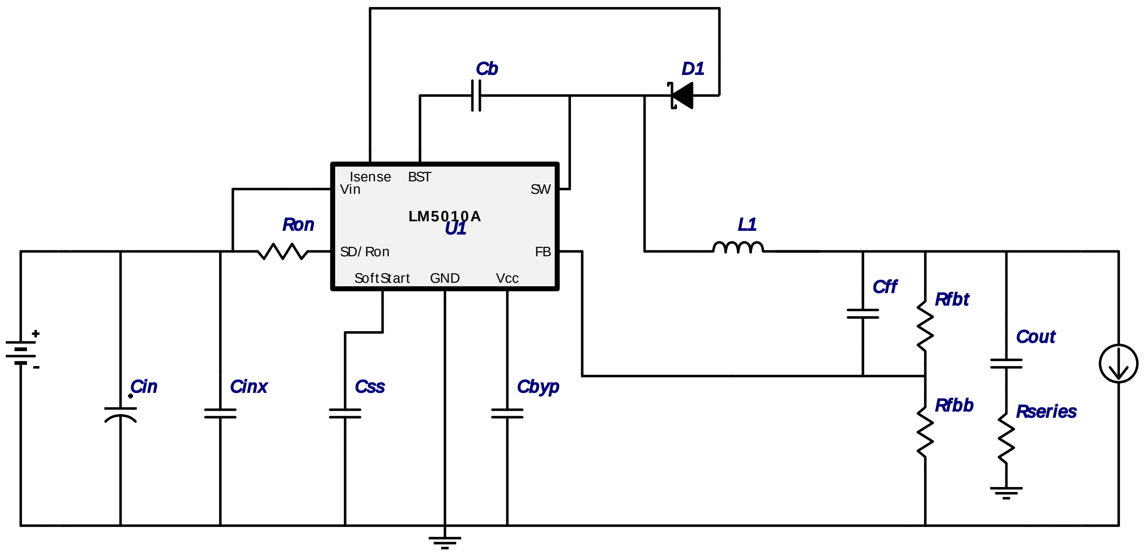
VinMin = 30.0V
VinMax = 60.0V
Vout = 8.4V
Iout = 0.6A

Device = LM5010AMH/NOPB
Topology = Buck
Created = 2/1/13 12:11:58 AM
BOM Cost = $2.46
Total Pd = 0.88 W
Footprint = 518.0 mm2
BOM Count = 19

WEBENCH ® Design Report

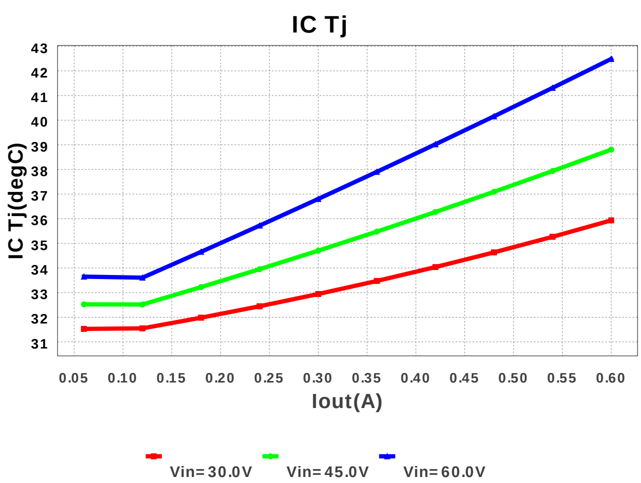
Design : 1494590/1 LM5010AMH/NOPB
LM5010AMH/NOPB 30.0V-60.0V to 8.4V @ 0.6A

