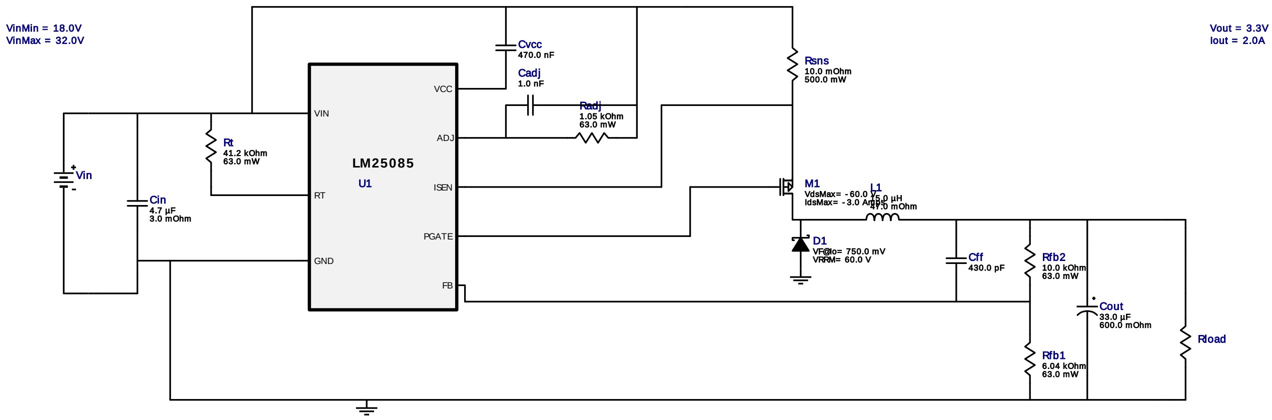
TEXAS INSTRUMENTS

WEBENCH ® Design Report

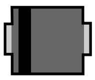
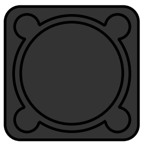
VinMin = 18.0V
VinMax = 32.0V
Vout = 3.3V
Iout = 2.0A

Device = LM25085MY/NOPB
Topology = Buck
Created = 9/30/14 3:25:12 AM
BOM Cost = $1.93
Footprint = 393.0 mm^2
BOM Count = 14
Total Pd = 1.95W

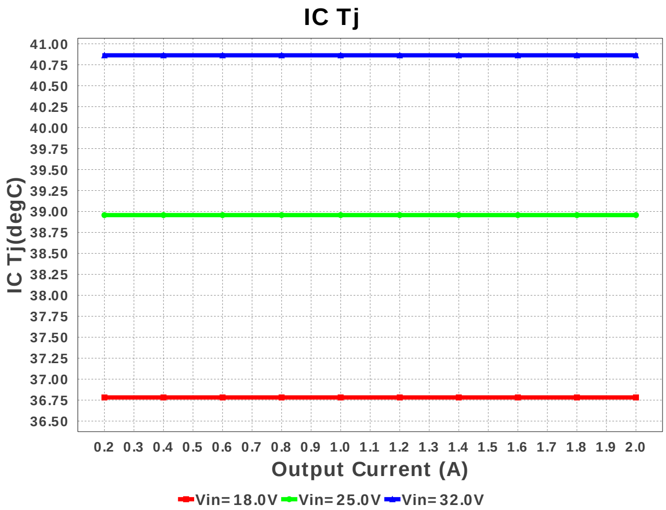
Design : 713603/92 LM25085MY/NOPB
LM25085MY/NOPB 18.0V-32.0V to 3.3V @ 2.0A

