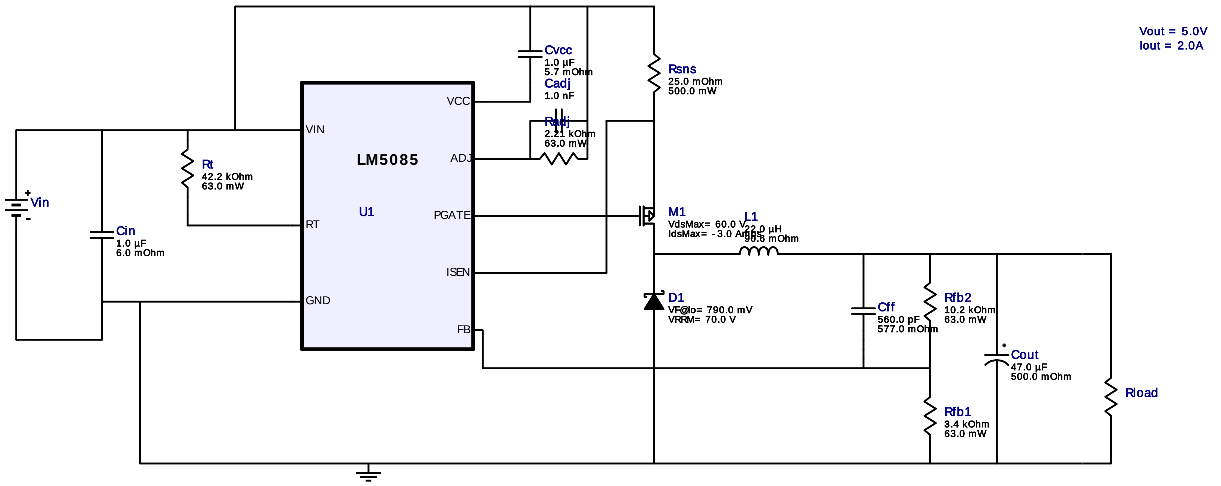
TEXAS INSTRUMENTS

VinMin = 24.0V
VinMax = 48.0V
Vout = 5.0V
Iout = 2.0A

Device = LM5085MM/NOPB
Topology = Buck
Created = 7/9/13 1:32:02 AM
BOM Cost = $2.47
BOM Count = 14
Total Pd = 2.61W

WEBENCH ® Design Report

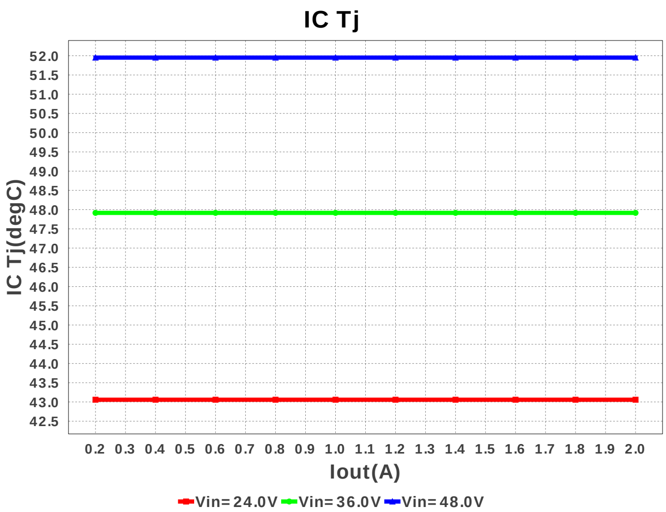
Design : 906020/20 LM5085MM/NOPB
LM5085MM/NOPB 24.0V-48.0V to 5.0V @ 2.0A

