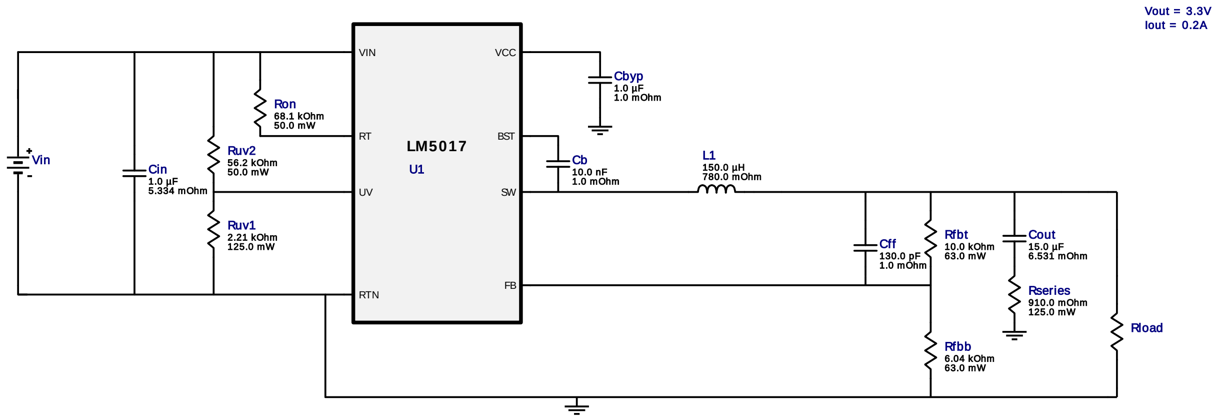
TEXAS INSTRUMENTS

VinMin = 44.0V
VinMax = 57.0V
Vout = 3.3V
Iout = 0.2A

Device = LM5017MR/NOPB
Topology = Buck
Created = 2018-09-14 08:25:29.992
BOM Cost = $2.82
BOM Count = 13
Total Pd = 1.04W

