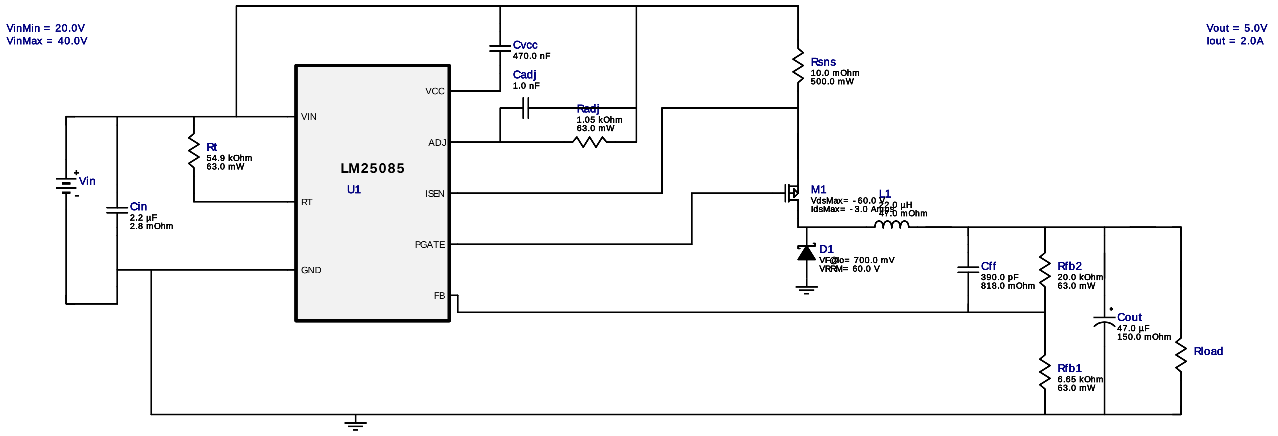
WEBENCH ® Design Report

VinMin = 20.0V
VinMax = 40.0V
Vout = 5.0V
Iout = 2.0A

Device = LM25085MY/NOPB
Topology = Buck
Created = 6/30/15 6:00:42 AM
BOM Cost = $2.31
Footprint = 367.0 mm^2
BOM Count = 14
Total Pd = 1.53W

