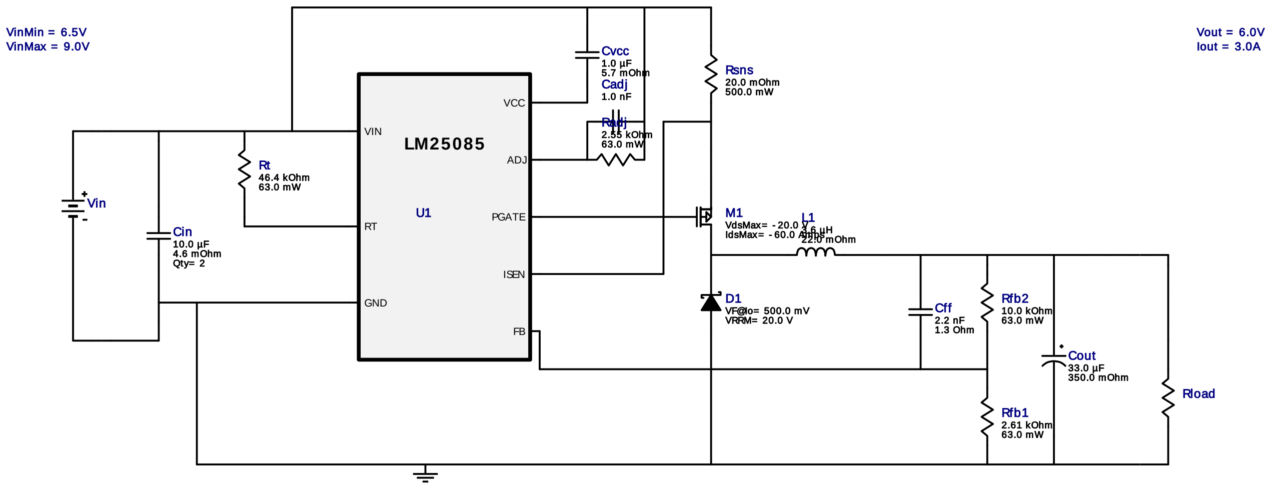
TEXAS INSTRUMENTS

WEBENCH® Design Report

VinMin = 6.5V
VinMax = 9.0V
Vout = 6.0V
Iout = 3.0A

Device = LM25085MM/NOPB
Topology = Buck
Created = 2/6/14 12:51:37 AM
BOM Cost = $2.08
Total Pd = 1.14W
Footprint = 258.0mm2
BOM Count = 15