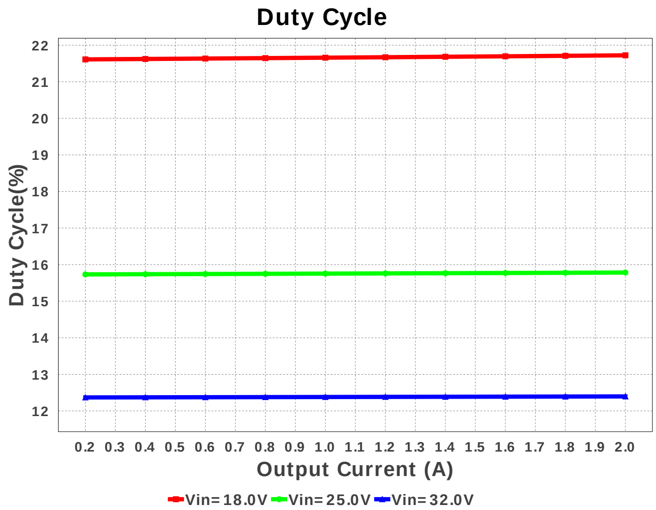


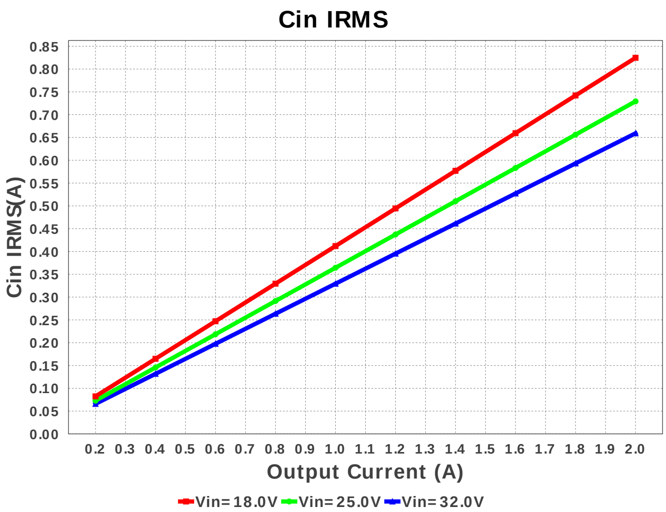
Electrical BOM

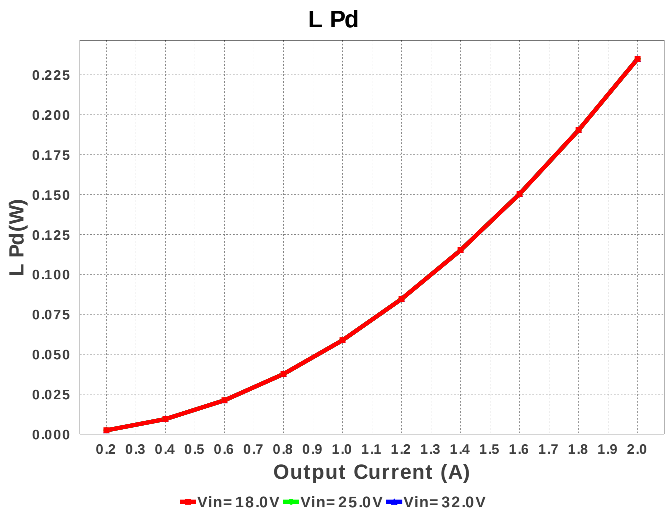
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cadj	Yageo America	CC0805KRX7R9BB102 Series= X7R	Cap= 1.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
2.	Cff	MuRata	GRM1555C1E431JA01D Series= C0G/NP0	Cap= 430.0 pF VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm^2
3.	Cin	MuRata	GRM31CR71H475KA12L Series= X7R	Cap= 4.7 uF ESR= 3.0 mOhm VDC= 50.0 V IRMS= 4.98 A	1	$0.10	 1206 11 mm^2
4.	Cout	AVX	TPSA336K006R0600 Series= TPS	Cap= 33.0 uF ESR= 600.0 mOhm VDC= 6.3 V IRMS= 318.0 mA	1	$0.13	 3216-18 11 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	Vishay-Semiconductor	SS36-E3/57T	VF@Io= 750.0 mV VRRM= 60.0 V	1	$0.18	 SMC 83 mm^2
7.	L1	Bourns	SRR1240-150M	L= 15.0 µH DCR= 47.0 mOhm	1	$0.41	 SRR1240 210 mm^2
8.	M1	Fairchild Semiconductor	FDC5614P	VdsMax= -60.0 V IdsMax= -3.0 Amps	1	$0.22	 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
10.	Rfb1	Vishay-Dale	CRCW04026K04FKED Series= CRCW..e3	Res= 6.04 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2