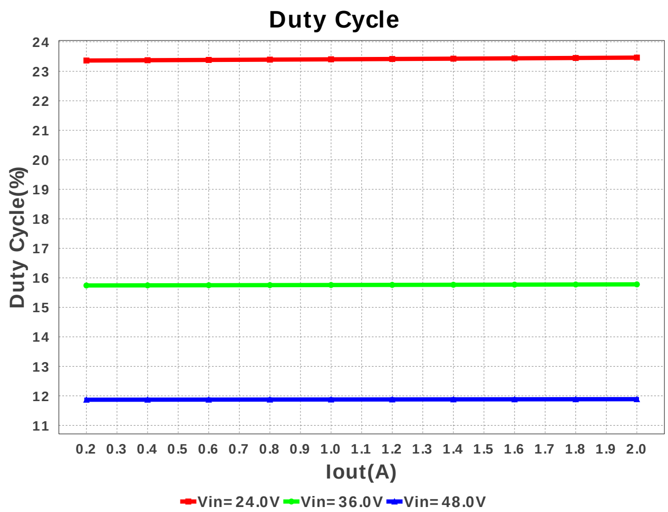


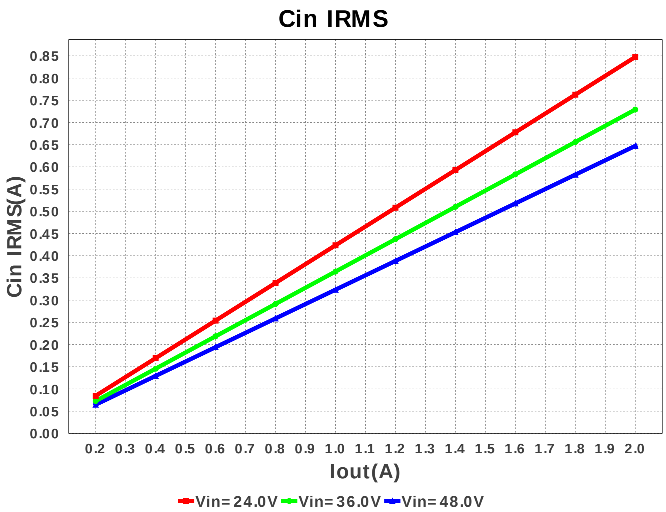
Electrical BOM

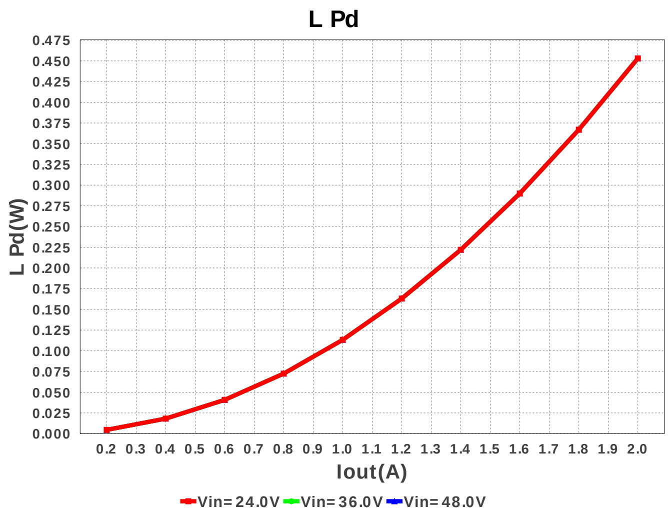
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cadj	Yageo America	CC0805KRX7R9BB102 Series= X7R	Cap= 1.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 13 mm^2
2.	Cff	Kemet	C0805C561K5RACTU Series= X7R	Cap= 560.0 pF ESR= 577.0 mOhm VDC= 50.0 V IRMS= 234.0 mA	1	$0.05	0805 13 mm^2
3.	Cin	TDK	C3216X7R2A105M Series= 285	Cap= 1.0 uF ESR= 6.0 mOhm VDC= 100.0 V IRMS= 4.5 A	1	$0.11	1206 19 mm^2
4.	Cout	AVX	TPSB476K010R0500 Series= TPS	Cap= 47.0 uF ESR= 500.0 mOhm VDC= 10.0 V IRMS= 371.0 mA	1	$0.29	3528-21 26 mm^2
5.	Cvcc	TDK	C1608X5R1C105K Series= X5R	Cap= 1.0 uF ESR= 5.7 mOhm VDC= 16.0 V IRMS= 0.0 A	1	$0.01	0603 10 mm^2
6.	D1	Diodes Inc.	B370-13-F	VF@Io= 790.0 mV VRRM= 70.0 V	1	$0.22	SMC 83 mm^2
7.	L1	Coilcraft	XAL5050-223MEB	L= 22.0 µH DCR= 90.6 mOhm	1	$0.60	XAL5050 54 mm^2
8.	M1	Fairchild Semiconductor	FDC5614P	VdsMax= 60.0 V IdsMax= -3.0 Amps	1	$0.19	SOT-23-6 24 mm^2
9.	Radj	Vishay-Dale	CRCW04022K21FKED Series= CRCW..e3	Res= 2.21 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 8 mm^2