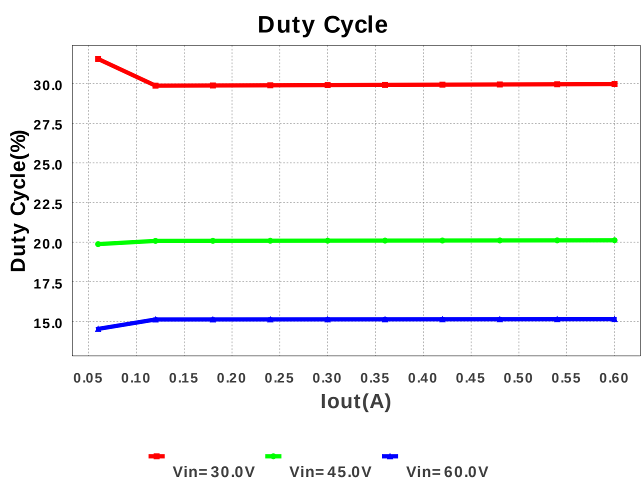


Electrical BOM

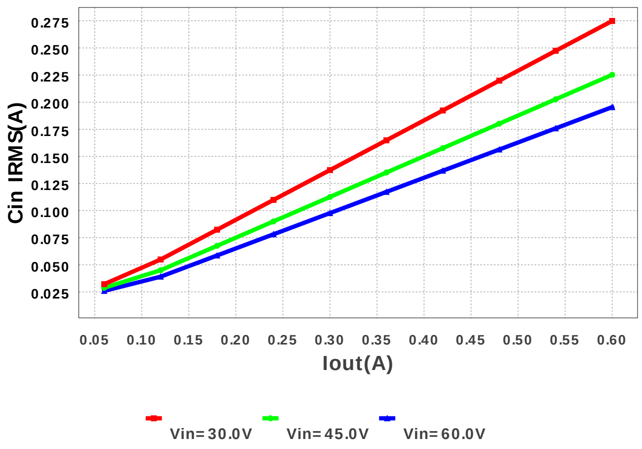
#	Name	Manufacturer	Part Number	Qty	Price	Properties	Footprint
1.	Cb	TDK	C1005X7R1C473K Series= X7R	1	$0.01	Cap= 47.0 nF ESR= 30.5 mOhm VDC= 16.0 V IRMS= 0.0 A	0402 8mm2
2.	Cb	TDK	C1005X7R1C473K Series= X7R	1	$0.01	Cap= 47.0 nF ESR= 30.5 mOhm VDC= 16.0 V IRMS= 0.0 A	0402 8mm2
3.	Cbyp	AVX	08053C104KAT2A Series= X7R	1	$0.01	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	0805 13mm2
4.	Cbyp	AVX	08053C104KAT2A Series= X7R	1	$0.01	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	0805 13mm2
5.	Cff	AVX	08053A222JAT2A Series= C0G/NP0	1	$0.05	Cap= 2.2 nF ESR= 920.0 mOhm VDC= 25.0 V IRMS= 0.0 A	0805 13mm2
6.	Cin	Panasonic	EEUED2D220 Series= 286	1	$0.19	Cap= 22.0 µF ESR= 813.86 mOhm VDC= 200.0 V IRMS= 600.0 mA	CAPPR5-10X20 144mm2
7.	Cinx	TDK	C2012X7R2A104K Series= X7R	1	$0.03	Cap= 100.0 nF ESR= 15.8 mOhm VDC= 100.0 V IRMS= 0.0 A	0805 13mm2
8.	Cinx	TDK	C2012X7R2A104K Series= X7R	1	$0.03	Cap= 100.0 nF ESR= 15.8 mOhm VDC= 100.0 V IRMS= 0.0 A	0805 13mm2