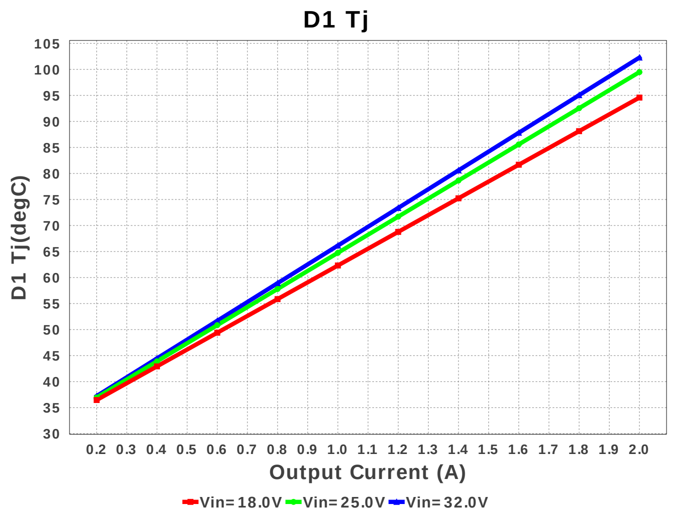
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
11.	Rfb2	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
12.	Rsns	Stackpole Electronics Inc	CSR1206FK10L0 Series= ?	Res= 10.0 mOhm Power= 500.0 mW Tolerance= 1.0%	1	$0.11	1206 11 mm²
13.	Rt	Vishay-Dale	CRCW040241K2FKED Series= CRCW..e3	Res= 41.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
14.	U1	Texas Instruments	LM25085MY/NOPB	Switcher	1	$0.70	MUY08A 24 mm²