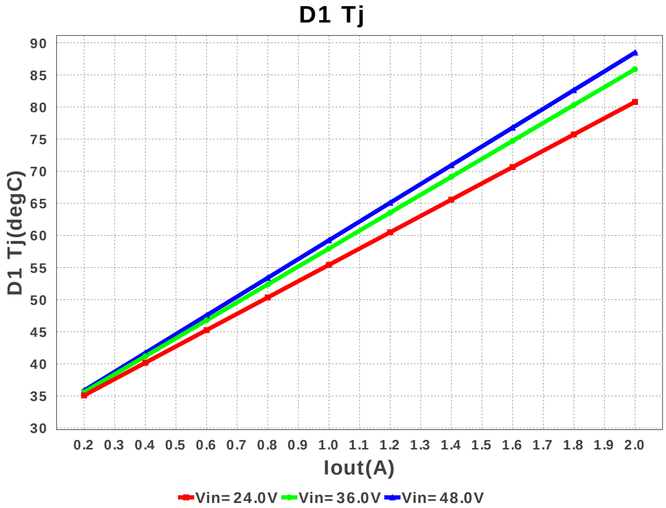
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	Rfb1	Vishay-Dale	CRCW04023K40FKED Series= CRCW..e3	Res= 3.4 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 8 mm^2
11.	Rfb2	Vishay-Dale	CRCW040210K2FKED Series= CRCW..e3	Res= 10.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 8 mm^2
12.	Rsns	Stackpole Electronics Inc	CSR1206FK25L0 Series= ?	Res= 25.0 mOhm Power= 500.0 mW Tolerance= 1.0%	1	$0.10	1206 19 mm^2
13.	Rt	Vishay-Dale	CRCW040242K2FKED Series= CRCW..e3	Res= 42.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 8 mm^2
14.	U1	Texas Instruments	LM5085MM/NOPB	Switcher	1	$0.85	MUA08A 34 mm^2