#	Name	Manufacturer	Part Number	Qty	Price	Properties	Footprint
9.	Cout	Kemet	C1206C475K4PACTU Series= X5R	1	$0.04	Cap= 4.7 µF ESR= 13.0 mOhm VDC= 16.0 V IRMS= 4.9 A	1206 19mm2
10.	Css	Kemet	C0805C472K5RACTU Series= X7R	1	$0.01	Cap= 4.7 nF ESR= 279.0 mOhm VDC= 50.0 V IRMS= 321.0 mA	0805 13mm2
11.	Css	Kemet	C0805C472K5RACTU Series= X7R	1	$0.01	Cap= 4.7 nF ESR= 279.0 mOhm VDC= 50.0 V IRMS= 321.0 mA	0805 13mm2
12.	D1	Diodes Inc.	B1100-13-F	1	$0.10	VF@Io= 790.0 mV VRRM= 100.0 V	SMA 37mm2
13.	L1	Bourns	SRN8040-101M	1	$0.21	L= 100.0 µH DCR= 400.0 mOhm	SRN8040 100mm2
14.	Rfbb	Vishay-Dale	CRCW04021K00FKED Series= CRCW..e3	1	$0.01	Res= 1,000 Ohm Power= 63.0 mW Tolerance= 1.0%	0402 8mm2
15.	Rfbt	Vishay-Dale	CRCW04022K37FKED Series= CRCW..e3	1	$0.01	Res= 2.37 kOhm Power= 63.0 mW Tolerance= 1.0%	0402 8mm2
16.	Ron	Vishay-Dale	CRCW040295K3FKED Series= CRCW..e3	1	$0.01	Res= 95.3 kOhm Power= 63.0 mW Tolerance= 1.0%	0402 8mm2
17.	Ron	Vishay-Dale	CRCW040295K3FKED Series= CRCW..e3	1	$0.01	Res= 95.3 kOhm Power= 63.0 mW Tolerance= 1.0%	0402 8mm2
18.	Rseries	Rohm	PMR25HZPFV1L00 Series= 313	1	$0.24	Res= 1.0 mOhm Power= 1.0 W Tolerance= 1.0%	1210 23mm2
19.	U1	Texas Instruments	LM5010AMH/NOPB	1	$1.47	Switcher	MXA14A 59mm2