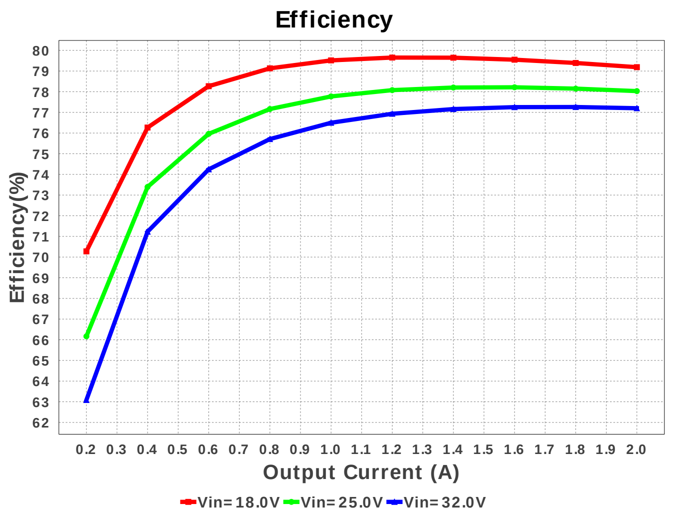


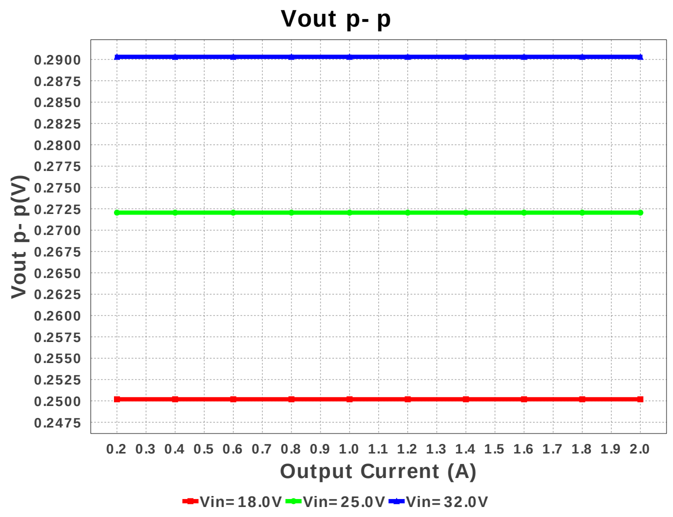


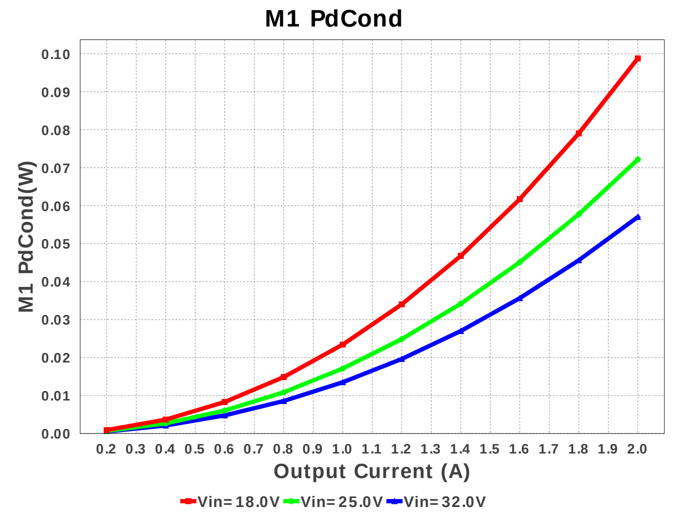


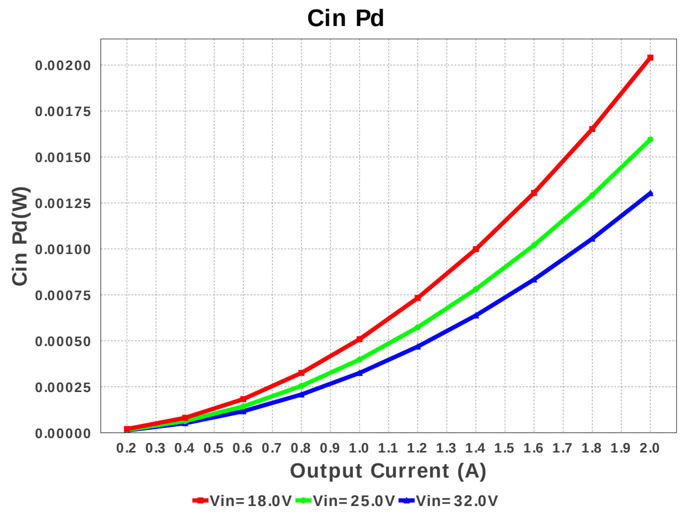


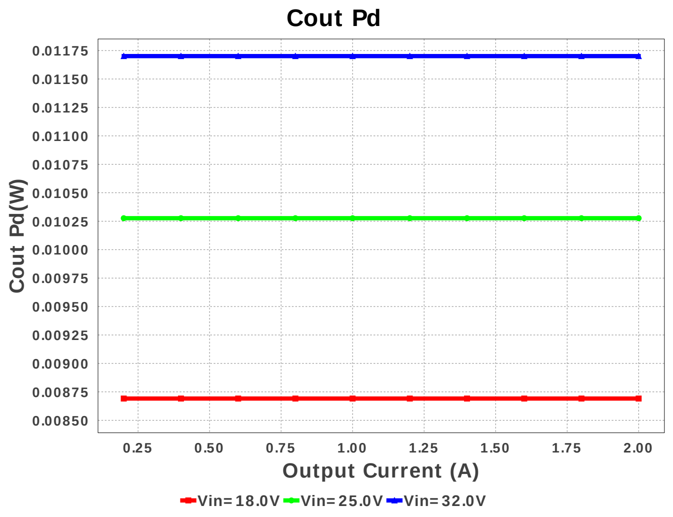

D1 Tj
D1 Tj(degC)
Output Current (A)
Vin=18.0V Vin=25.0V Vin=32.0V

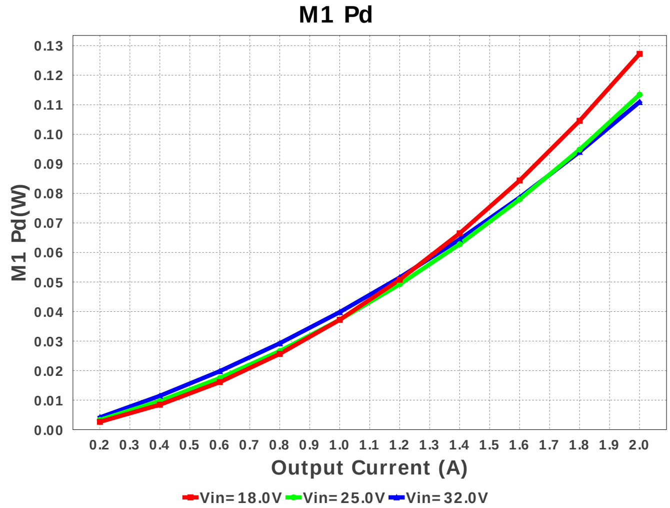

Efficiency
Efficiency(%)
Output Current (A)
Vin=18.0V Vin=25.0V Vin=32.0V

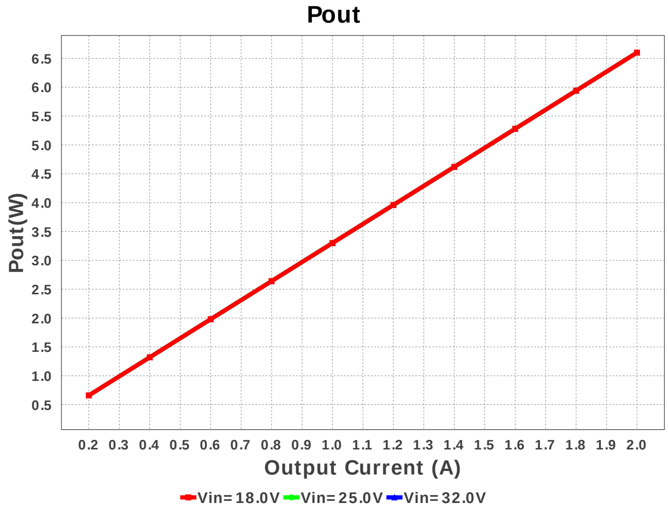

Vout p-p
Vout p-p(V)
Output Current (A)
Vin=18.0V Vin=25.0V Vin=32.0V

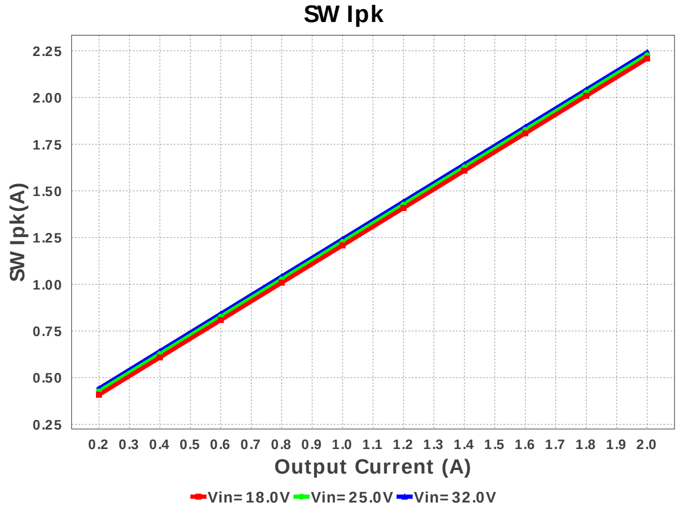

M1 PdCond
M1 PdCond(W)
Output Current (A)
Vin=18.0V Vin=25.0V Vin=32.0V

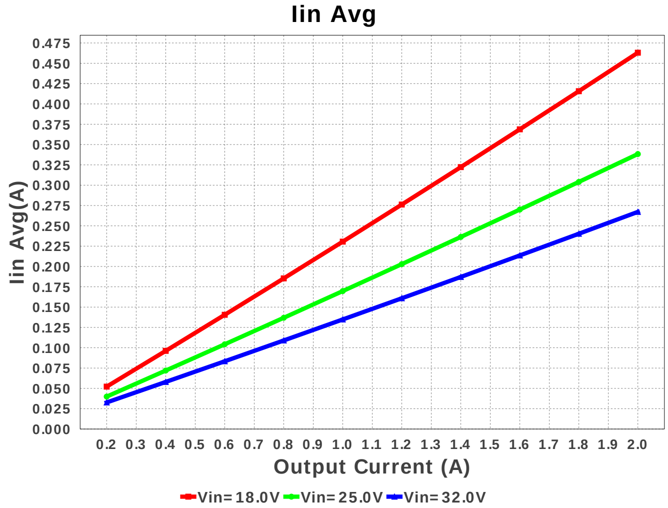

Cin Pd
Cin Pd(W)
Output Current (A)