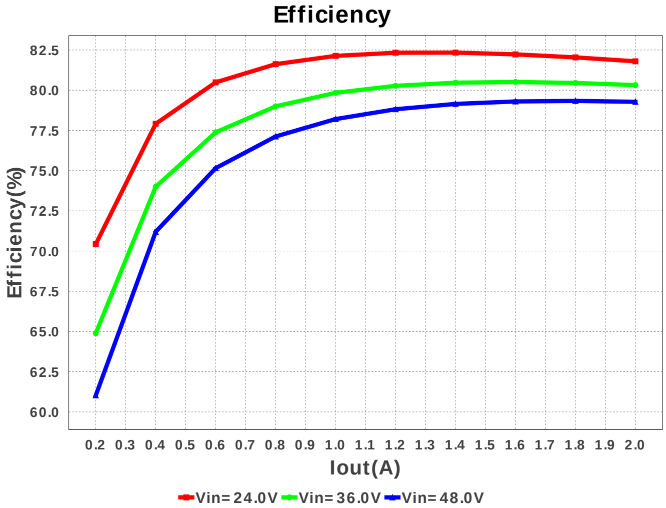


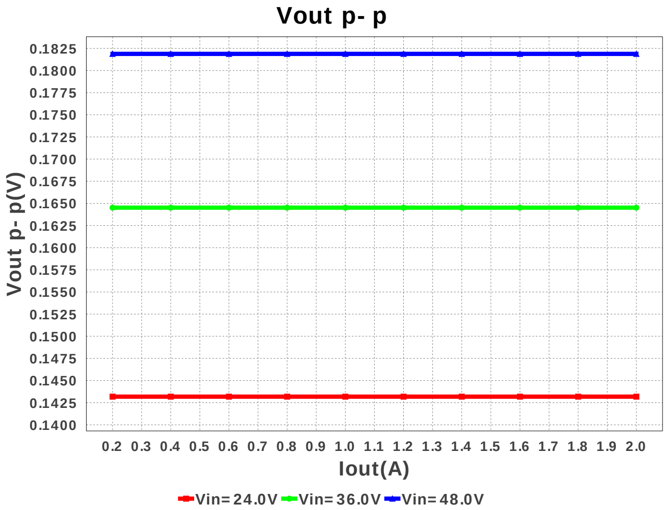


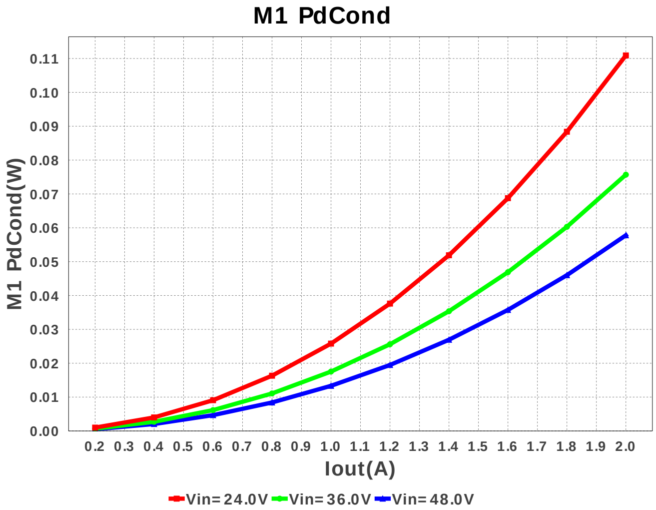


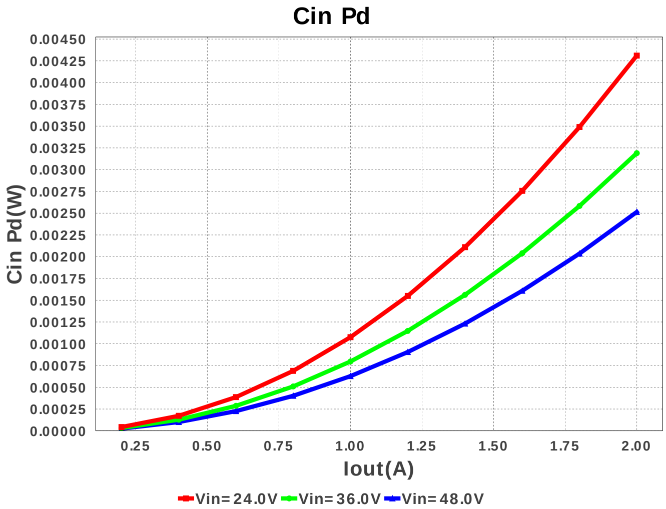


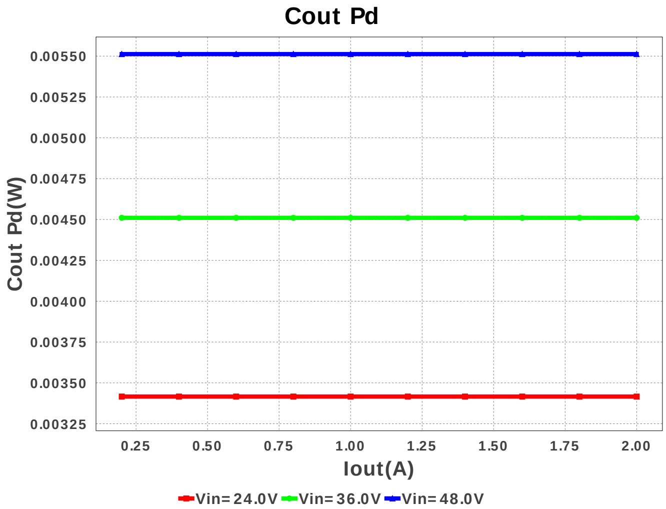

D1 Tj
D1 Tj(degC)
Iout(A)
Vin= 24.0V Vin= 36.0V Vin= 48.0V


Efficiency
Efficiency(%)
Iout(A)
Vin= 24.0V Vin= 36.0V Vin= 48.0V

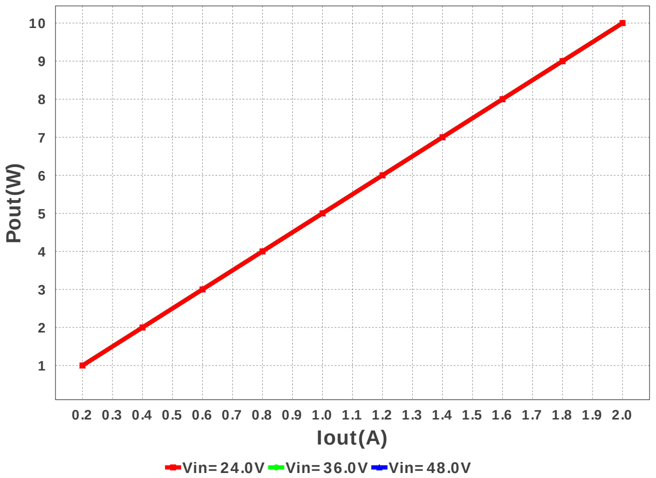

Vout p- p
Vout p- p(V)
Iout(A)
Vin= 24.0V Vin= 36.0V Vin= 48.0V


M1 PdCond
M1 PdCond(W)
Iout(A)
Vin= 24.0V Vin= 36.0V Vin= 48.0V

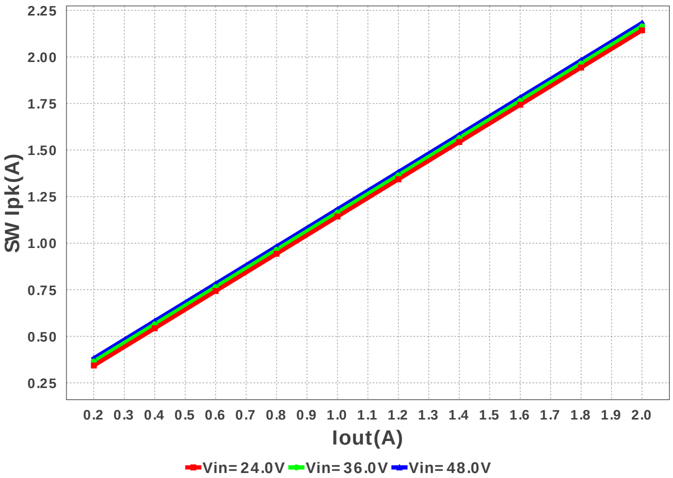

Cin Pd
Cin Pd(W)
Iout(A)
Vin= 24.0V Vin= 36.0V Vin= 48.0V


Cout Pd
Cout Pd(W)
Iout(A)
Vin= 24.0V Vin= 36.0V Vin= 48.0V

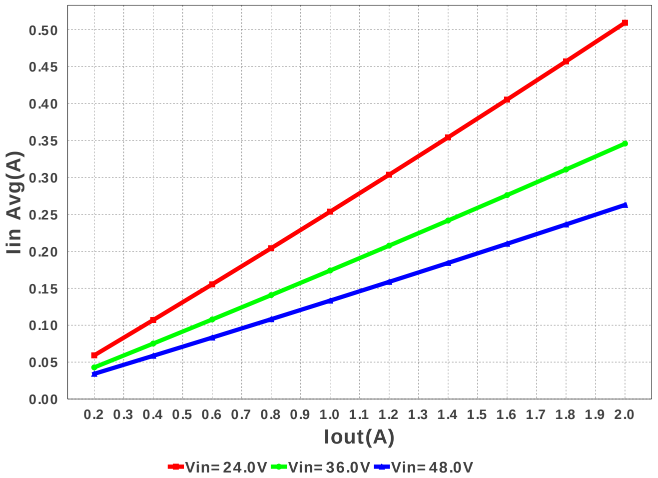