Design : 3515386/15 LM25085MM/NOPB
LM25085MM/NOPB 6.5V-9.0V to 6.0V @ 3.0A

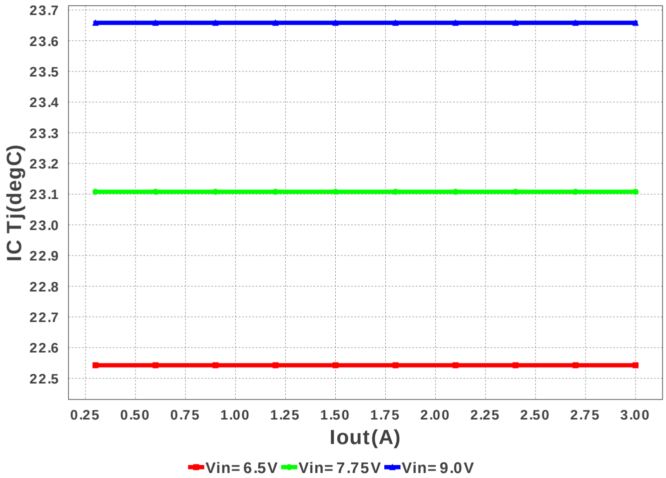


Electrical BOM

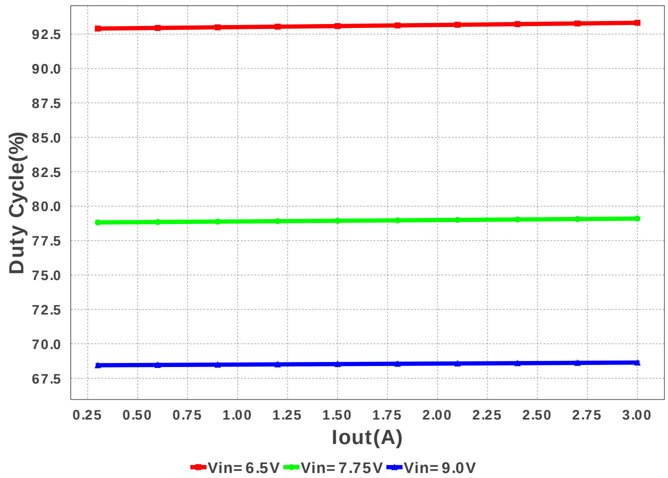
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cadj	Yageo America	CC0805KRX7R9BB102 Series= X7R	Cap= 1.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7mm2
2.	Cff	MuRata	GRM188R71E222KA01D Series= X7R	Cap= 2.2 nF ESR= 1.3 Ohm VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0603 5mm2
3.	Cin	TDK	C3216X5R1C106M Series= X5R	Cap= 10.0 µF ESR= 4.6 mOhm VDC= 16.0 V IRMS= 2.7 A	2	$0.06	1206 11mm2
4.	Cout	AVX	TPSB336K016R0350 Series= TPS	Cap= 33.0 µF ESR= 350.0 mOhm VDC= 16.0 V IRMS= 444.0 mA	1	$0.33	3528-21 17mm2
5.	Cvcc	TDK	C1608X5R1C105K Series= X5R	Cap= 1.0 µF ESR= 5.7 mOhm VDC= 16.0 V IRMS= 0.0 A	1	$0.01	0603 5mm2
6.	D1	Diodes Inc.	B220A-13-F	VF@Io= 500.0 mV VRRM= 20.0 V	1	$0.09	SMA 37mm2
7.	L1	Bourns	SRN8040-3R6Y	L= 3.6 µH DCR= 22.0 mOhm	1	$0.21	SRN8040 100mm2
8.	M1	Texas Instruments	CSD25401Q3	VdsMax= -20.0 V IdsMax= -60.0 Amps	1	$0.46	TRANS_NexFET_Q3 19mm2
9.	Radj	Vishay-Dale	CRCW04022K55FKED Series= CRCW..e3	Res= 2.55 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3mm2

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	Rfb1	Vishay-Dale	CRCW04022K61FKED Series= CRCW..e3	Res= 2.61 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3mm2
11.	Rfb2	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3mm2
12.	Rsns	Stackpole Electronics Inc	CSR1206FK20L0 Series= ?	Res= 20.0 mOhm Power= 500.0 mW Tolerance= 1.0%	1	$0.10	1206 11mm2
13.	Rt	Vishay-Dale	CRCW040246K4FKED Series= CRCW..e3	Res= 46.4 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3mm2
14.	U1	Texas Instruments	LM25085MM/NOPB	Switcher	1	$0.70	MUA08A 24mm2