Design : 4387550/1 LM25085MY/NOPB
LM25085MY/NOPB 20.0V-40.0V to 5.00V @ 2.0A

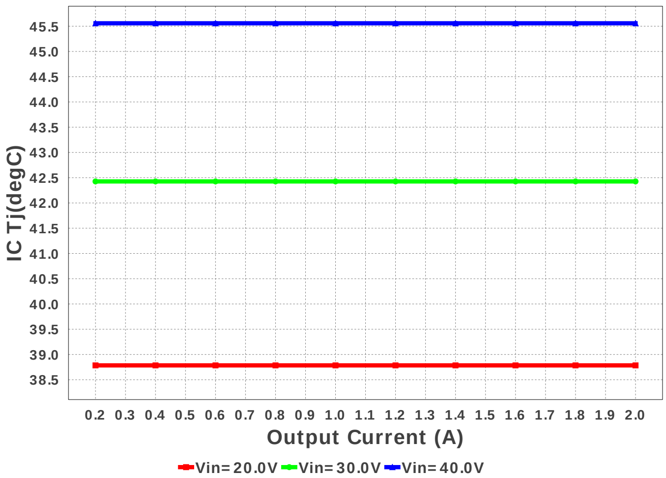


Electrical BOM

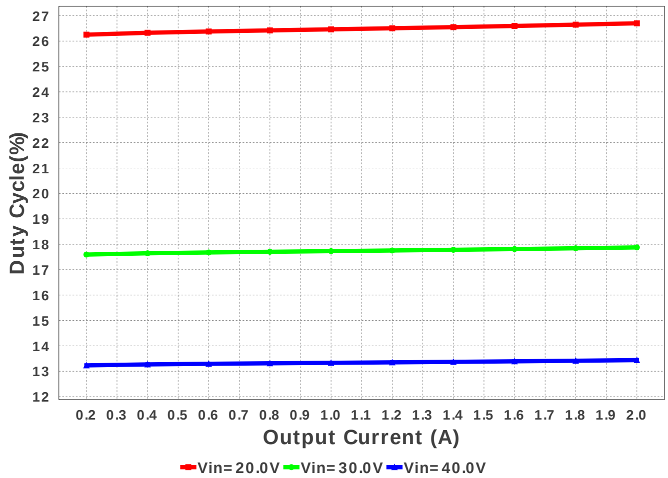
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cadj	Yageo America	CC0805JRNPO9BN102 Series= C0G/NP0	Cap= 1.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
2.	Cff	Kemet	C0805C391K5RACTU Series= X7R	Cap= 390.0 pF ESR= 818.0 mOhm VDC= 50.0 V IRMS= 193.0 mA	1	$0.06	0805 7 mm^2
3.	Cin	TDK	C3225X7R2A225K230AB Series= X7R	Cap= 2.2 uF ESR= 2.8 mOhm VDC= 100.0 V IRMS= 9.8247 A	1	$0.19	1210 15 mm^2
4.	Cout	Panasonic	6TPU47MSI Series= 1277	Cap= 47.0 uF ESR= 150.0 mOhm VDC= 6.3 V IRMS= 510.0 mA	1	$0.46	2012-10 7 mm^2
5.	Cvcc	Taiyo Yuden	EMK212B7474KD-T Series= X7R	Cap= 470.0 nF VDC= 16.0 V IRMS= 0.0 A	1	$0.02	0805 7 mm^2
6.	D1	Diodes Inc.	B360A-13-F	VF@Io= 700.0 mV VRRM= 60.0 V	1	$0.14	SMA 37 mm^2
7.	L1	Bourns	SDR1307-220ML	L= 22.0 µH DCR= 47.0 mOhm	1	$0.35	SDR1307 227 mm^2
8.	M1	Fairchild Semiconductor	FDC5614P	VdsMax= -60.0 V IdsMax= -3.0 Amps	1	$0.23	SOT-23-6 15 mm^2
9.	Radj	Vishay-Dale	CRCW04021K05FKED Series= CRCW..e3	Res= 1.05 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	Rfb1	Vishay-Dale	CRCW04026K65FKED Series= CRCW..e3	Res= 6.65 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
11.	Rfb2	Vishay-Dale	CRCW040220K0FKED Series= CRCW..e3	Res= 20.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
12.	Rsns	Stackpole Electronics Inc	CSR1206FK10L0 Series= ?	Res= 10.0 mOhm Power= 500.0 mW Tolerance= 1.0%	1	$0.11	1206 11 mm^2
13.	Rt	Vishay-Dale	CRCW040254K9FKED Series= CRCW..e3	Res= 54.9 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
14.	U1	Texas Instruments	LM25085MY/NOPB	Switcher	1	$0.70	MUY08A 24 mm^2