Pout



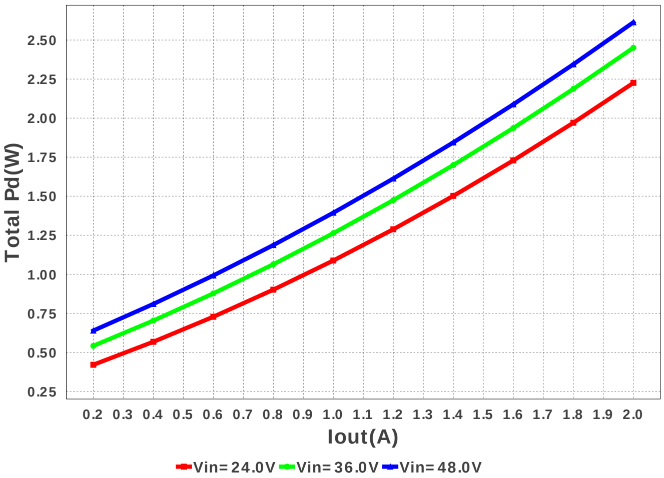
SW Ipk



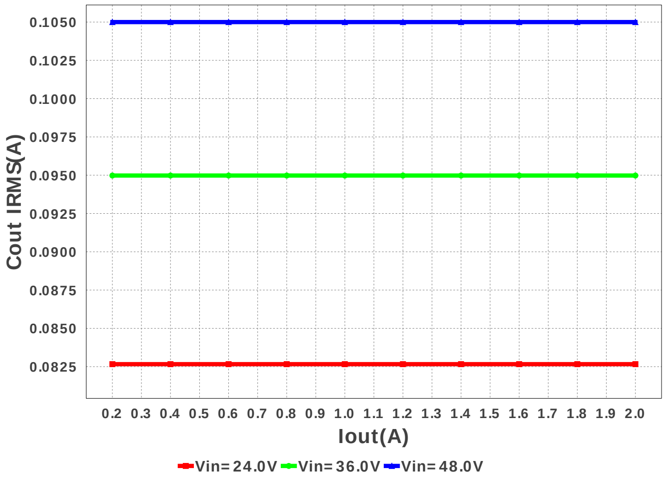
Iin Avg



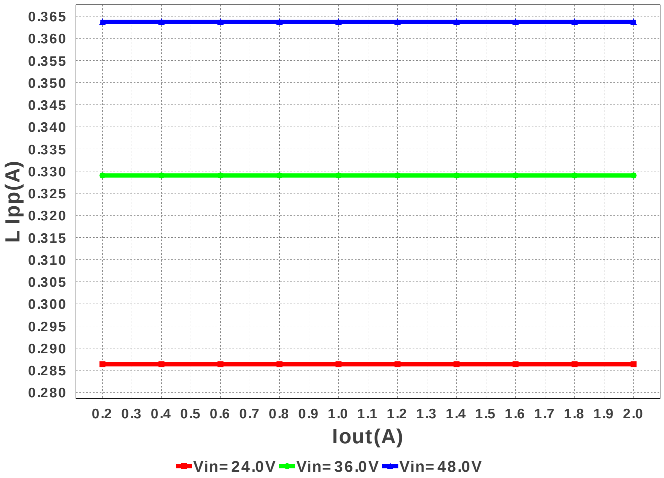
Total Pd

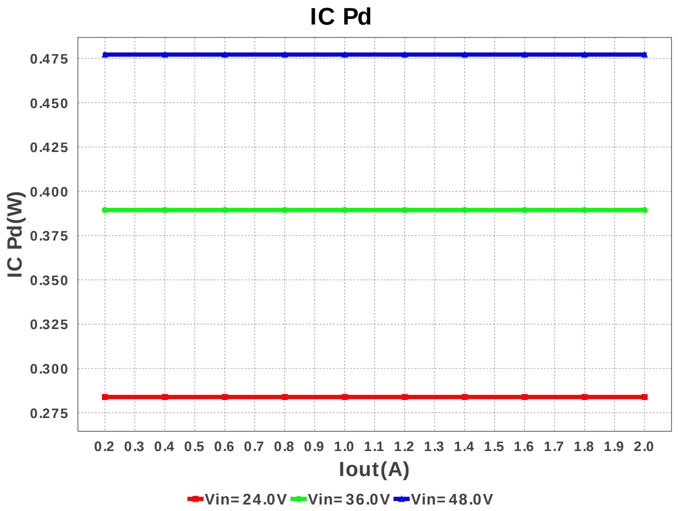


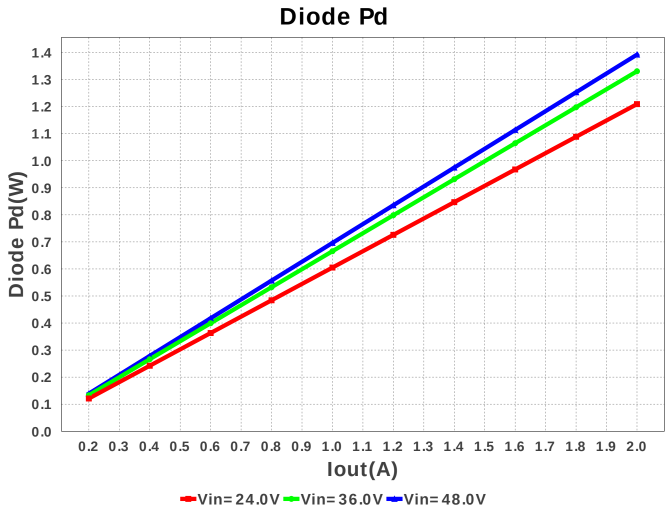
Cout IRMS

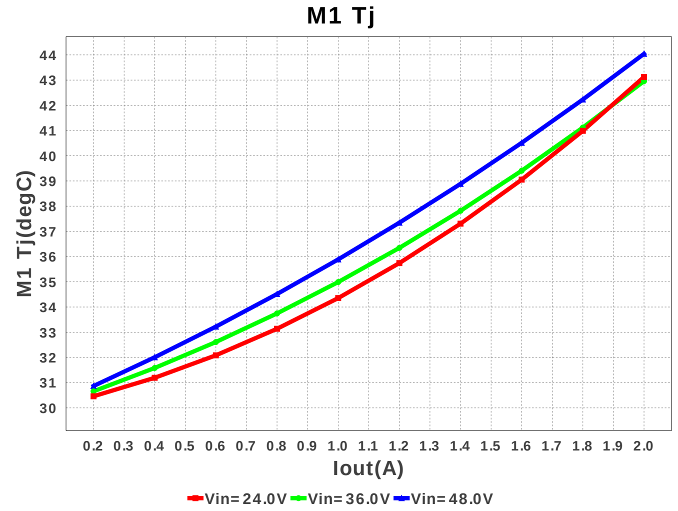


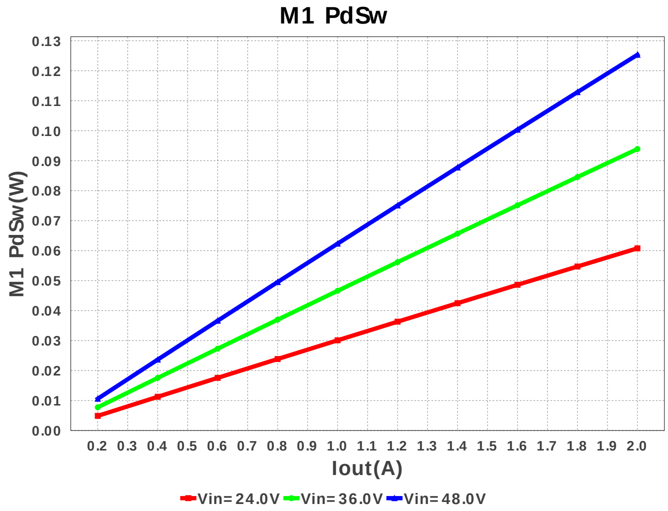
L Ipp











Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	647.292 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	104.999 mA	Current	Output capacitor RMS ripple current
3.	Iin Avg	262.8 mA	Current	Average input current
4.	L Ipp	363.728 mA	Current	Peak-to-peak inductor ripple current
5.	SW Ipk	2.182 A	Current	Peak switch current
6.	BOM Count	14	General	Total Design BOM count