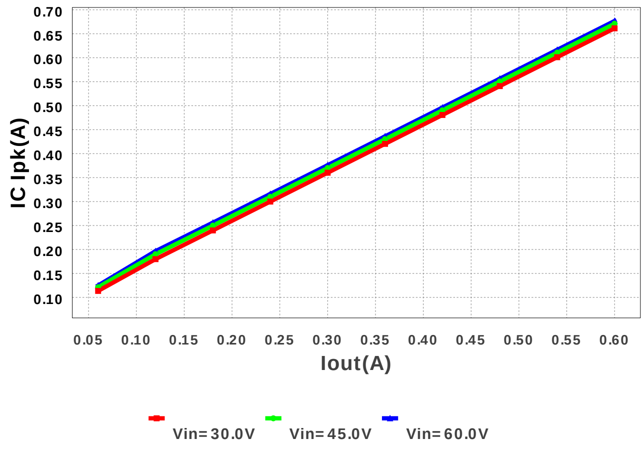




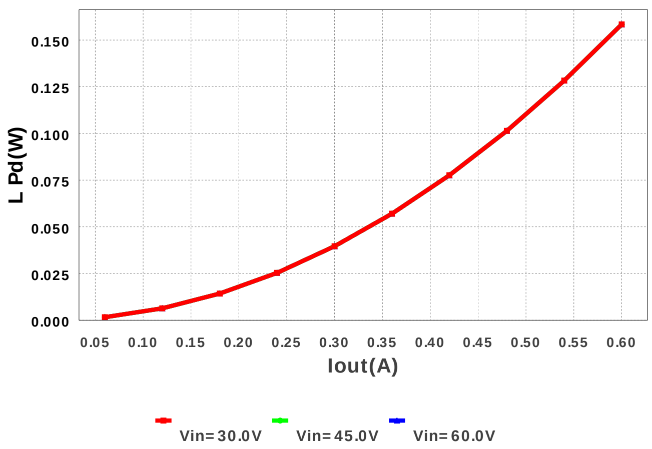
Cin IRMS



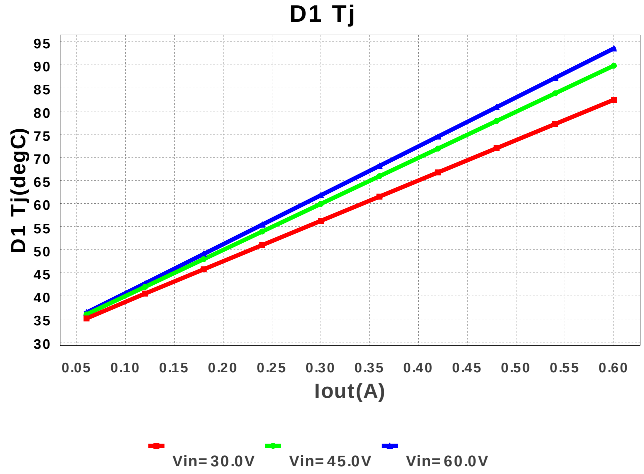
IC Ipk



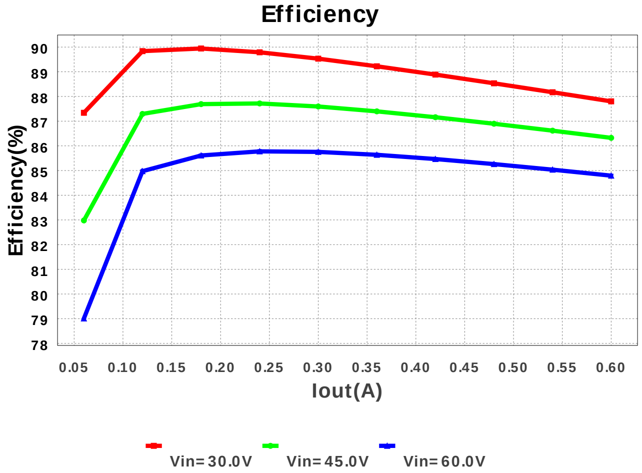
L Pd



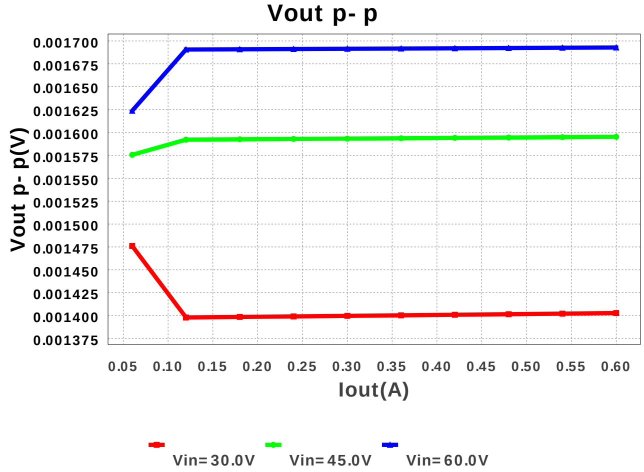
D1 Tj

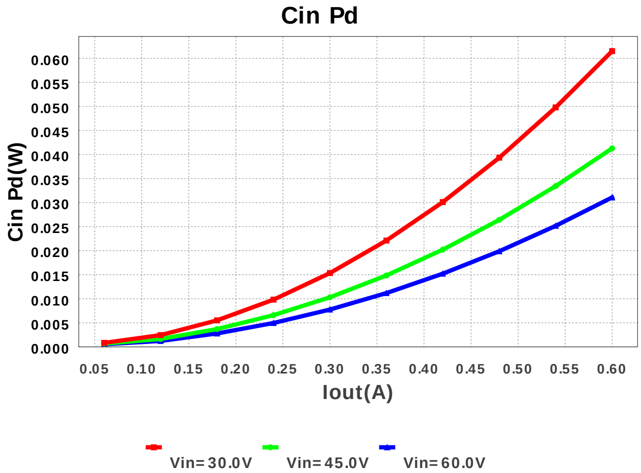


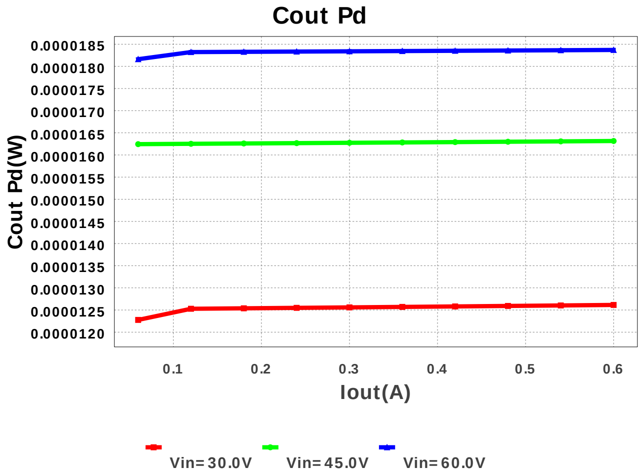
Efficiency

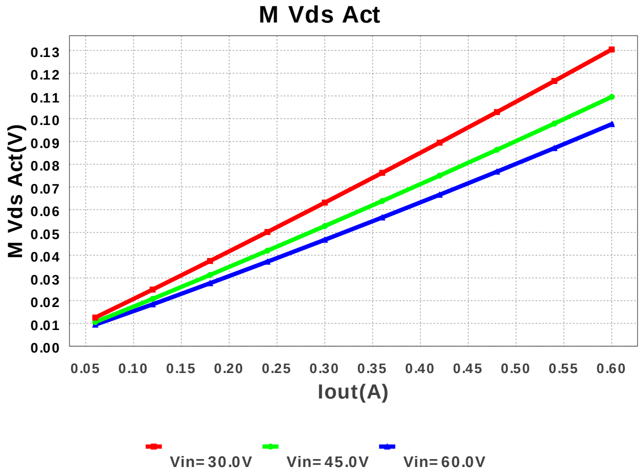


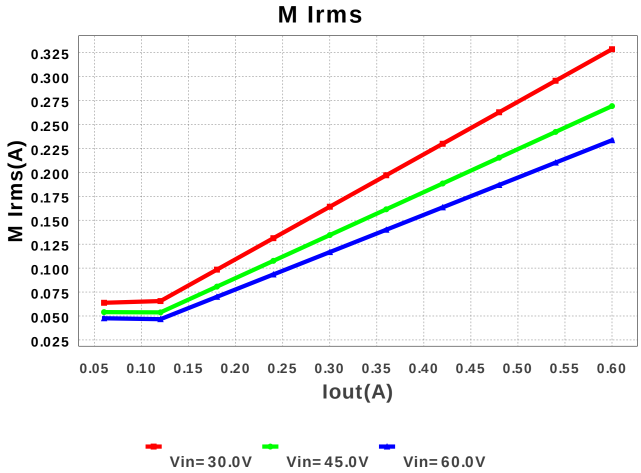
Vout p- p

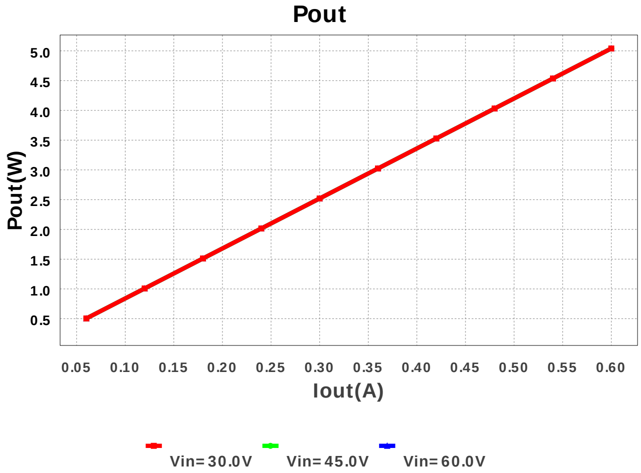


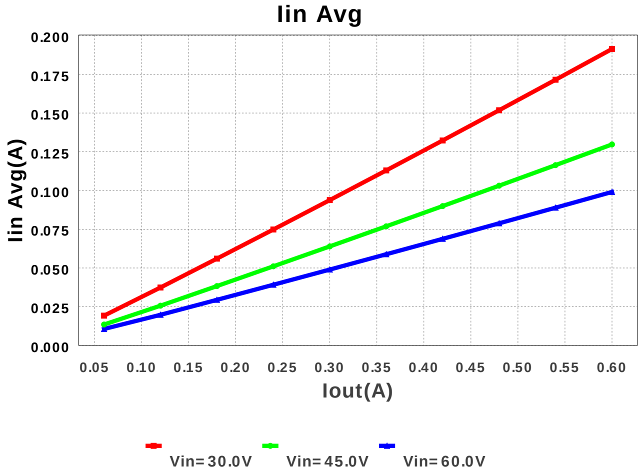

Cin Pd
Cin Pd(W)
Iout(A)
Vin=30.0V
Vin=45.0V
Vin=60.0V


Cout Pd
Cout Pd(W)
Iout(A)
Vin=30.0V
Vin=45.0V
Vin=60.0V

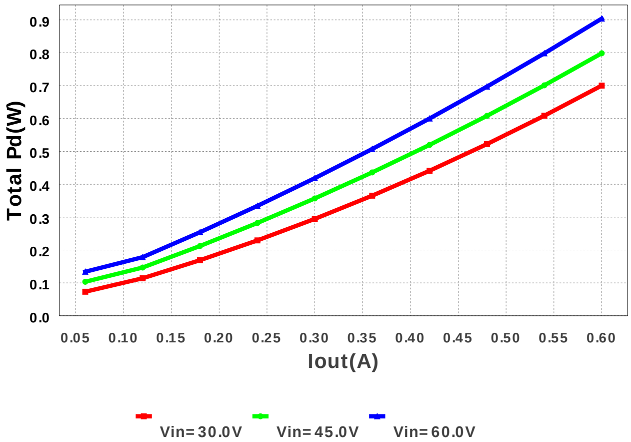

M Vds Act
M Vds Act(V)
Iout(A)
Vin=30.0V
Vin=45.0V
Vin=60.0V


M Irms
M Irms(A)
Iout(A)
Vin=30.0V
Vin=45.0V
Vin=60.0V