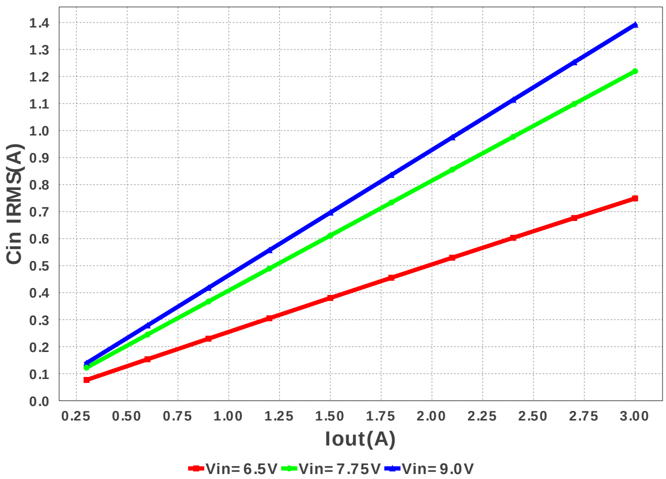
IC Tj



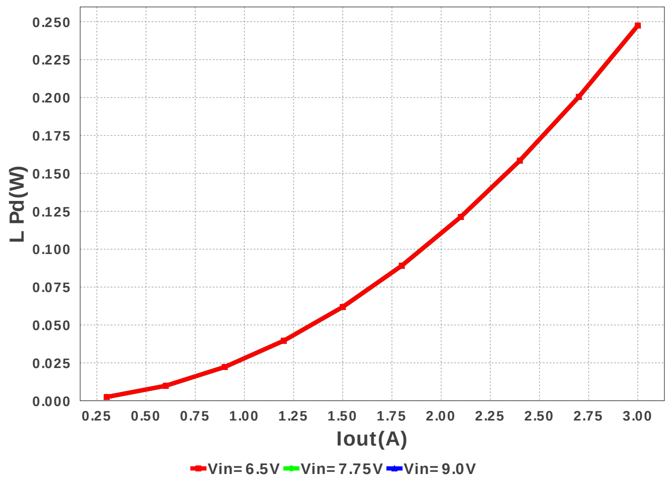
Duty Cycle

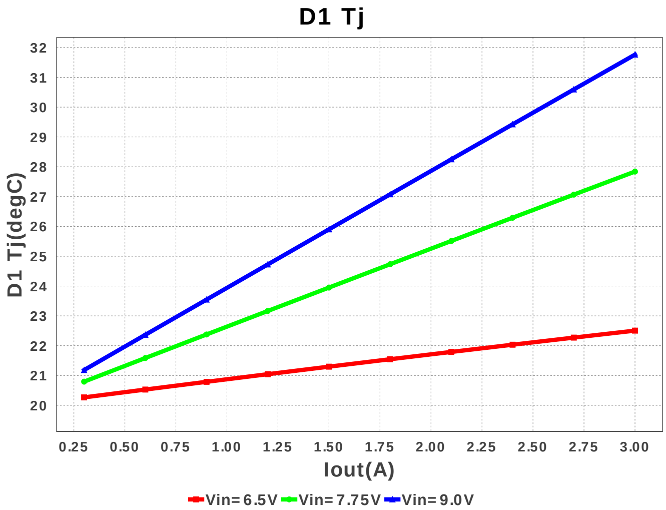


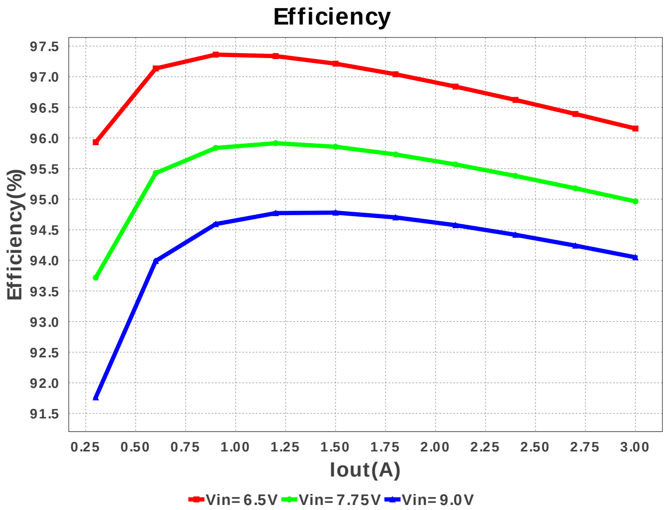
Cin IRMS

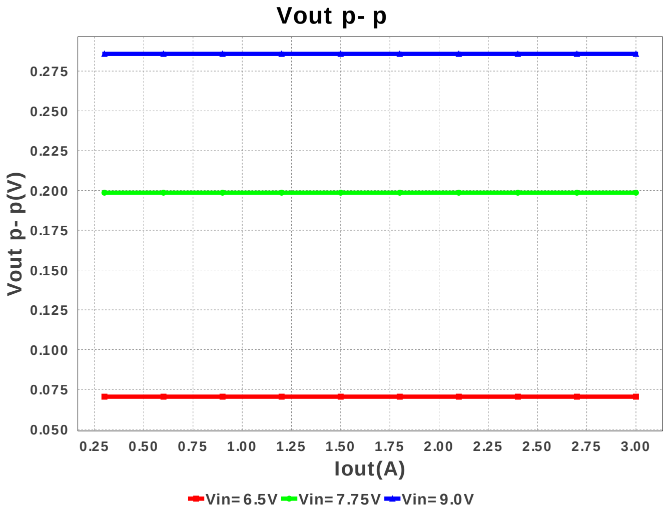


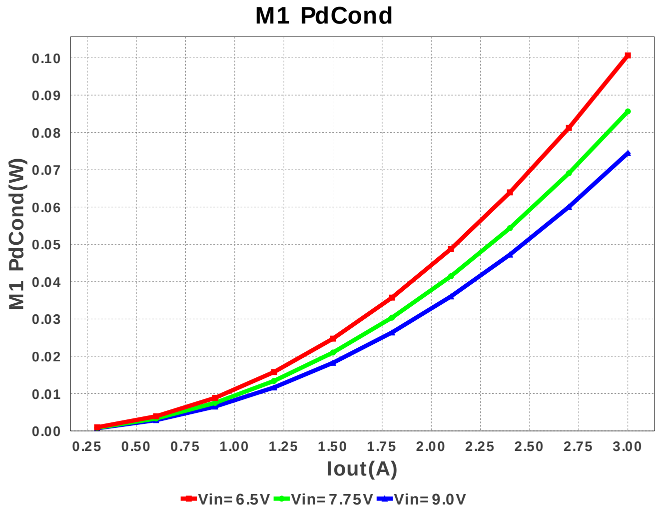
L Pd

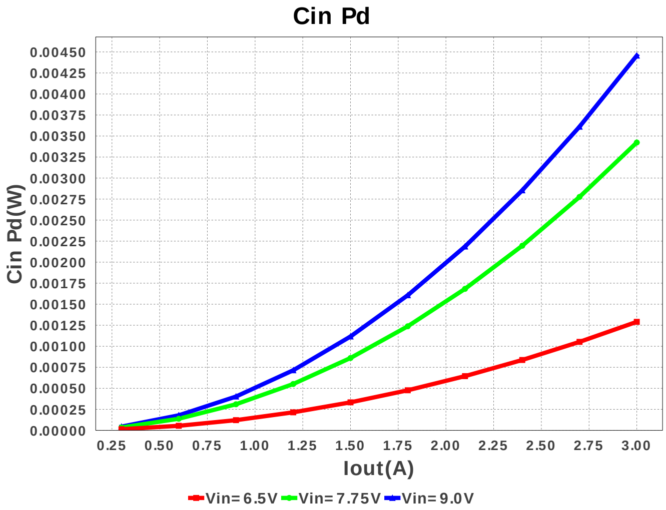


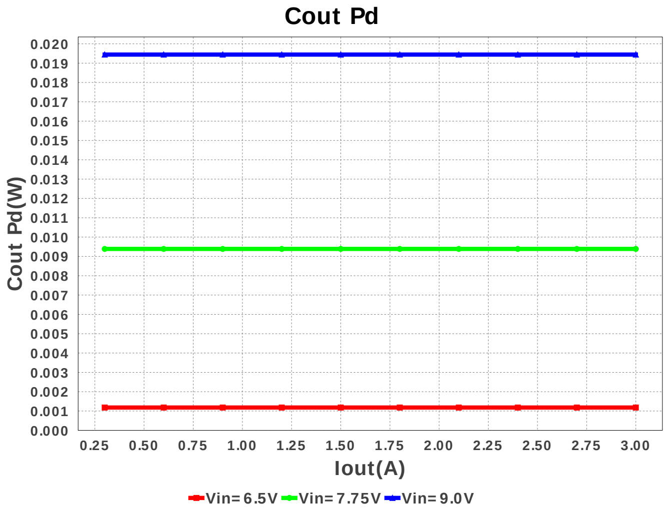

D1 Tj
D1 Tj(degC)
Iout(A)
Vin=6.5V Vin=7.75V Vin=9.0V


Efficiency
Efficiency(%)
Iout(A)
Vin=6.5V Vin=7.75V Vin=9.0V

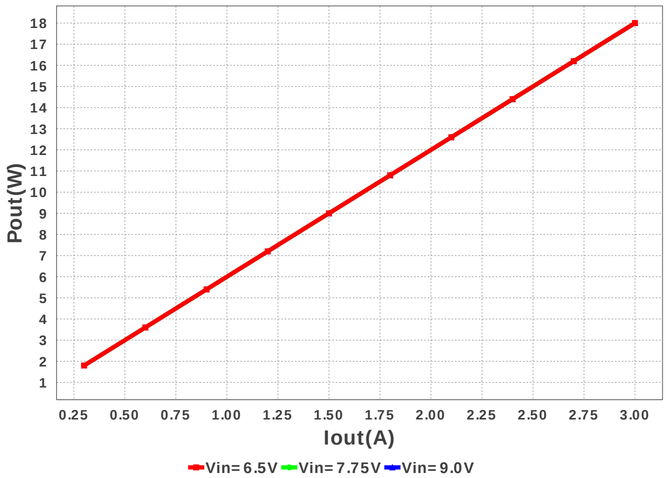

Vout p-p
