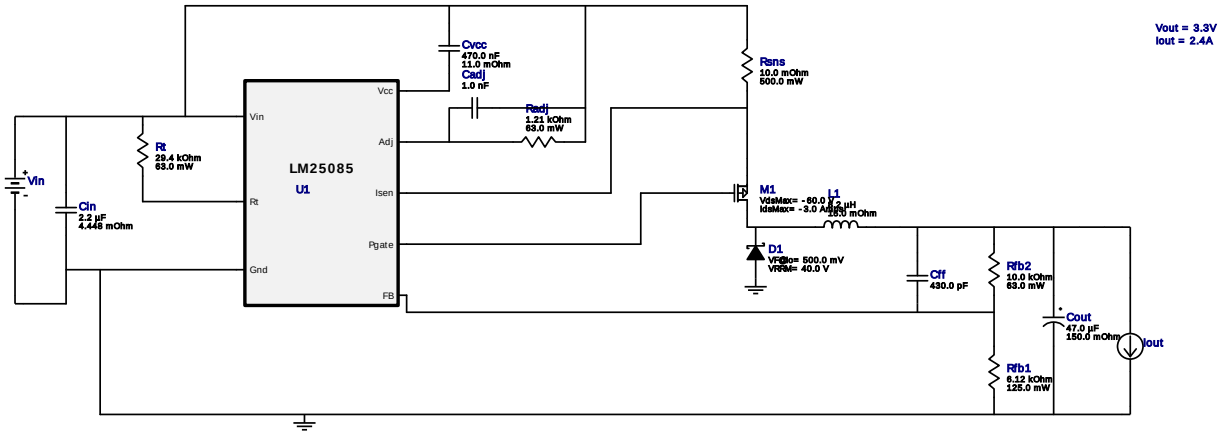
WEBENCH® Design Report

VinMin = 14.0V
VinMax = 22.0V
Vout = 3.3V
Iout = 2.4A

Device = LM25085MY/NOPB
Topology = Buck
Created = 9/17/16 6:18:10 AM
BOM Cost = $2.11
BOM Count = 14
Total Pd = 1.43W

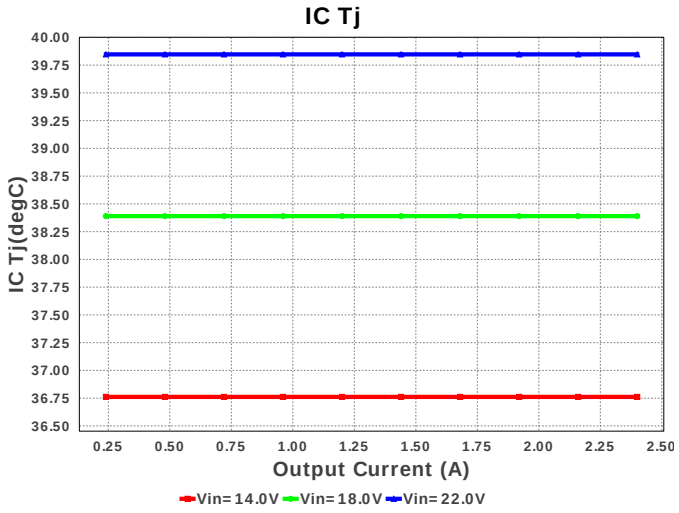
Design : 4358520/445 LM25085MY/NOPB
LM25085MY/NOPB 14.0V-22.0V to 3.30V @ 2.4A