WEBENCH ® Design Report

Design : LM5017MR/NOPB
LM5017MR/NOPB 44.0V-57.0V to 3.30V @ 0.2A

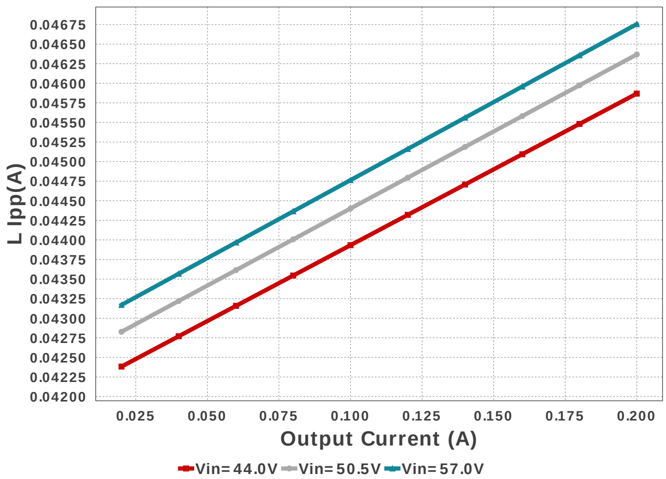


Electrical BOM

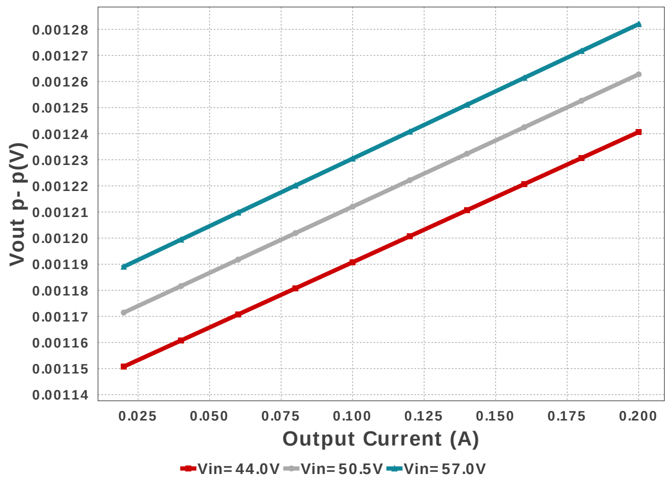
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cb	MuRata	GRM155R61C103KA01D Series= X5R	Cap= 10.0 nF ESR= 1.0 mOhm VDC= 16.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
2.	Cbyp	Taiyo Yuden	EMK212B7105KG-T Series= X7R	Cap= 1.0 uF ESR= 1.0 mOhm VDC= 16.0 V IRMS= 0.0 A	1	$0.02	0805 7 mm²
3.	Cff	MuRata	GRM1555C1H131JA01D Series= C0G/NP0	Cap= 130.0 pF ESR= 1.0 mOhm VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
4.	Cin	MuRata	GRM31CR72A105KA01L Series= X7R	Cap= 1.0 uF ESR= 5.334 mOhm VDC= 100.0 V IRMS= 1.55432 A	1	$0.25	1206_190 11 mm²
5.	Cout	TDK	C1608X5R1A156M080AC Series= X5R	Cap= 15.0 uF ESR= 6.531 mOhm VDC= 10.0 V IRMS= 2.03438 A	1	$0.14	0603 5 mm²
6.	L1	TDK	SLF6028T-151MR34-PF	L= 150.0 µH DCR= 780.0 mOhm	1	$0.40	SLF6028 64 mm²
7.	Rfbb	Vishay-Dale	CRCW04026K04FKED Series= CRCW..e3	Res= 6.04 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
8.	Rfbt	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
9.	Ron	Yageo	RC0201FR-0768K1L Series= ?	Res= 68.1 kOhm Power= 50.0 mW Tolerance= 1.0%	1	$0.01	0201 2 mm²
10.	Rseries	Panasonic	ERJ-2BQFR91X Series= ERJ-2B	Res= 910.0 mOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.06	0402 3 mm²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
11.	Ruv1	Panasonic	ERJ-6ENF2211V Series= ERJ-6E	Res= 2.21 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm^2
12.	Ruv2	Yageo	RC0201FR-0756K2L Series= ?	Res= 56.2 kOhm Power= 50.0 mW Tolerance= 1.0%	1	$0.01	0201 2 mm^2
13.	U1	Texas Instruments	LM5017MR/NOPB	Switcher	1	$1.88	MRA08A 56 mm^2