Vin=18.0V Vin=25.0V Vin=32.0V

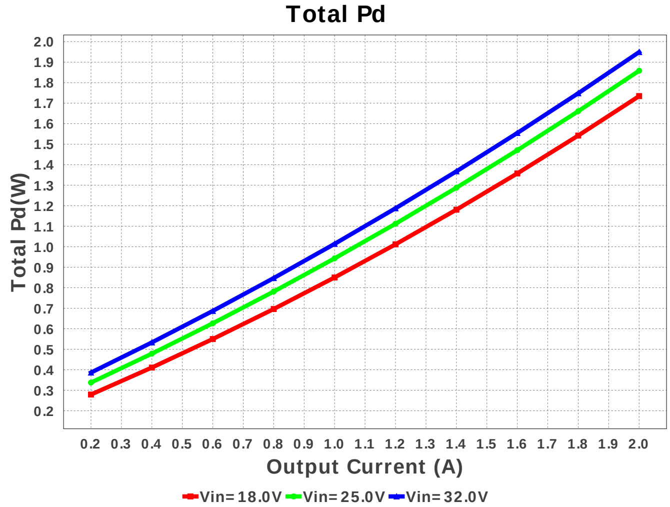

Cout Pd
Cout Pd(W)
Output Current (A)
Vin=18.0V Vin=25.0V Vin=32.0V

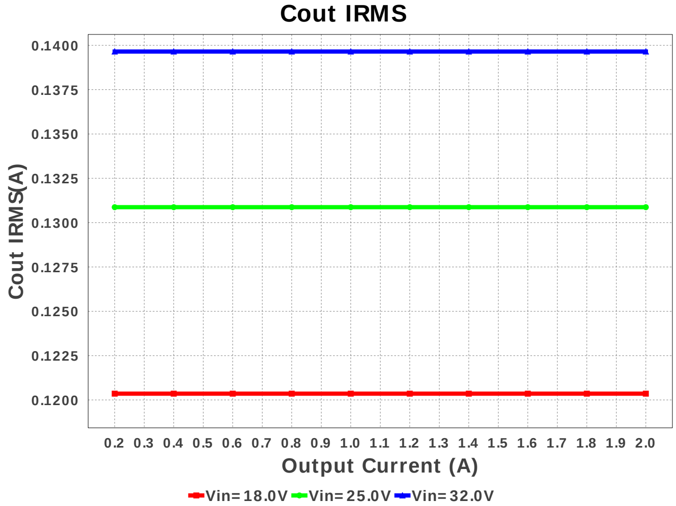

M1 Pd
M1 Pd(W)
Output Current (A)
Vin=18.0V Vin=25.0V Vin=32.0V

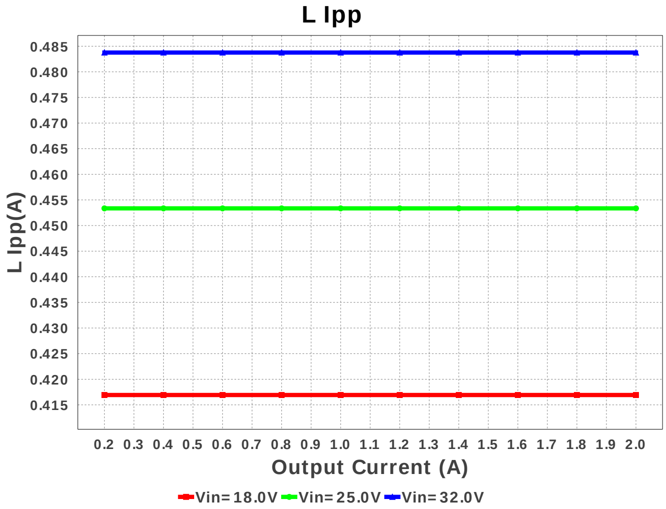

Pout
Pout(W)
Output Current (A)
Vin=18.0V Vin=25.0V Vin=32.0V

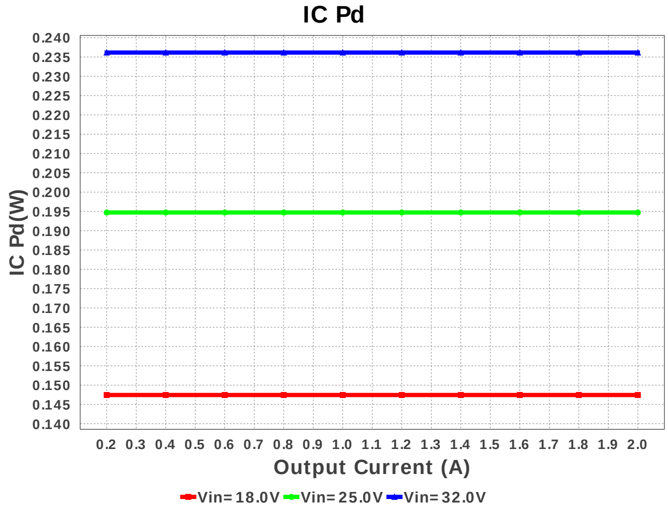

SW Ipk
SW Ipk(A)
Output Current (A)
Vin=18.0V Vin=25.0V Vin=32.0V

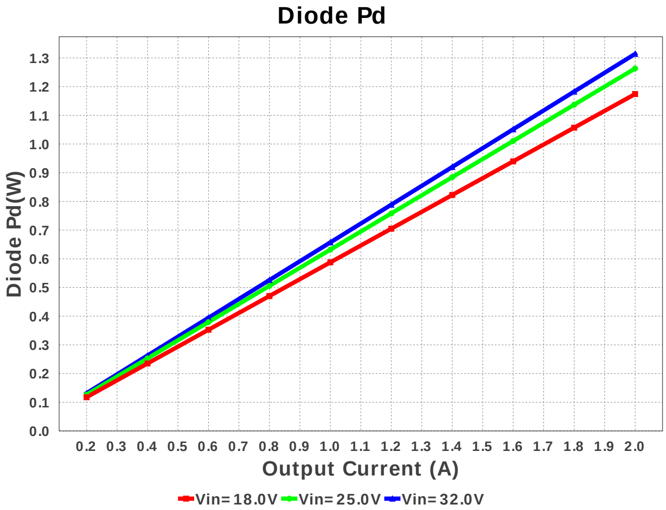

Iin Avg
Iin Avg(A)
Output Current (A)
Vin=18.0V Vin=25.0V Vin=32.0V

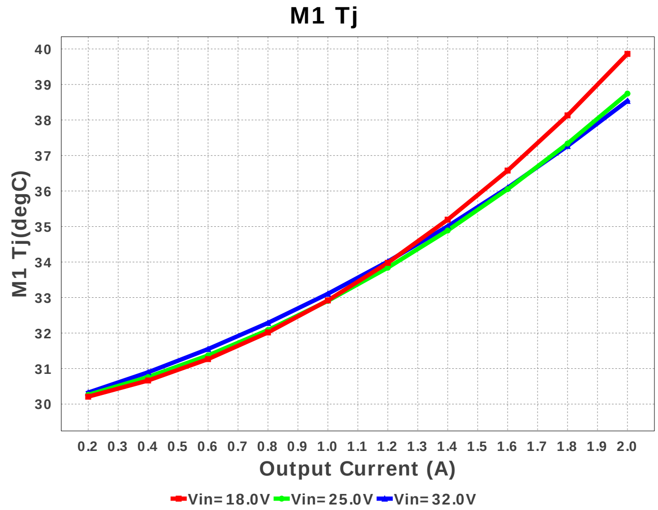

Total Pd
Total Pd(W)
Output Current (A)
Vin=18.0V Vin=25.0V Vin=32.0V

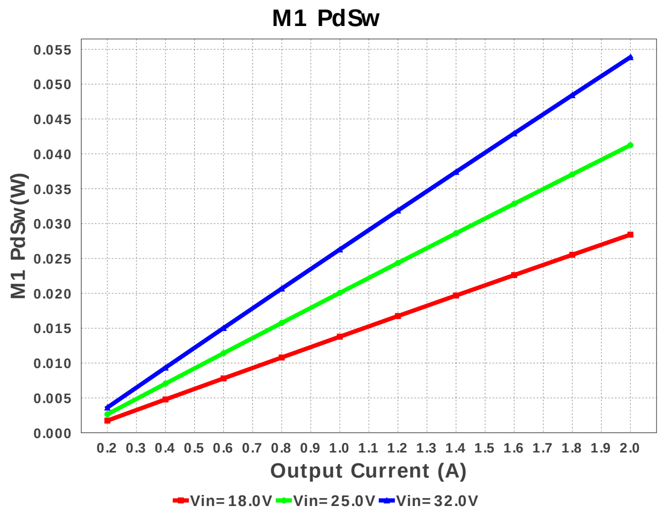