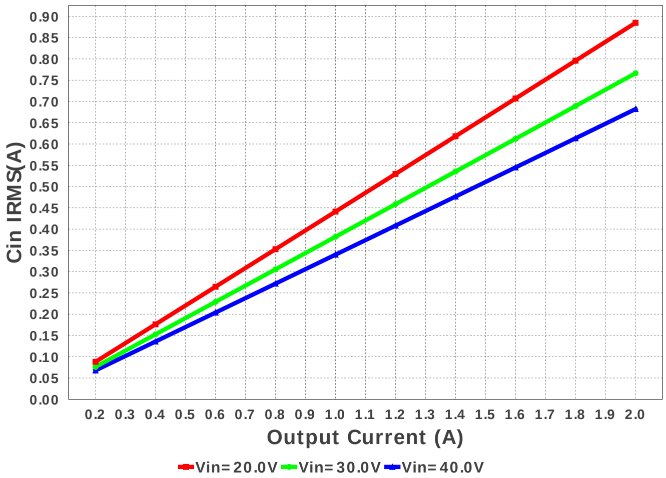
IC Tj



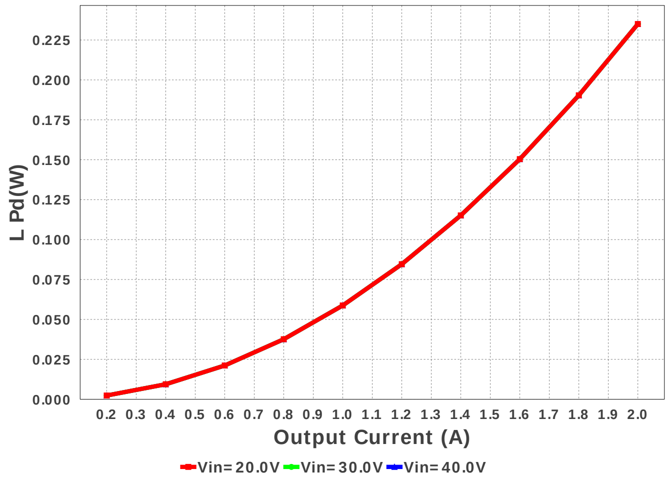
Duty Cycle

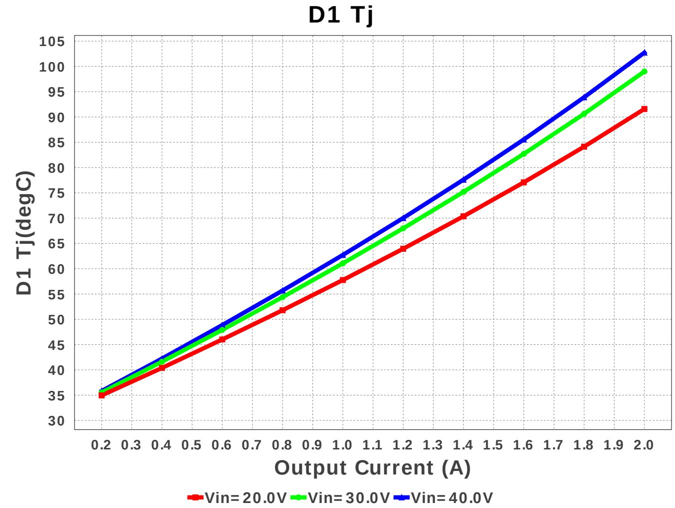


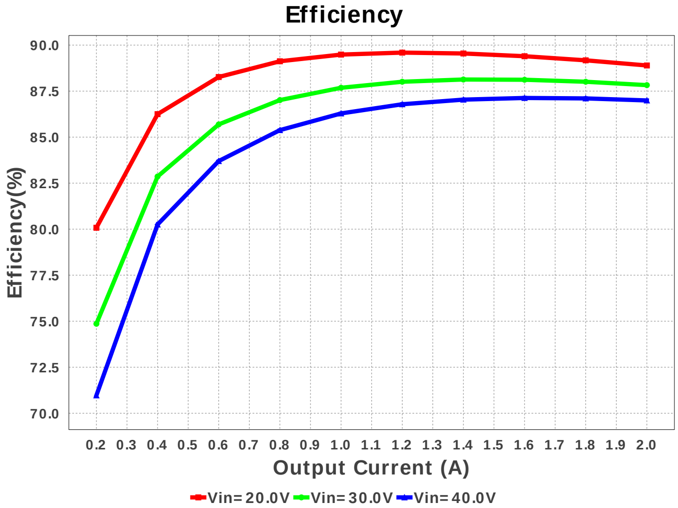
Cin IRMS

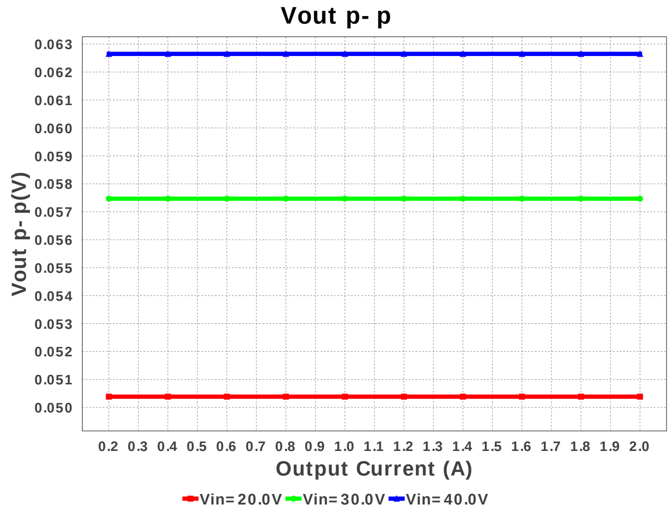


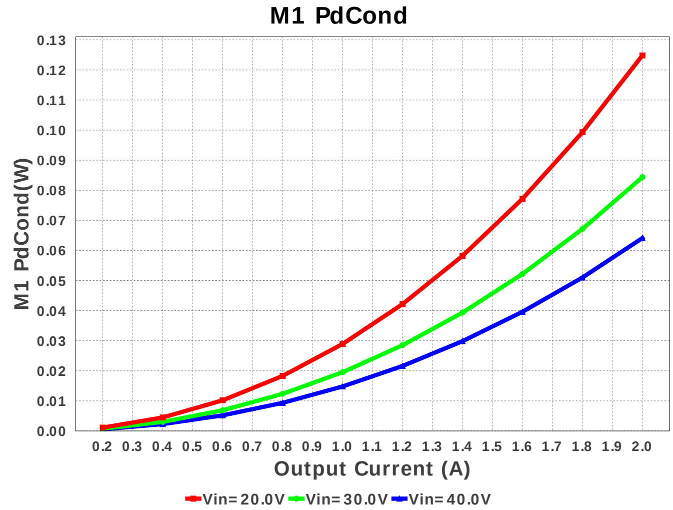
L Pd

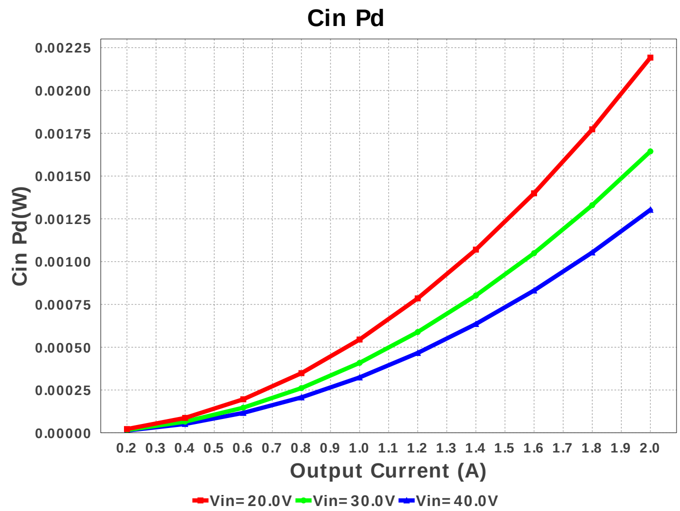


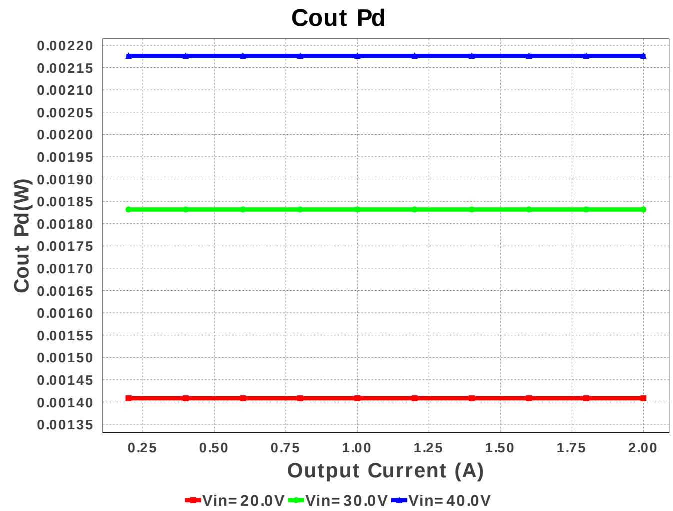

D1 Tj
D1 Tj(degC)
Output Current (A)
Vin= 20.0V Vin= 30.0V Vin= 40.0V


Efficiency
Efficiency(%)
Output Current (A)
Vin= 20.0V Vin= 30.0V Vin= 40.0V

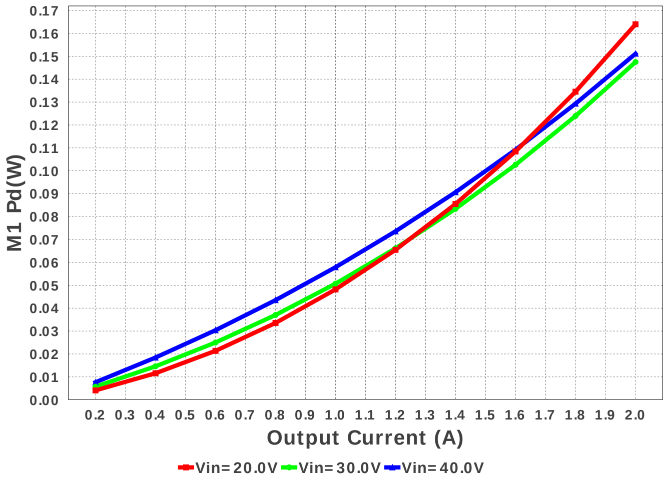

Vout p- p