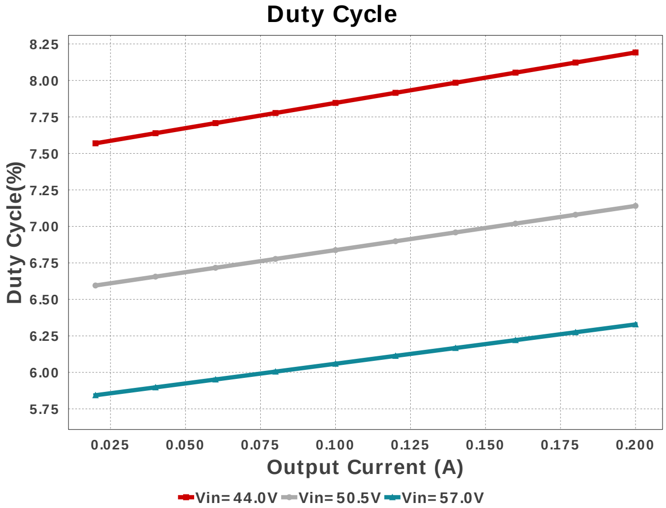
L Ipp



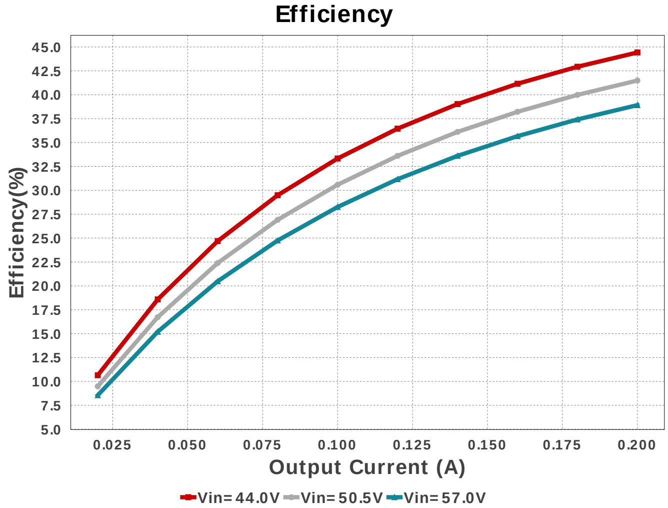
Vout p- p

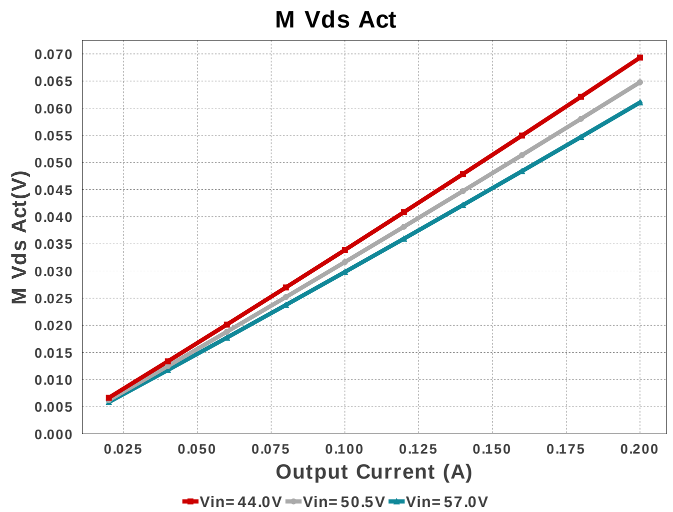


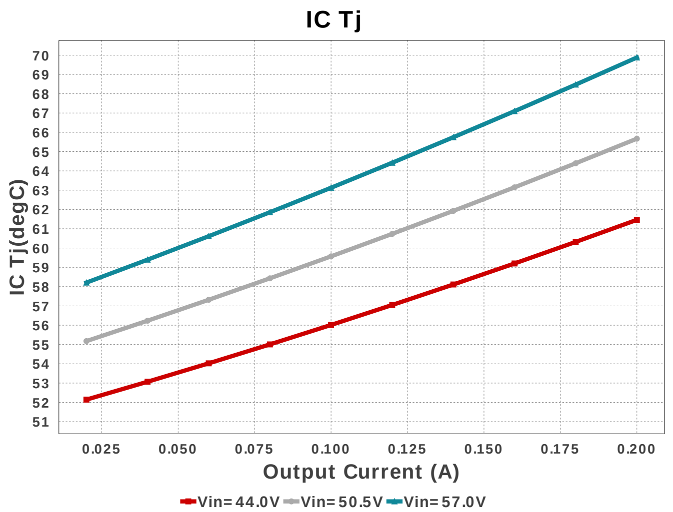
Duty Cycle

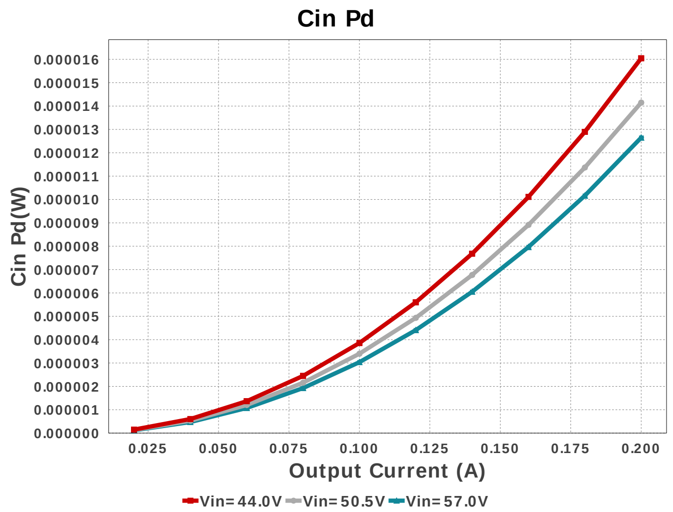


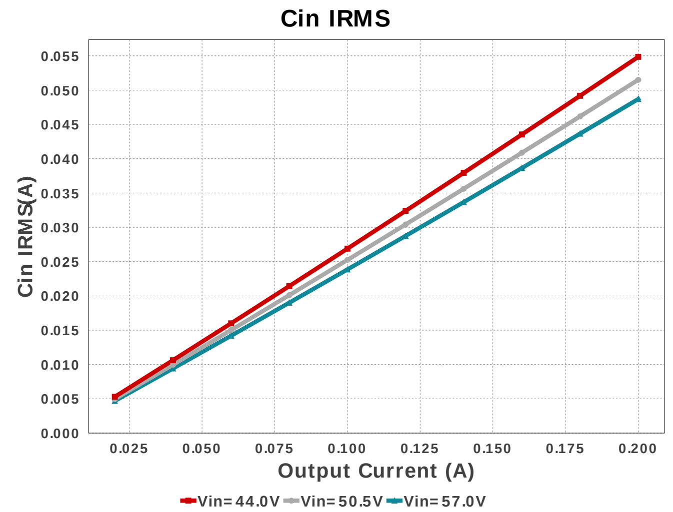
Efficiency

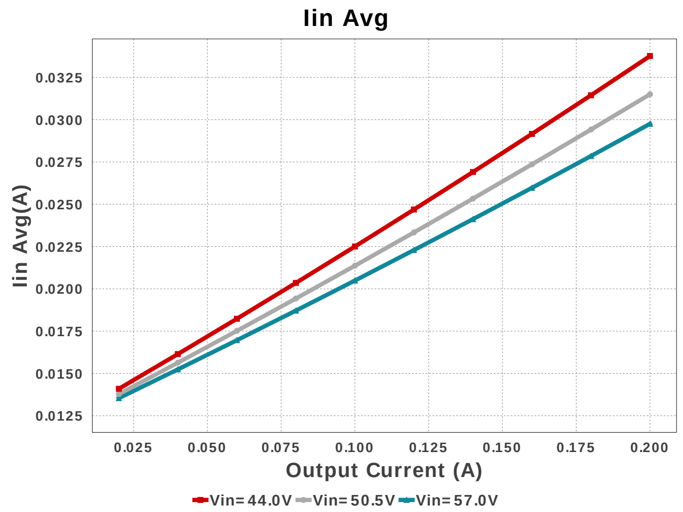


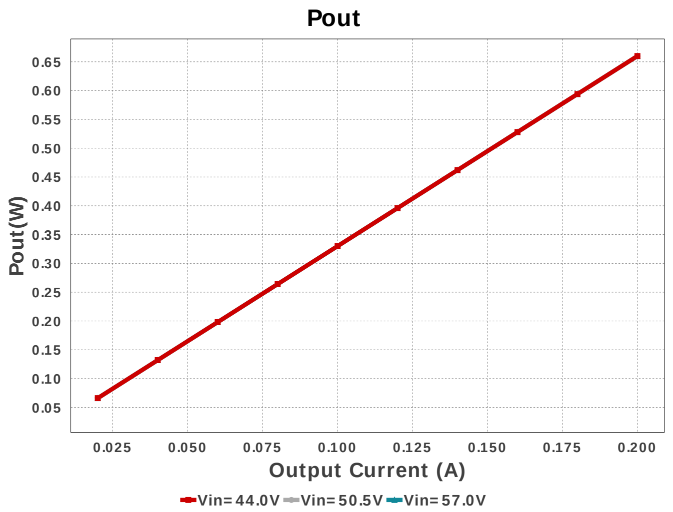

M Vds Act
M Vds Act(V)
Output Current (A)
Vin= 44.0V Vin= 50.5V Vin= 57.0V

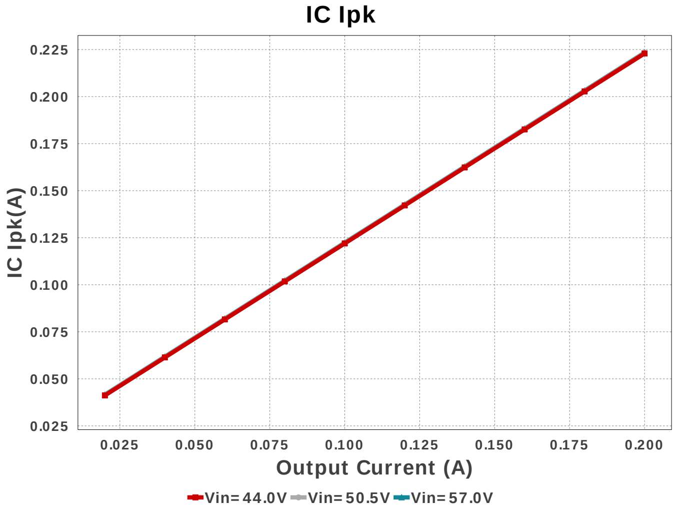

IC Tj
IC Tj(degC)
Output Current (A)
Vin= 44.0V Vin= 50.5V Vin= 57.0V

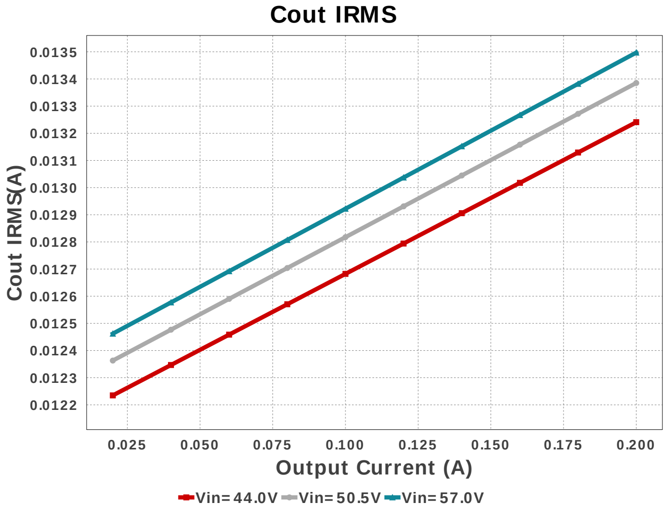

Cin Pd
Cin Pd(W)
Output Current (A)
Vin= 44.0V Vin= 50.5V Vin= 57.0V

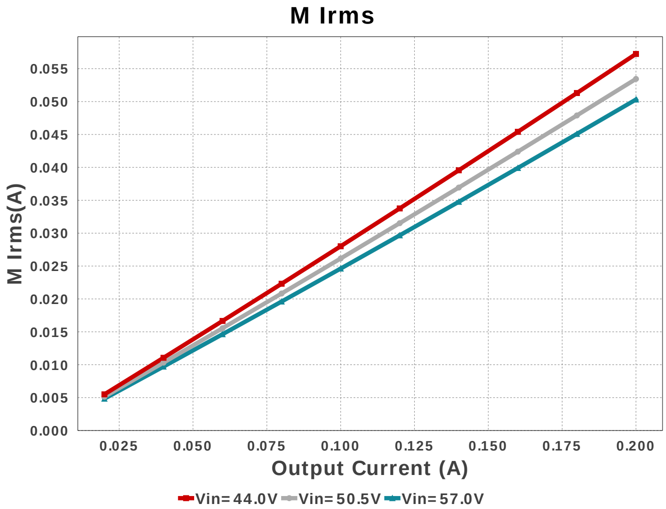

Cin IRMS
Cin IRMS(A)
Output Current (A)
Vin= 44.0V Vin= 50.5V Vin= 57.0V