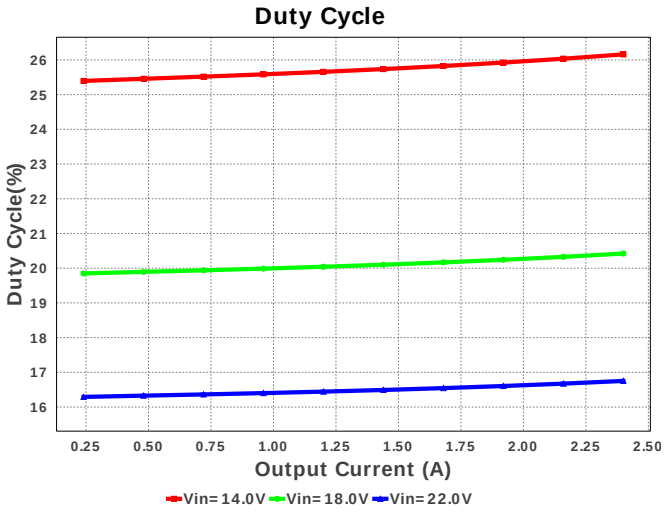


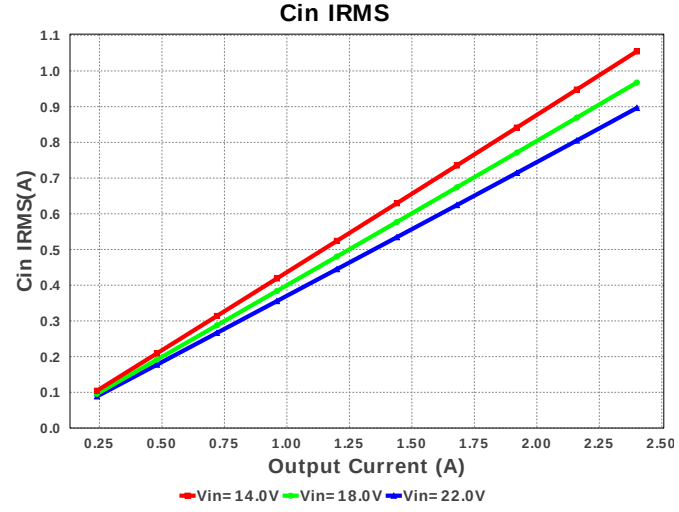
Electrical BOM

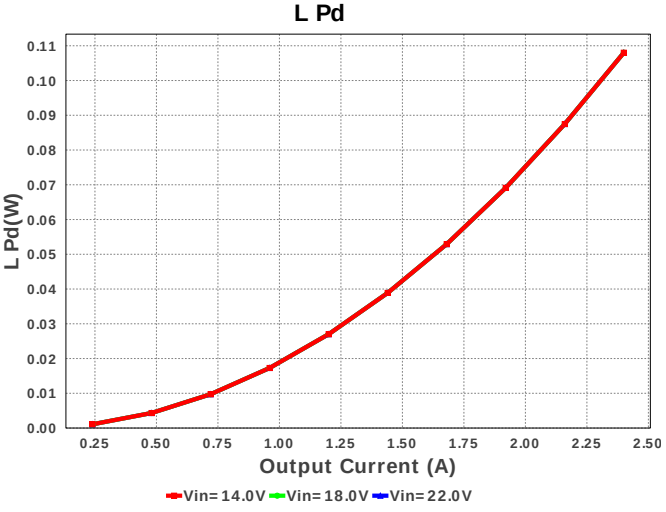
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cadj	Samsung Electro-Mechanics	CL21C102JBCNFNC Series= C0G/NP0	Cap= 1.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
2.	Cff	MuRata	GRM1555C1H431GA01D Series= C0G/NP0	Cap= 430.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.02	0402 3 mm²
3.	Cin	MuRata	GRM31CR71H225KA88L Series= X7R	Cap= 2.2 uF ESR= 4.448 mOhm VDC= 50.0 V IRMS= 2.2252 A	1	$0.05	1206_190 11 mm²
4.	Cout	Panasonic	6TPU47MSI Series= ?	Cap= 47.0 uF ESR= 150.0 mOhm VDC= 6.3 V IRMS= 510.0 mA	1	$0.46	CAPSMT_6_S09 7 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	Diodes Inc.	B340-13-F	VF@Io= 500.0 mV VRRM= 40.0 V	1	$0.10	SMC 83 mm²
7.	L1	Bourns	SRU1048-8R2Y	L= 8.2 µH DCR= 15.0 mOhm	1	$0.33	SRU1048 144 mm²
8.	M1	Fairchild Semiconductor	FDC5614P	VdsMax= -60.0 V IdsMax= -3.0 Amps	1	$0.23	SOT-23-6 15 mm²
9.	Radj	Vishay-Dale	CRCW04021K21FKED Series= CRCW..e3	Res= 1.21 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²