Vout p-p(V)
Iout(A)
Vin=6.5V Vin=7.75V Vin=9.0V


M1 PdCond
M1 PdCond(W)
Iout(A)
Vin=6.5V Vin=7.75V Vin=9.0V

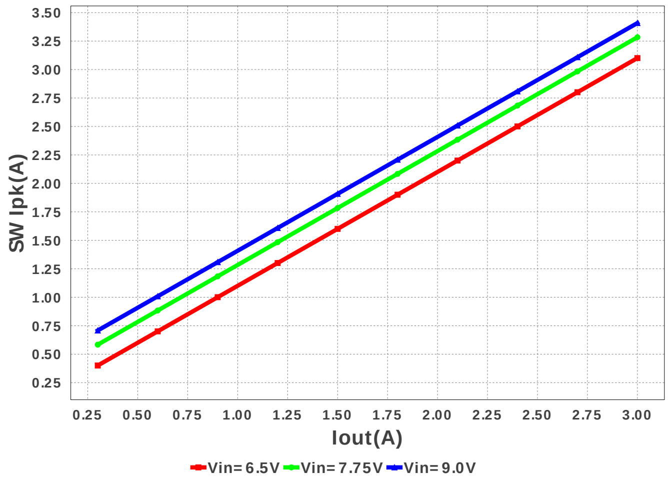

Cin Pd
Cin Pd(W)
Iout(A)
Vin=6.5V Vin=7.75V Vin=9.0V


Cout Pd
Cout Pd(W)
Iout(A)
Vin=6.5V Vin=7.75V Vin=9.0V

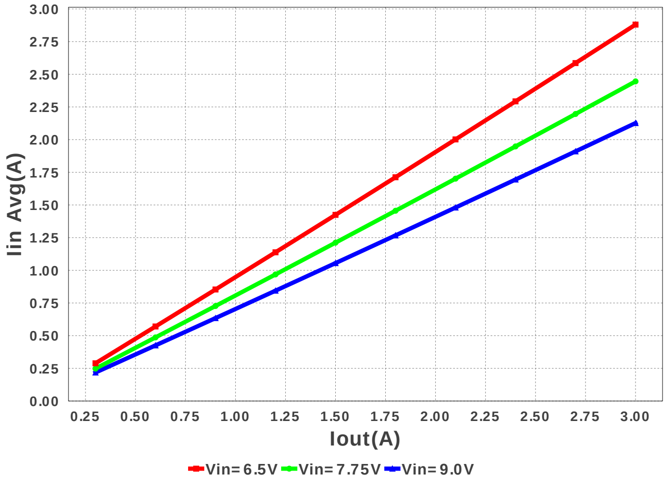
Pout



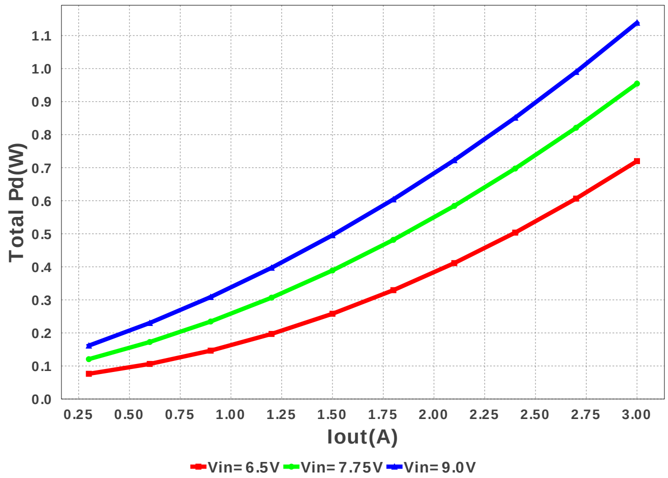
SW Ipk



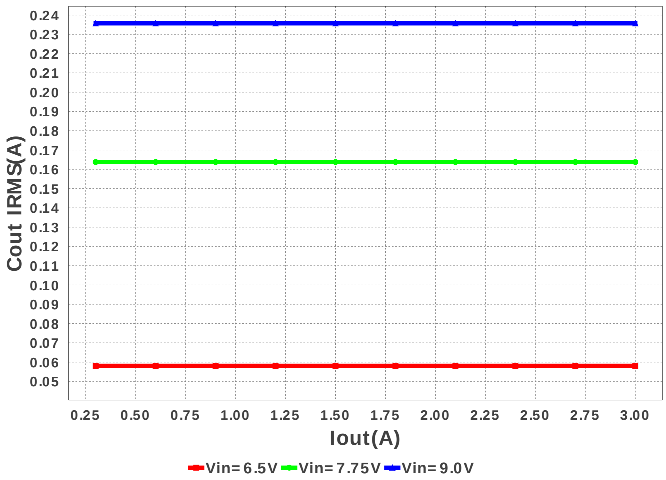
Iin Avg



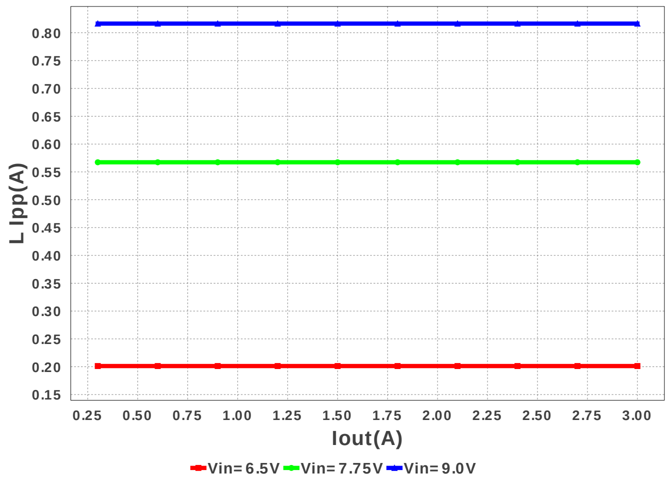
Total Pd

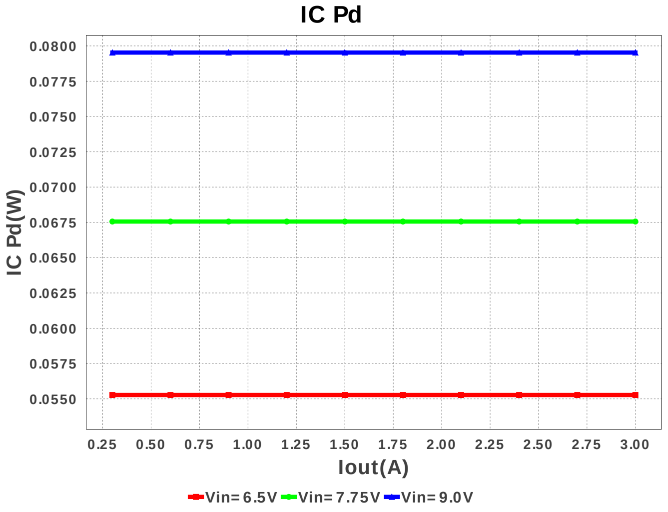


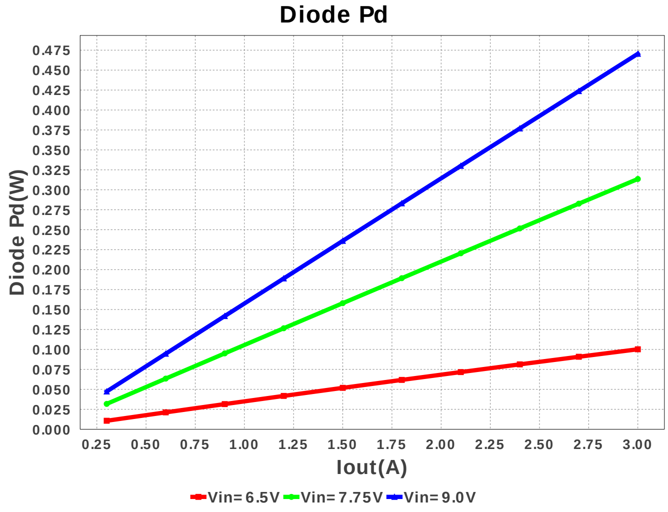