Vout p- p(V)
Output Current (A)
Vin= 20.0V Vin= 30.0V Vin= 40.0V


M1 PdCond
M1 PdCond(W)
Output Current (A)
Vin= 20.0V Vin= 30.0V Vin= 40.0V

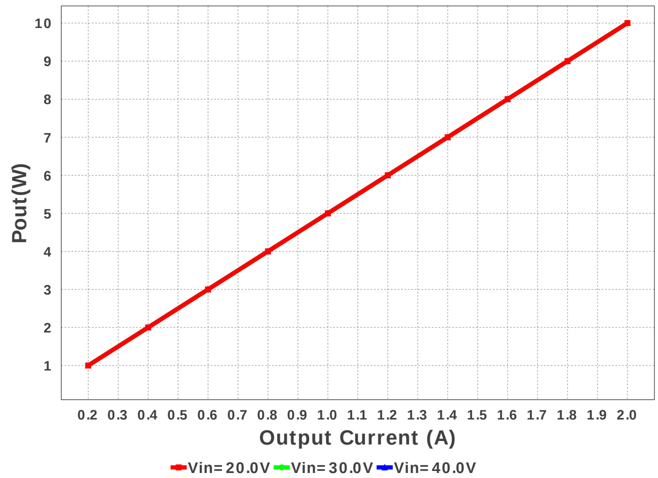

Cin Pd
Cin Pd(W)
Output Current (A)
Vin= 20.0V Vin= 30.0V Vin= 40.0V


Cout Pd
Cout Pd(W)
Output Current (A)
Vin= 20.0V Vin= 30.0V Vin= 40.0V

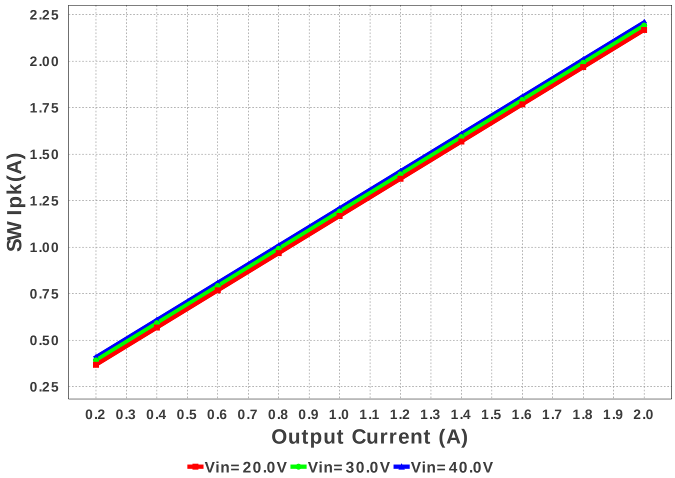
M1 Pd



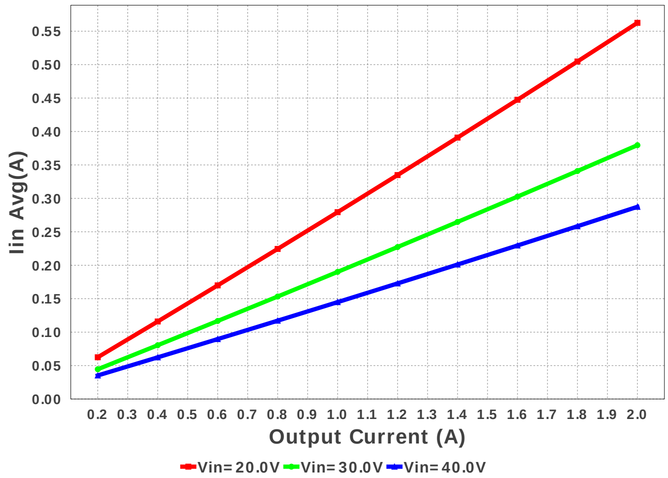
Pout



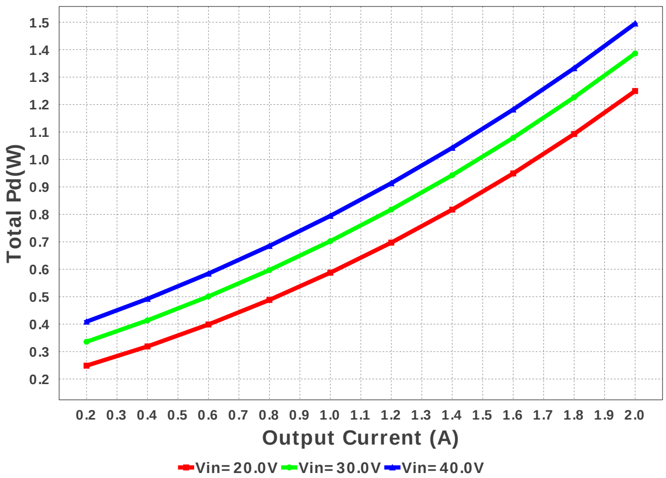
SW Ipk



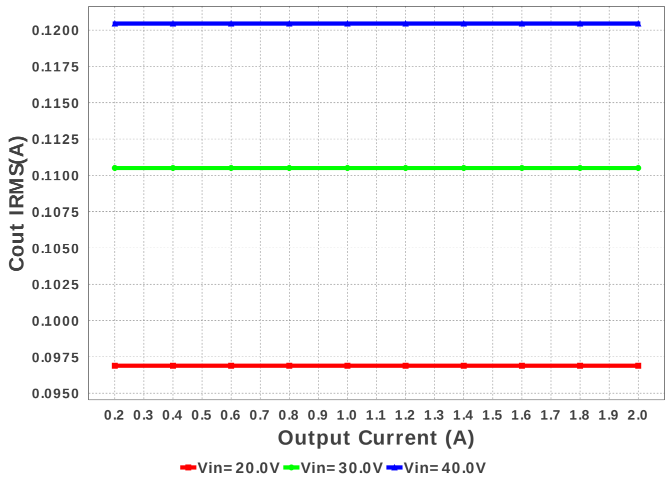
Iin Avg

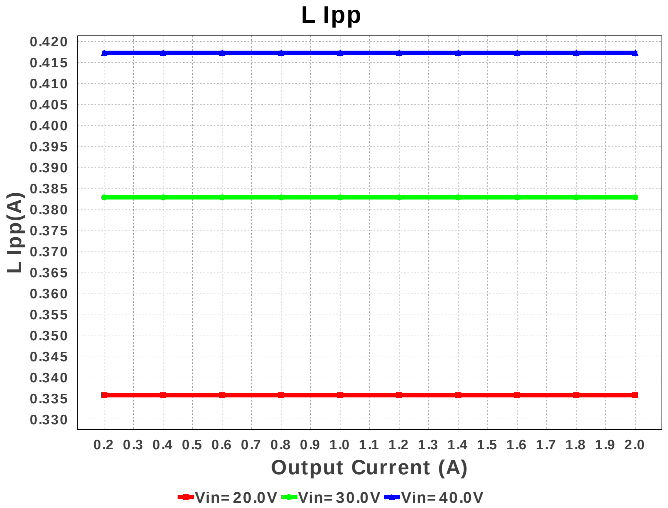