7.	FootPrint	326.0 mm^2	General	Total Foot Print Area of BOM components
8.	Frequency	441.209 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	$2.47	General	Total BOM Cost
12.	D1 Tj	88.471 degC	Op_Point	D1 junction temperature
13.	Vout OP	5.0 V	Op_Point	Operational Output Voltage
14.	Duty Cycle	11.888 %	Op_point	Duty cycle
15.	Efficiency	79.275 %	Op_point	Steady state efficiency
16.	IC Tj	51.951 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	44.042 degC	Op_point	M1 MOSFET junction temperature
20.	VIN_OP	48.0 V	Op_point	Vin operating point
21.	Vout p-p	181.877 mV	Op_point	Peak-to-peak output ripple voltage
22.	Cin Pd	2.514 mW	Power	Input capacitor power dissipation
23.	Cout Pd	5.512 mW	Power	Output capacitor power dissipation
24.	Diode Pd	1.392 W	Power	Diode power dissipation
25.	IC Pd	477.205 mW	Power	IC power dissipation
26.	L Pd	453.0 mW	Power	Inductor power dissipation
27.	M1 PdCond	58.571 mW	Power	M1 MOSFET conduction losses
28.	M1 PdSw	125.341 mW	Power	M1 MOSFET switching losses
29.	Total Pd	2.614 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	48.0	Maximum input voltage
4.	VinMin	24.0	Minimum input voltage
5.	Vout	5.0	Output Voltage
6.	Vout1	5.0	Output Voltage #1
7.	base_pn	LM5085	Base Product Number
8.	source	DC	Input Source Type
9.	Ta	30.0	Ambient temperature
10.	UserFsw	344.651 k	Customer Selected Frequency

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.