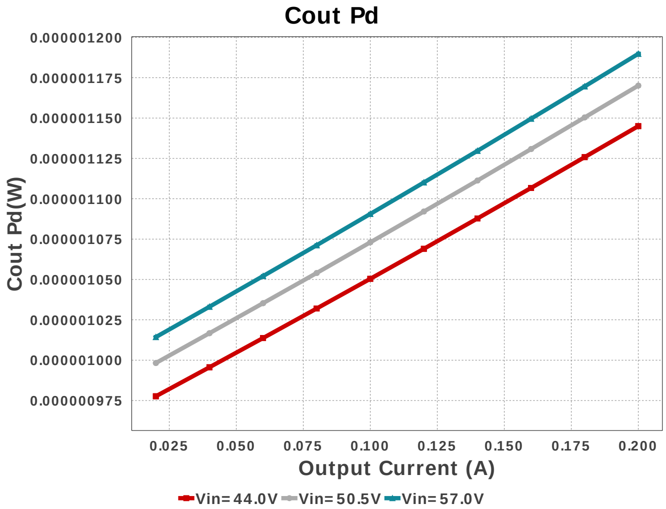

Iin Avg
Iin Avg(A)
Output Current (A)
Vin= 44.0V Vin= 50.5V Vin= 57.0V

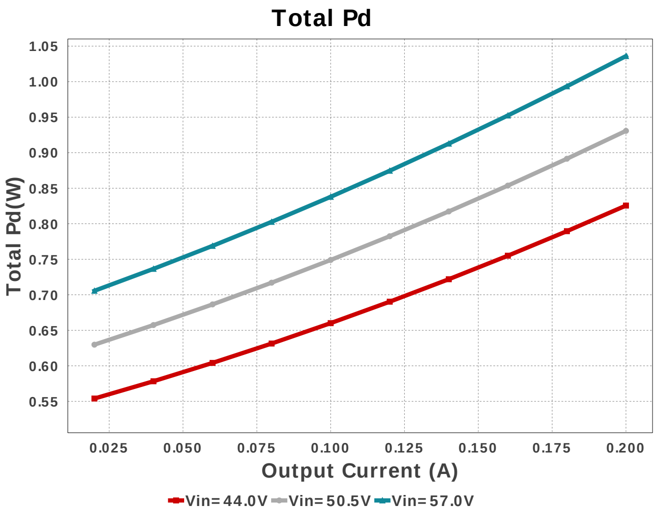

Pout
Pout(W)
Output Current (A)
Vin= 44.0V Vin= 50.5V Vin= 57.0V

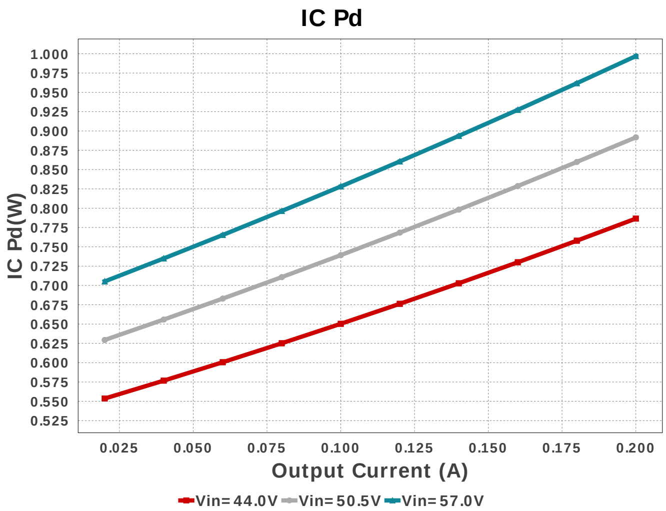

IC Ipk
IC Ipk(A)
Output Current (A)
Vin=44.0V Vin=50.5V Vin=57.0V

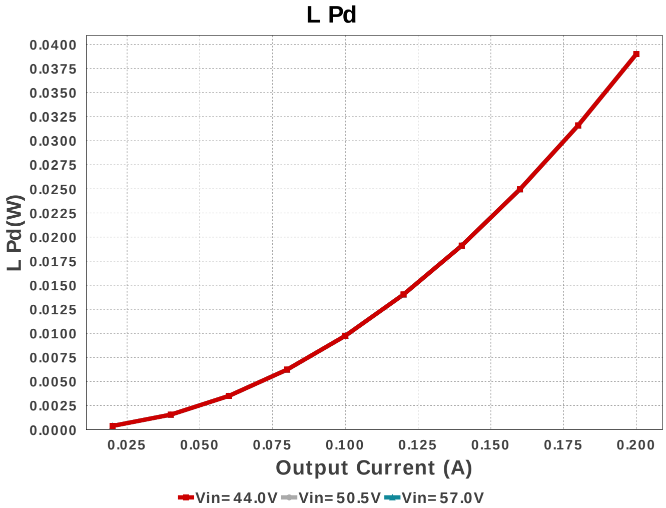

Cout IRMS
Cout IRMS(A)
Output Current (A)
Vin=44.0V Vin=50.5V Vin=57.0V


M Irms
M Irms(A)
Output Current (A)
Vin=44.0V Vin=50.5V Vin=57.0V


Cout Pd
Cout Pd(W)
Output Current (A)
Vin=44.0V Vin=50.5V Vin=57.0V


Total Pd
Total Pd(W)
Output Current (A)
Vin=44.0V Vin=50.5V Vin=57.0V


IC Pd
IC Pd(W)
Output Current (A)
Vin=44.0V Vin=50.5V Vin=57.0V



Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	48.696 mA	Capacitor	Input capacitor RMS ripple current
