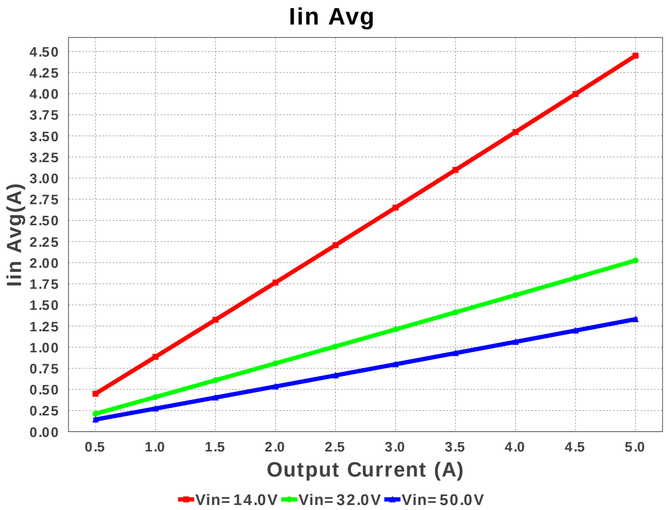

Cin Pd
Cin Pd(W)
Output Current (A)
Vin=14.0V Vin=32.0V Vin=50.0V

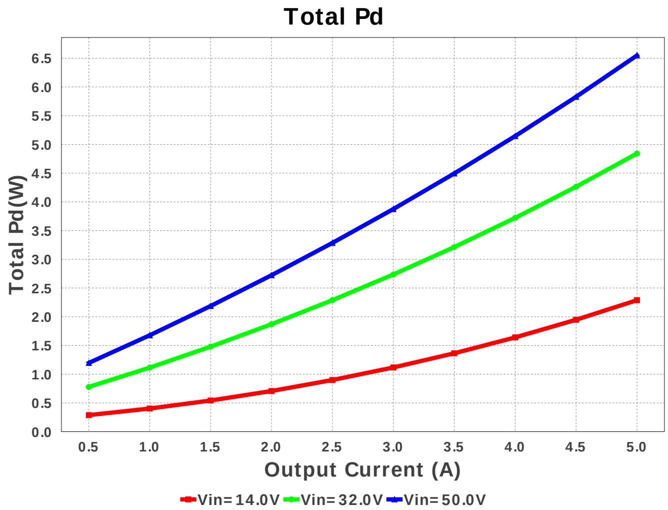

Cout Pd
Cout Pd(W)
Output Current (A)
Vin=14.0V Vin=32.0V Vin=50.0V

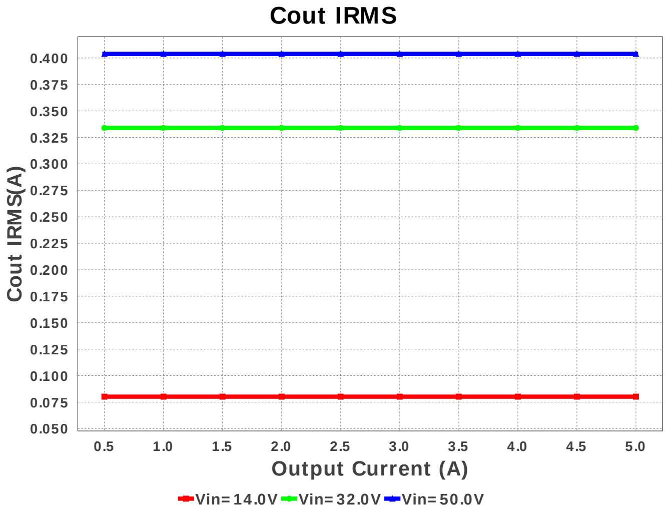

M1 Pd
M1 Pd(W)
Output Current (A)
Vin=14.0V Vin=32.0V Vin=50.0V

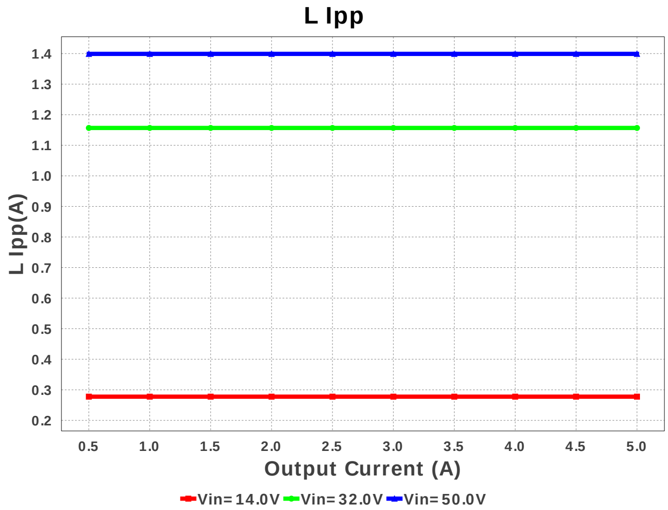

Pout
Pout(W)
Output Current (A)
Vin=14.0V Vin=32.0V Vin=50.0V

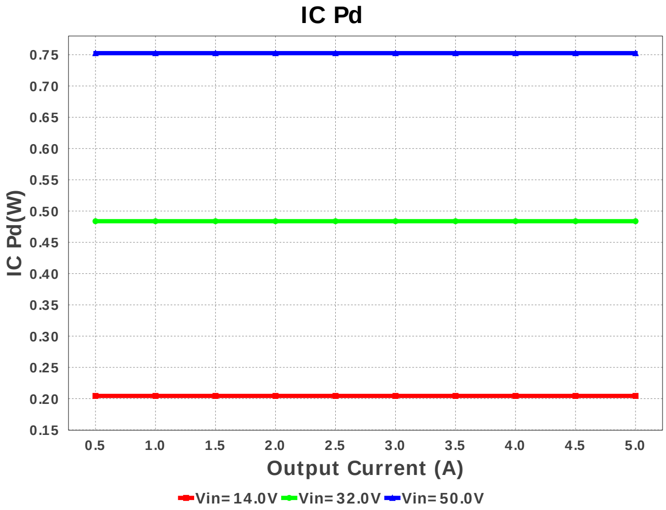

SW Ipk
SW Ipk(A)
Output Current (A)
Vin=14.0V Vin=32.0V Vin=50.0V

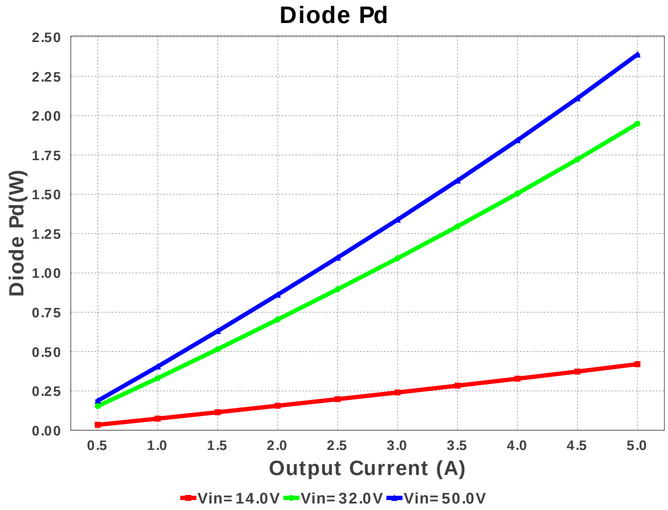

Iin Avg
Iin Avg(A)
Output Current (A)
Vin=14.0V Vin=32.0V Vin=50.0V

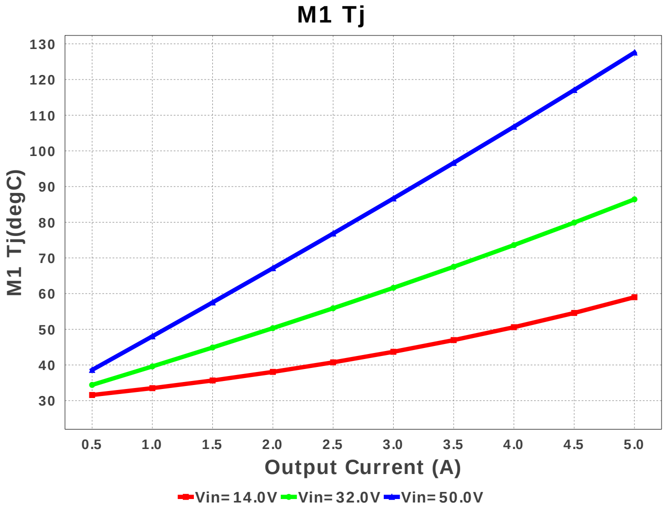

Total Pd
Total Pd(W)
Output Current (A)
Vin=14.0V Vin=32.0V Vin=50.0V

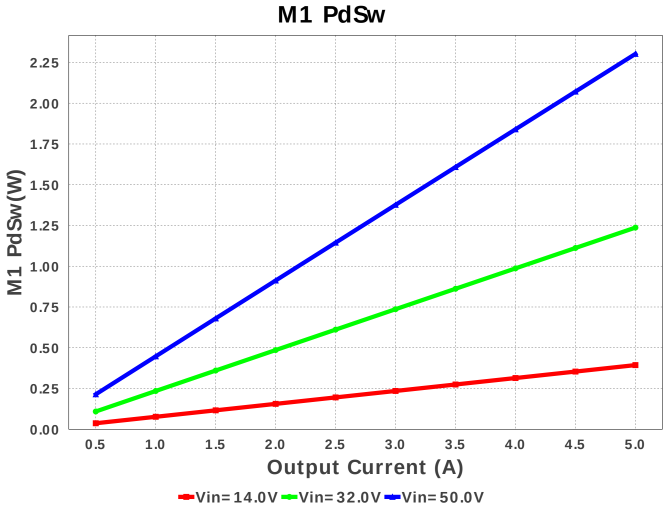

Cout IRMS
Cout IRMS(A)
Output Current (A)
Vin=14.0V Vin=32.0V Vin=50.0V


L Ipp
L Ipp(A)
Output Current (A)
Vin=14.0V Vin=32.0V Vin=50.0V


IC Pd
IC Pd(W)
Output Current (A)
Vin=14.0V Vin=32.0V Vin=50.0V


Diode Pd
Diode Pd(W)
Output Current (A)
Vin=14.0V Vin=32.0V Vin=50.0V





Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	2.165 A	Current	Input capacitor RMS ripple current
2.	Cout IRMS	403.852 mA	Current	Output capacitor RMS ripple current
3.	Iin Avg	1.331 A	Current	Average input current
4.	L Ipp	1.399 A	Current	Peak-to-peak inductor ripple current
5.	SW Ipk	5.699 A	Current	Peak switch current
6.	BOM Count	15	General	Total Design BOM count
7.	FootPrint	1.655 k mm^2	General	Total Foot Print Area of BOM components
8.	Frequency	134.807 kHz	General	Switching frequency
9.	IC Tolerance	25.0 mV	General	IC Feedback Tolerance
10.	Mode	CCM	General	Conduction Mode
11.	Pout	60.0 W	General	Total output power
12.	Total BOM	$0.0	General	Total BOM Cost
13.	D1 Tj	101.673 degC	Op_Point	D1 junction temperature
14.	Vout Actual	11.934 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
15.	Vout OP	12.0 V	Op_Point	Operational Output Voltage
16.	Duty Cycle	24.982 %	Op_point	Duty cycle
17.	Efficiency	90.173 %	Op_point	Steady state efficiency
18.	IC Tj	64.616 degC	Op_point	IC junction temperature
19.	ICThetaJA	46.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
20.	IOUT_OP	5.0 A	Op_point	Iout operating point
21.	M1 Tj	127.558 degC	Op_point	M1 MOSFET junction temperature
22.	VIN_OP	50.0 V	Op_point	Vin operating point
23.	Vout p-p	282.545 mV	Op_point	Peak-to-peak output ripple voltage
24.	Cin Pd	84.335 mW	Power	Input capacitor power dissipation
25.	Cout Pd	32.619 mW	Power	Output capacitor power dissipation
26.	Diode Pd	2.389 W	Power	Diode power dissipation
27.	IC Pd	752.516 mW	Power	IC power dissipation
28.	L Pd	593.75 mW	Power	Inductor power dissipation
29.	M1 Pd	2.436 W	Power	M1 MOSFET total power dissipation
30.	M1 PdCond	133.95 mW	Power	M1 MOSFET conduction losses
31.	M1 PdSw	2.302 W	Power	M1 MOSFET switching losses
32.	Total Pd	6.539 W	Power	Total Power Dissipation
33.	Vout Tolerance	3.006 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	5.0	Maximum Output Current
2.	VinMax	50.0	Maximum input voltage
3.	VinMin	14.0	Minimum input voltage
4.	Vout	12.0	Output Voltage
5.	base_pn	LM5085	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. **LM5085** Product Folder : http://www.ti.com/product/LM5085 : contains the data sheet and other resources.