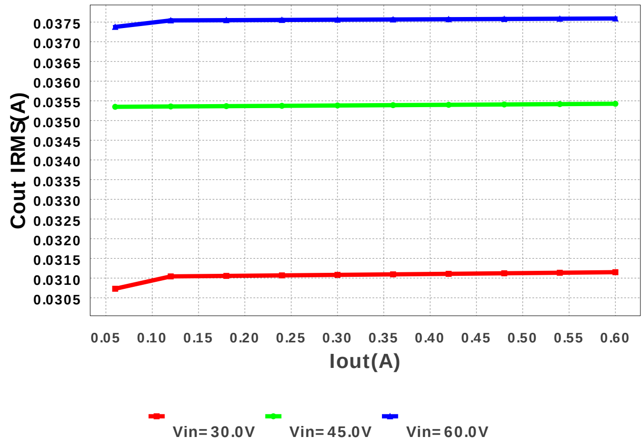

Pout
Pout(W)
Iout(A)
Vin=30.0V
Vin=45.0V
Vin=60.0V


Iin Avg
Iin Avg(A)
Iout(A)
Vin=30.0V
Vin=45.0V
Vin=60.0V

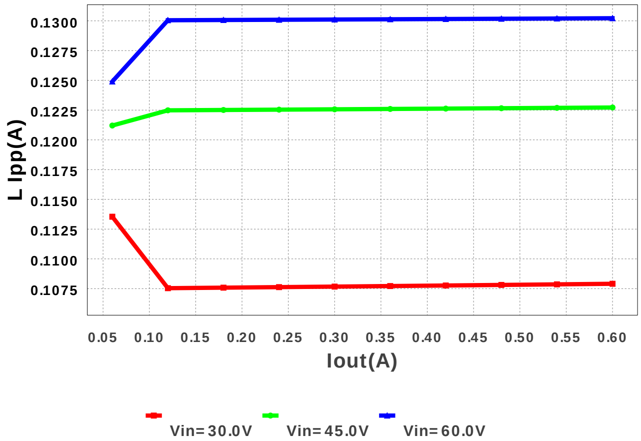
Total Pd



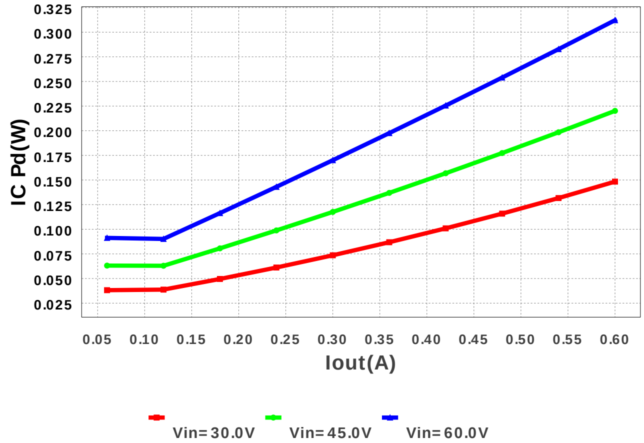
Cout IRMS



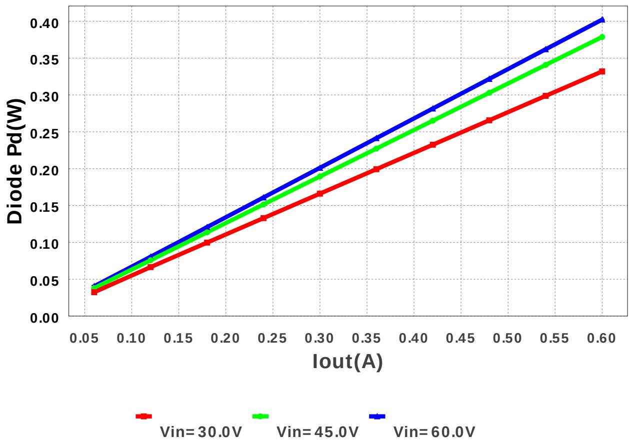
L Ipp



IC Pd



Diode Pd



Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	195.42 m A	Current	Input capacitor RMS ripple current
2.	Cout IRMS	41.008 m A	Current	Output capacitor RMS ripple current
3.	IC Ipk	600.0 m A	Current	Peak switch current in IC
4.	Iin Avg	98.712 m A	Current	Average input current
5.	L Ipp	142.057 m A	Current	Peak-to-peak inductor ripple current
6.	M1 Irms	233.474 m A	Current	Q Iavg
7.	BOM Count	19.0	General	Total Design BOM count
8.	FootPrint	518.0 mm2	General	Total Foot Print Area of BOM components