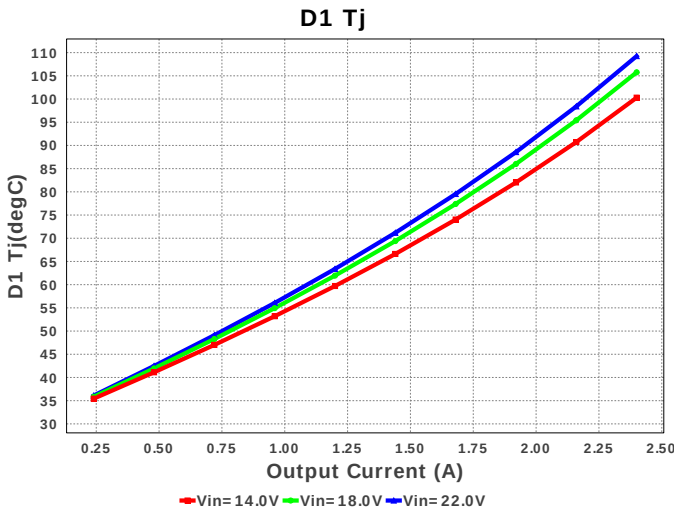
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	Rfb1	Yageo America	RT0805BRD076K12L Series= RT0805	Res= 6.12 kOhm Power= 125.0 mW Tolerance= 0.1%	1	$0.05	0805 7 mm^2
11.	Rfb2	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 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	CRCW040229K4FKED Series= CRCW..e3	Res= 29.4 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