Cout IRMS

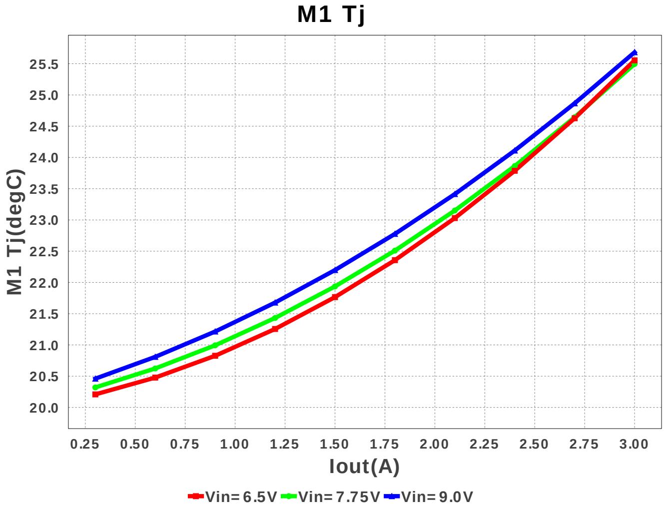


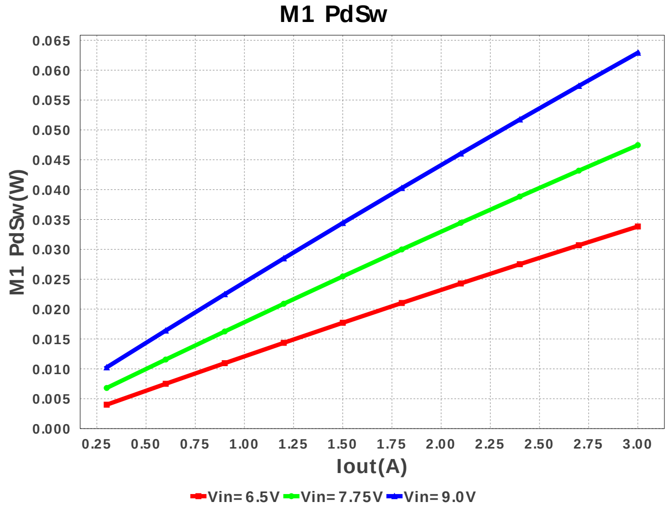
L Ipp











Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	1.392 A	Current	Input capacitor RMS ripple current
2.	Cout IRMS	235.692 mA	Current	Output capacitor RMS ripple current
3.	Iin Avg	2.126 A	Current	Average input current
4.	L Ipp	816.463 mA	Current	Peak-to-peak inductor ripple current
5.	SW Ipk	3.408 A	Current	Peak switch current
6.	BOM Count	15	General	Total Design BOM count
7.	FootPrint	258.0 mm2	General	Total Foot Print Area of BOM components