Cout IRMS
Cout IRMS(A)
Output Current (A)
Vin=18.0V Vin=25.0V Vin=32.0V

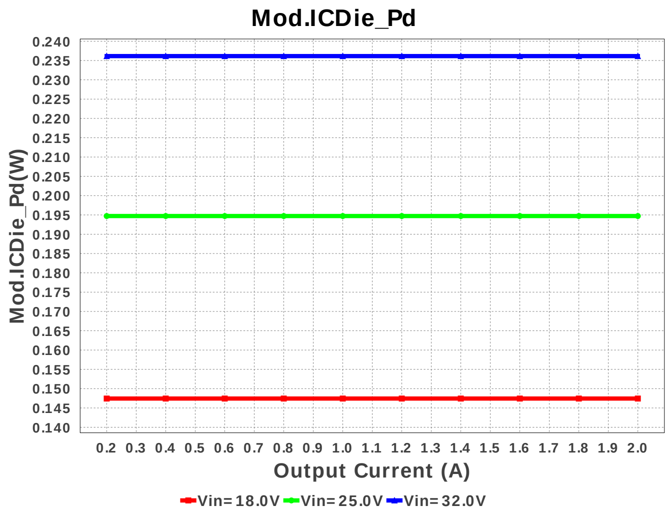












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	659.097 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	139.65 mA	Current	Output capacitor RMS ripple current
3.	Iin Avg	267.16 mA	Current	Average input current
4.	L Ipp	483.762 mA	Current	Peak-to-peak inductor ripple current
5.	SW Ipk	2.242 A	Current	Peak switch current
6.	BOM Count	14	General	Total Design BOM count
7.	FootPrint	393.0 mm^2	General	Total Foot Print Area of BOM components
8.	Frequency	340.53 kHz	General	Switching frequency
9.	IC Tolerance	25.0 mV	General	IC Feedback Tolerance
10.	Pout	6.6 W	General	Total output power