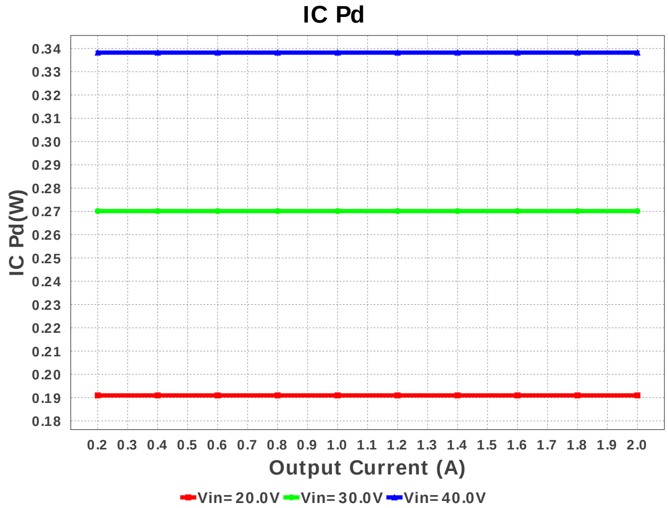
Total Pd

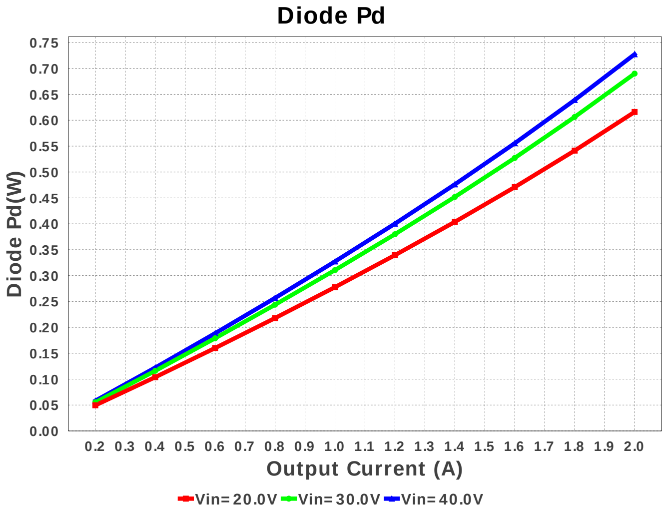


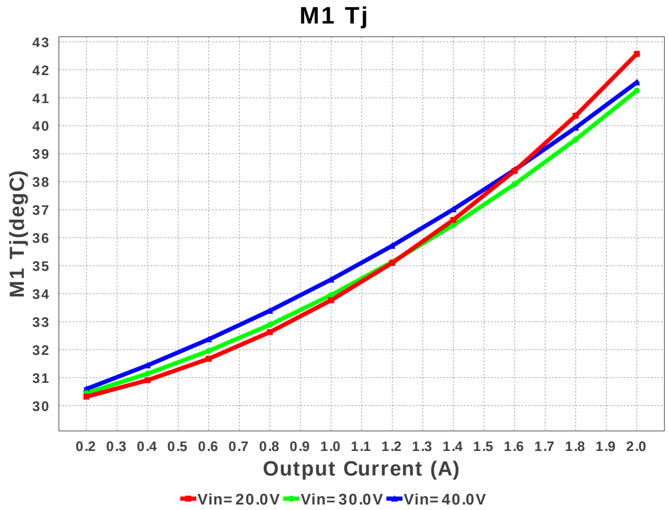
Cout IRMS

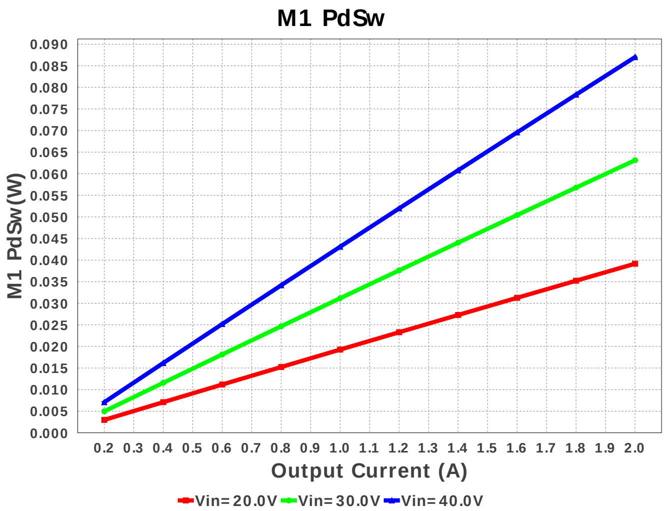












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	683.035 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	120.451 mA	Current	Output capacitor RMS ripple current
3.	Iin Avg	288.23 mA	Current	Average input current
4.	L Ipp	417.25 mA	Current	Peak-to-peak inductor ripple current
5.	SW Ipk	2.209 A	Current	Peak switch current
6.	BOM Count	14	General	Total Design BOM count