8.	Frequency	647.403 kHz	General	Switching frequency
9.	IC Tolerance	25.0 mV	General	IC Feedback Tolerance
10.	Pout	18.0 W	General	Total output power
11.	Total BOM	$2.08	General	Total BOM Cost
12.	D1 Tj	31.761 degC	Op_Point	D1 junction temperature
13.	Vout OP	6.0 V	Op_Point	Operational Output Voltage
14.	Duty Cycle	68.637 %	Op_point	Duty cycle
15.	Efficiency	94.051 %	Op_point	Steady state efficiency
16.	IC Tj	23.658 degC	Op_point	IC junction temperature
17.	ICThetaJA	46.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
18.	IOUT_OP	3.0 A	Op_point	Iout operating point
19.	M1 Tj	25.683 degC	Op_point	M1 MOSFET junction temperature
20.	VIN_OP	9.0 V	Op_point	Vin operating point
21.	Vout p-p	285.802 mV	Op_point	Peak-to-peak output ripple voltage
22.	Cin Pd	4.456 mW	Power	Input capacitor power dissipation
23.	Cout Pd	19.443 mW	Power	Output capacitor power dissipation
24.	Diode Pd	470.447 mW	Power	Diode power dissipation
25.	IC Pd	79.529 mW	Power	IC power dissipation
26.	L Pd	247.5 mW	Power	Inductor power dissipation
27.	M1 PdCond	74.235 mW	Power	M1 MOSFET conduction losses
28.	M1 PdSw	62.911 mW	Power	M1 MOSFET switching losses
29.	Total Pd	1.139 W	Power	Total Power Dissipation

Design Inputs

#	Name	Value	Description
1.	Iout	3.0 A	Maximum Output Current
2.	Iout1	3.0 Amps	Output Current #1
3.	VinMax	9.0 V	Maximum input voltage
4.	VinMin	6.5 V	Minimum input voltage
5.	Vout	6.0 V	Output Voltage
6.	Vout1	6.0 Volt	Output Voltage #1
7.	base_pn	LM25085	Base Product Number
8.	source	DC	Input Source Type
9.	Ta	20.0 degC	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.