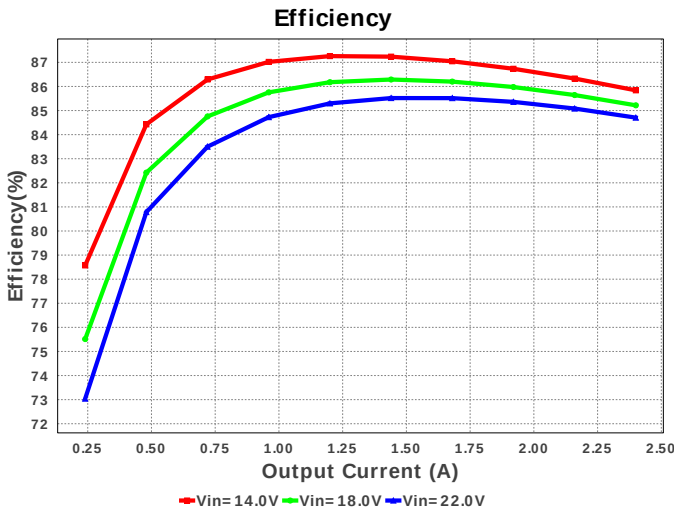


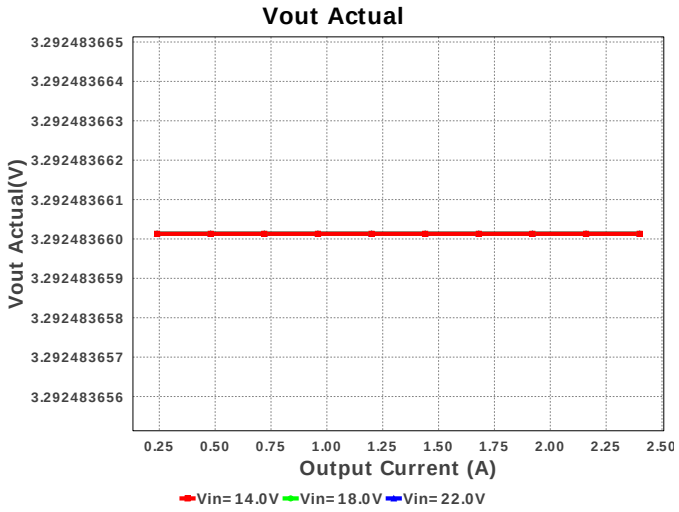


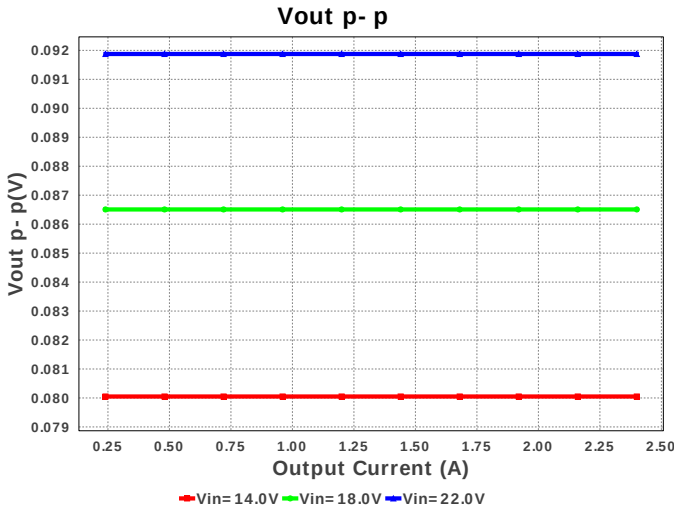


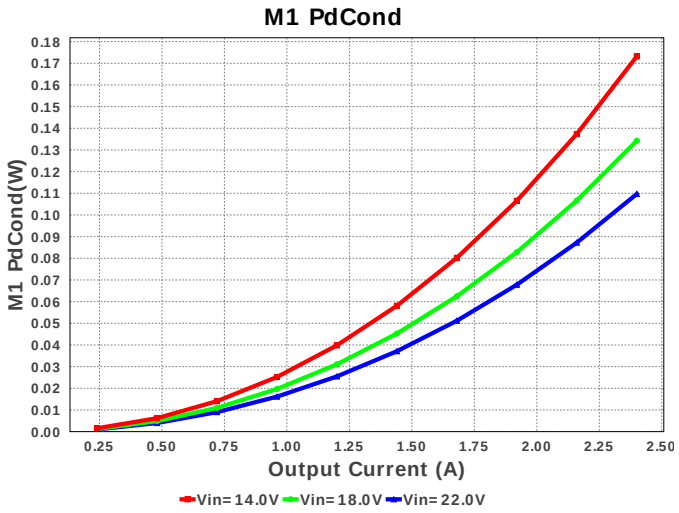


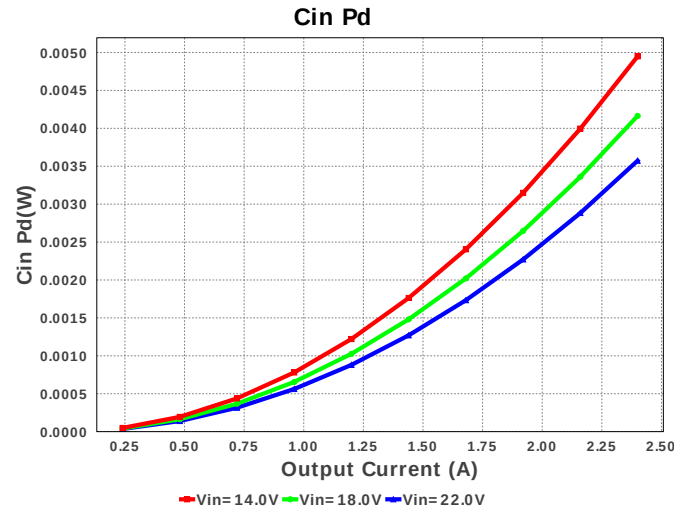


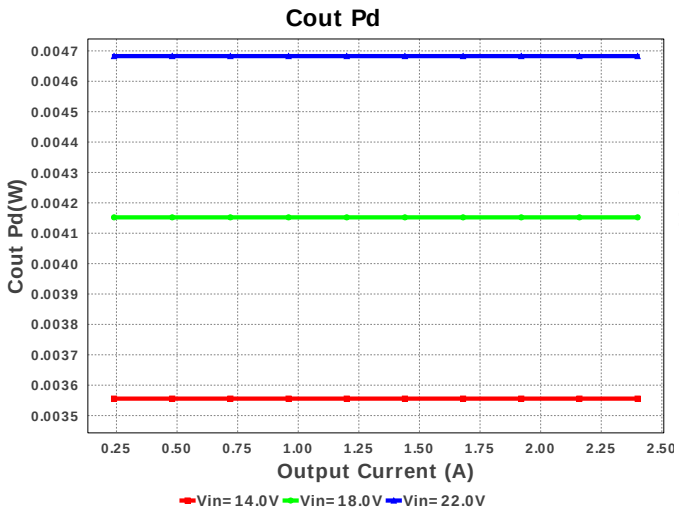


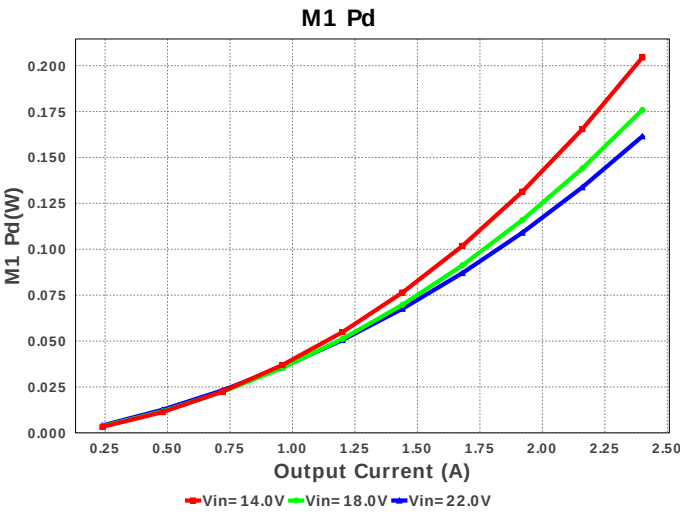


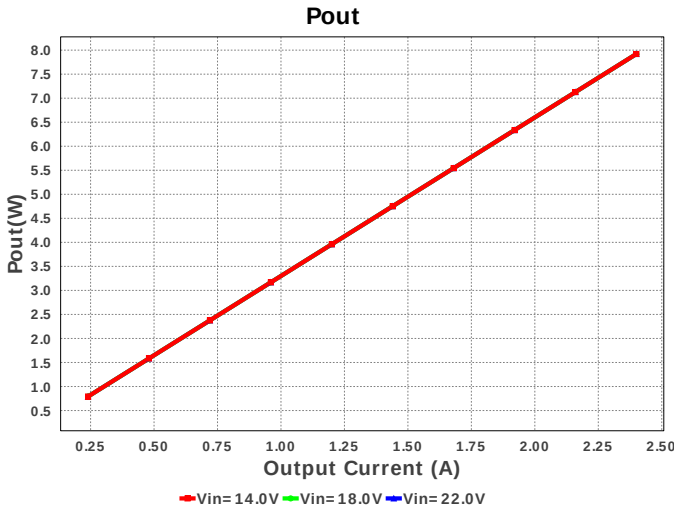


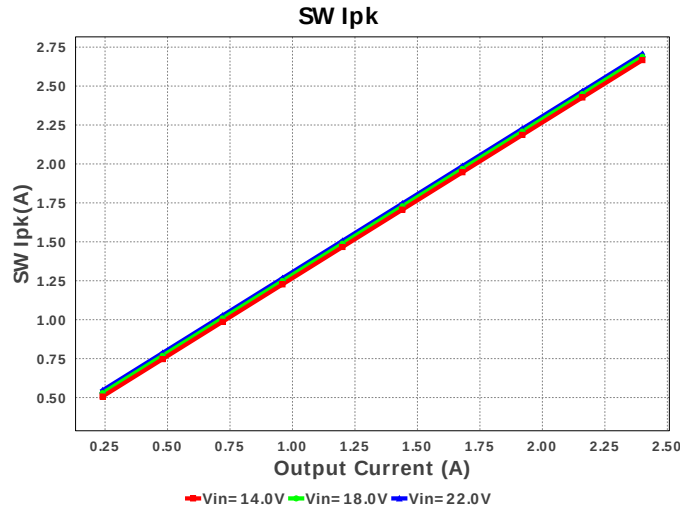


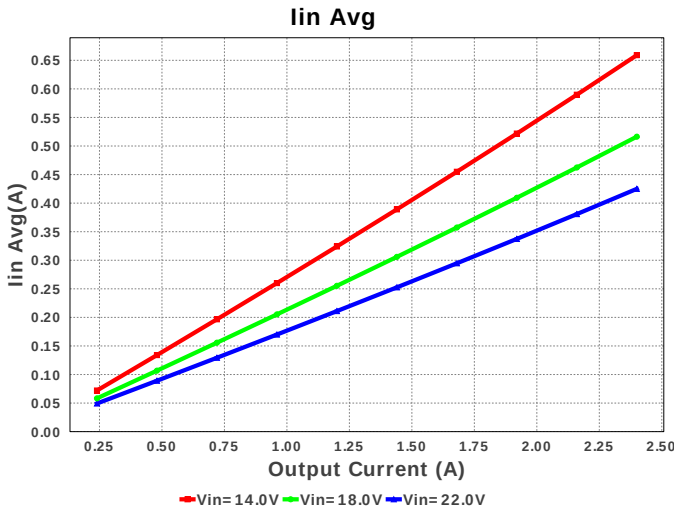


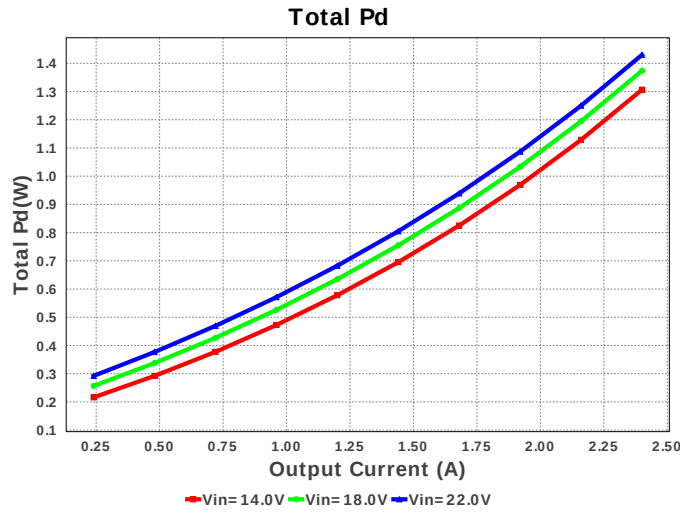


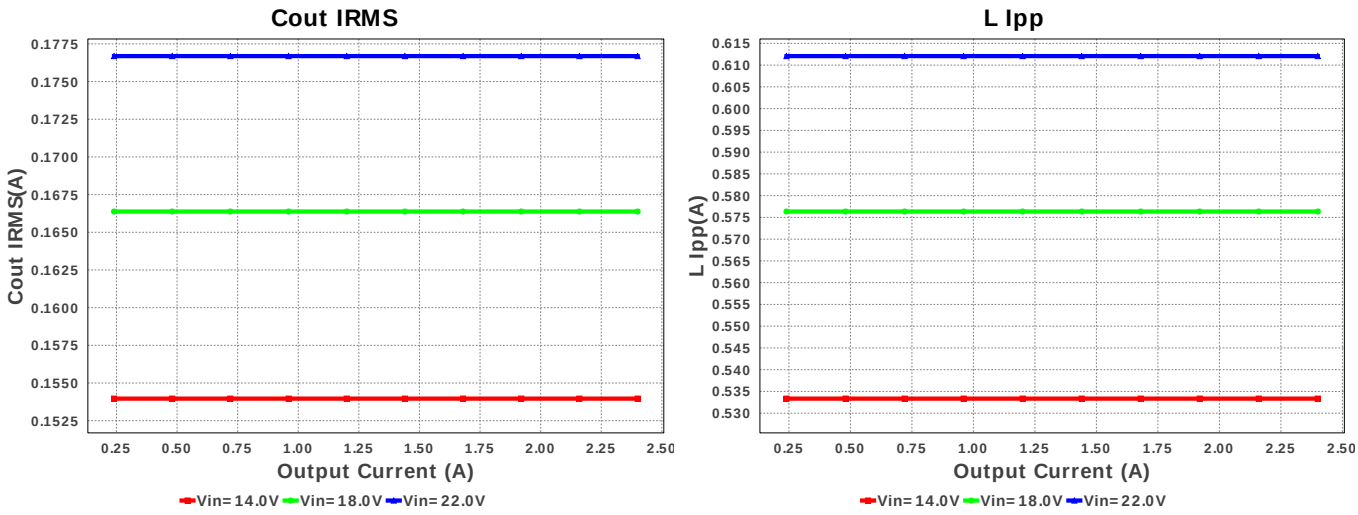


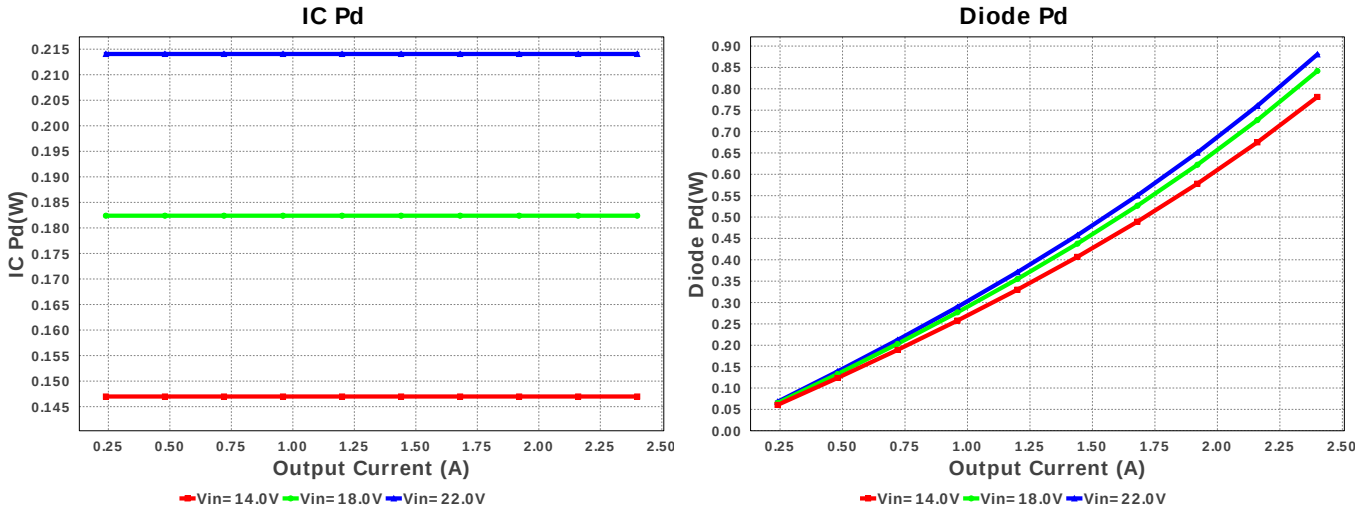