2.	Cin Pd	12.648 µW	Capacitor	Input capacitor power dissipation
3.	Cout IRMS	13.497 mA	Capacitor	Output capacitor RMS ripple current
4.	Cout Pd	1.19 µW	Capacitor	Output capacitor power dissipation
5.	IC Ipk	223.378 mA	IC	Peak switch current in IC
6.	IC Pd	996.95 mW	IC	IC power dissipation
7.	IC Tj	69.878 degC	IC	IC junction temperature
8.	IC Tolerance	25.0 mV	IC	IC Feedback Tolerance
9.	ICThetaJA	40.0 degC/W	IC	IC junction-to-ambient thermal resistance
10.	Iin Avg	29.754 mA	IC	Average input current
11.	L Ipp	46.755 mA	Inductor	Peak-to-peak inductor ripple current
12.	L Pd	39.0 mW	Inductor	Inductor power dissipation
13.	M1 Irms	50.314 mA	Mosfet	Q Iavg
14.	M Vds Act	61.054 mV	Mosfet	Voltage drop across the MosFET
15.	Cin Pd	12.648 µW	Power	Input capacitor power dissipation
16.	Cout Pd	1.19 µW	Power	Output capacitor power dissipation
17.	IC Pd	996.95 mW	Power	IC power dissipation
18.	L Pd	39.0 mW	Power	Inductor power dissipation
19.	Total Pd	1.036 W	Power	Total Power Dissipation
20.	BOM Count	13	System Information	Total Design BOM count
21.	Duty Cycle	6.329 %	System Information	Duty cycle
22.	Efficiency	38.916 %	System Information	Steady state efficiency
23.	FootPrint	168.0 mm^2	System Information	Total Foot Print Area of BOM components
24.	Frequency	484.581 kHz	System Information	Switching frequency
25.	Iout	200.0 mA	System Information	Iout operating point
26.	Mode	CCM	System Information	Conduction Mode
27.	Pout	660.0 mW	System Information	Total output power
28.	Total BOM	$2.82	System Information	Total BOM Cost
29.	Vin	57.0 V	System Information	Vin operating point
30.	Vout	3.3 V	System Information	Operational Output Voltage
31.	Vout Actual	3.32 V	System Information	Vout Actual calculated based on selected voltage divider resistors
32.	Vout Tolerance	3.285 %	System Information	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
33.	Vout p-p	1.282 mV	System Information	Peak-to-peak output ripple voltage

Design Inputs

#	Name	Value	Description
1.	Iout	200.0 m	Maximum Output Current

#	Name	Value	Description
2.	VinMax	57.0	Maximum input voltage
3.	VinMin	44.0	Minimum input voltage
4.	Vout	3.3	Output Voltage
5.	base_pn	LM5017	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. **LM5017** Product Folder : http://www.ti.com/product/LM5017 : contains the data sheet and other resources.