9.	Frequency	550.0 k Hz	General	Switching frequency
10.	IC Tolerance	50.0 m V	General	IC Feedback Tolerance
11.	M Vds Act	96.881 m V	General	Voltage drop across the MosFET

#	Name	Value	Category	Description
12.	Mode	CCM	General	Conduction Mode
13.	Pout	5.04 W	General	Total output power
14.	Total BOM	$2.46	General	Total BOM Cost
15.	D1 Tj	93.552 degC	Op_Point	D1 junction temperature
16.	Vout OP	8.4 V	Op_Point	Operational Output Voltage
17.	Duty Cycle	15.142 %	Op_point	Duty cycle
18.	Efficiency	85.096 %	Op_point	Steady state efficiency
19.	IC Tj	41.64 degC	Op_point	IC junction temperature
20.	ICThetaJA	40.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
21.	IOUT_OP	600.0 m A	Op_point	Iout operating point
22.	VIN_OP	60.0 V	Op_point	Vin operating point
23.	Vout p-p	1.847 m V	Op_point	Peak-to-peak output ripple voltage
24.	Cin Pd	31.081 m W	Power	Input capacitor power dissipation
25.	Cout Pd	21.862 µ W	Power	Output capacitor power dissipation
26.	Diode Pd	402.228 m W	Power	Diode power dissipation
27.	IC Pd	291.007 m W	Power	IC power dissipation
28.	L Pd	158.4 m W	Power	Inductor power dissipation
29.	Total Pd	882.722 m W	Power	Total Power Dissipation

Design Inputs

#	Name	Value	Description
1.	Iout	600.0 mA	Maximum Output Current
2.	Iout1	600.0 mAmps	Output Current #1
3.	VinMax	60.0 V	Maximum input voltage
4.	VinMin	30.0 V	Minimum input voltage
5.	Vout	8.4 V	Output Voltage
6.	Vout1	8.4 Volt	Output Voltage #1
7.	base_pn	LM5010A	National Based 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. **LM5010A** Product Folder : http://www.ti.com/product/lm5010a : contains the data sheet and other resources.