7.	FootPrint	367.0 mm^2	General	Total Foot Print Area of BOM components
8.	Frequency	400.289 kHz	General	Switching frequency
9.	IC Tolerance	25.0 mV	General	IC Feedback Tolerance
10.	Pout	10.0 W	General	Total output power
11.	Total BOM	$2.31	General	Total BOM Cost

#	Name	Value	Category	Description
12.	D1 Tj	106.085 degC	Op_Point	D1 junction temperature
13.	Vout OP	5.0 V	Op_Point	Operational Output Voltage
14.	Duty Cycle	13.481 %	Op_point	Duty cycle
15.	Efficiency	86.737 %	Op_point	Steady state efficiency
16.	IC Tj	45.558 degC	Op_point	IC junction temperature
17.	ICThetaJA	46.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
18.	IOUT_OP	2.0 A	Op_point	Iout operating point
19.	M1 Tj	41.572 degC	Op_point	M1 MOSFET junction temperature
20.	VIN_OP	40.0 V	Op_point	Vin operating point
21.	Vout p-p	62.65 mV	Op_point	Peak-to-peak output ripple voltage
22.	Cin Pd	1.306 mW	Power	Input capacitor power dissipation
23.	Cout Pd	2.176 mW	Power	Output capacitor power dissipation
24.	Diode Pd	760.855 mW	Power	Diode power dissipation
25.	IC Pd	338.208 mW	Power	IC power dissipation
26.	L Pd	235.0 mW	Power	Inductor power dissipation
27.	M1 Pd	151.62 mW	Power	M1 MOSFET total power dissipation
28.	M1 PdCond	64.572 mW	Power	M1 MOSFET conduction losses
29.	M1 PdSw	87.048 mW	Power	M1 MOSFET switching losses
30.	Total Pd	1.529 W	Power	Total Power Dissipation

Design Inputs

#	Name	Value	Description
1.	Iout	2.0	Maximum Output Current
2.	Iout1	2.0	Output Current #1
3.	VinMax	40.0	Maximum input voltage
4.	VinMin	20.0	Minimum input voltage
5.	Vout	5.0	Output Voltage
6.	Vout1	5.0	Output Voltage #1
7.	base_pn	LM25085	Base Product Number
8.	source	DC	Input Source Type
9.	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.