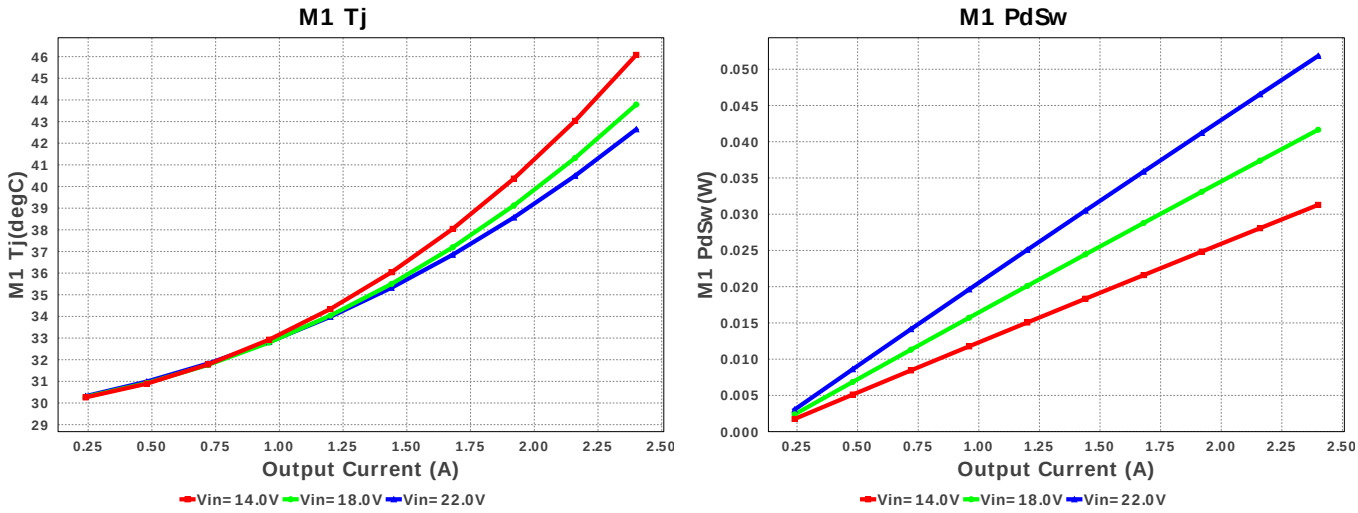












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	896.27 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	176.689 mA	Current	Output capacitor RMS ripple current
3.	Iin Avg	425.0 mA	Current	Average input current
4.	L Ipp	612.07 mA	Current	Peak-to-peak inductor ripple current
5.	SW Ipk	2.706 A	Current	Peak switch current
6.	BOM Count	14	General	Total Design BOM count
7.	FootPrint	327.0 mm^2	General	Total Foot Print Area of BOM components