11.	Total BOM	$1.93	General	Total BOM Cost

#	Name	Value	Category	Description
12.	D1 Tj	102.272 degC	Op_Point	D1 junction temperature
13.	Vout OP	3.3 V	Op_Point	Operational Output Voltage
14.	Duty Cycle	12.397 %	Op_point	Duty cycle
15.	Efficiency	77.2 %	Op_point	Steady state efficiency
16.	IC Tj	40.863 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	38.538 degC	Op_point	M1 MOSFET junction temperature
20.	VIN_OP	32.0 V	Op_point	Vin operating point
21.	Vout p-p	290.307 mV	Op_point	Peak-to-peak output ripple voltage
22.	Cin Pd	1.303 mW	Power	Input capacitor power dissipation
23.	Cout Pd	11.701 mW	Power	Output capacitor power dissipation
24.	Diode Pd	1.314 W	Power	Diode power dissipation
25.	IC Pd	236.145 mW	Power	IC power dissipation
26.	L Pd	235.0 mW	Power	Inductor power dissipation
27.	M1 Pd	110.999 mW	Power	M1 MOSFET total power dissipation
28.	M1 PdCond	57.129 mW	Power	M1 MOSFET conduction losses
29.	M1 PdSw	53.87 mW	Power	M1 MOSFET switching losses
30.	Total Pd	1.949 W	Power	Total Power Dissipation

Design Inputs

#	Name	Value	Description
1.	Iout	2.0 A	Maximum Output Current
2.	Iout1	2.0 Amps	Output Current #1
3.	VinMax	32.0 V	Maximum input voltage
4.	VinMin	18.0 V	Minimum input voltage
5.	Vout	3.3 V	Output Voltage
6.	Vout1	3.3 Volt	Output Voltage #1
7.	base_pn	LM25085	Base Product Number
8.	source	DC	Input Source Type
9.	Ta	30.0 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.