8.	Frequency	471.114 kHz	General	Switching frequency
9.	IC Tolerance	25.0 mV	General	IC Feedback Tolerance
10.	Mode	CCM	General	Conduction Mode
11.	Pout	7.92 W	General	Total output power

#	Name	Value	Category	Description
12.	Total BOM	$2.11	General	Total BOM Cost
13.	D1 Tj	109.25 degC	Op_Point	D1 junction temperature
14.	Vout Actual	3.292 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
15.	Vout OP	3.3 V	Op_Point	Operational Output Voltage
16.	Duty Cycle	16.753 %	Op_point	Duty cycle
17.	Efficiency	84.706 %	Op_point	Steady state efficiency
18.	IC Tj	39.847 degC	Op_point	IC junction temperature
19.	ICThetaJA	46.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
20.	IOUT_OP	2.4 A	Op_point	Iout operating point
21.	M1 Tj	42.644 degC	Op_point	M1 MOSFET junction temperature
22.	VIN_OP	22.0 V	Op_point	Vin operating point
23.	Vout p-p	91.875 mV	Op_point	Peak-to-peak output ripple voltage
24.	Cin Pd	3.573 mW	Power	Input capacitor power dissipation
25.	Cout Pd	4.683 mW	Power	Output capacitor power dissipation
26.	Diode Pd	880.556 mW	Power	Diode power dissipation
27.	IC Pd	214.061 mW	Power	IC power dissipation
28.	L Pd	108.0 mW	Power	Inductor power dissipation
29.	M1 Pd	161.514 mW	Power	M1 MOSFET total power dissipation
30.	M1 PdCond	109.674 mW	Power	M1 MOSFET conduction losses
31.	M1 PdSw	51.84 mW	Power	M1 MOSFET switching losses
32.	Total Pd	1.43 W	Power	Total Power Dissipation
33.	Vout Tolerance	2.697 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	2.4	Maximum Output Current
2.	VinMax	22.0	Maximum input voltage
3.	VinMin	14.0	Minimum input voltage
4.	Vout	3.3	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.