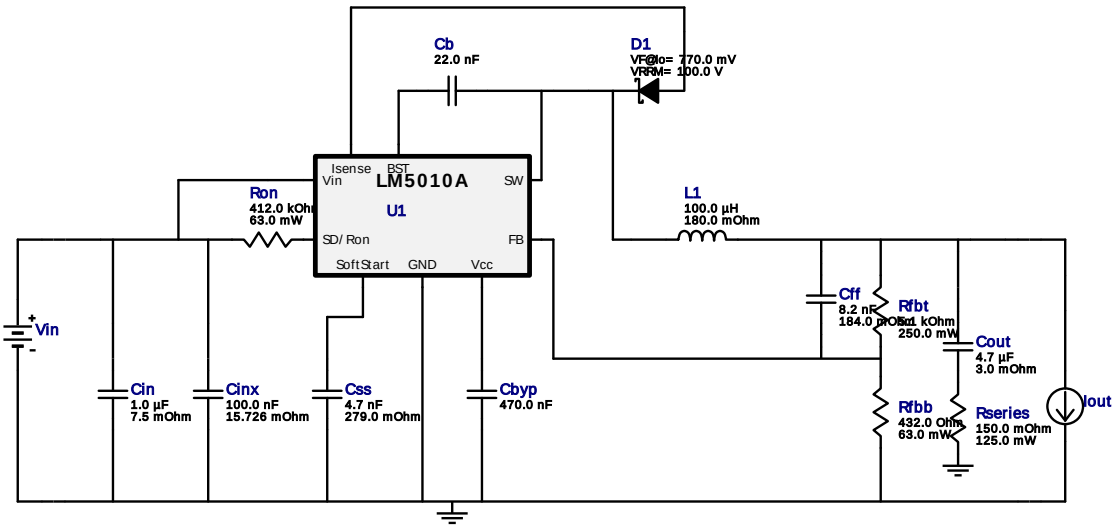
WEBENCH® Design Report

VinMin = 48.0V
VinMax = 60.0V
Vout = 32.0V
Iout = 1.0A

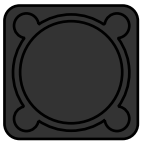
Device = LM5010AMH/NOPB
Topology = Buck
Created = 12/11/14 10:33:36 PM
BOM Cost = $2.79
Footprint = 358.0 mm²
BOM Count = 14
Total Pd = 2.12W

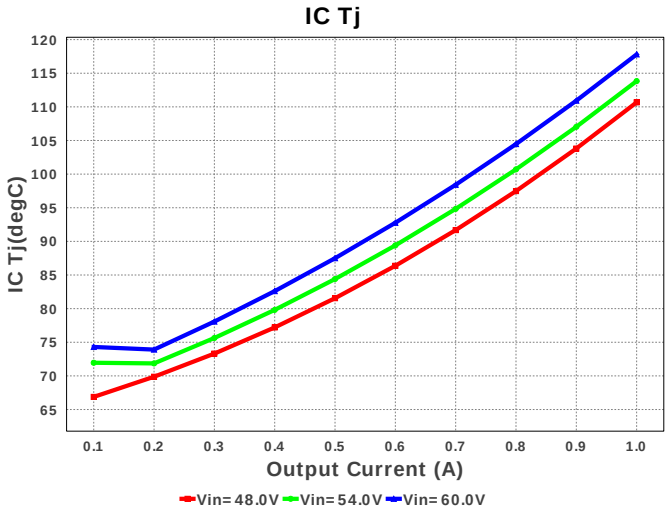
Design : 1542746/389 LM5010AMH/NOPB
LM5010AMH/NOPB 48.0V-60.0V to 32.00V @ 1.0A

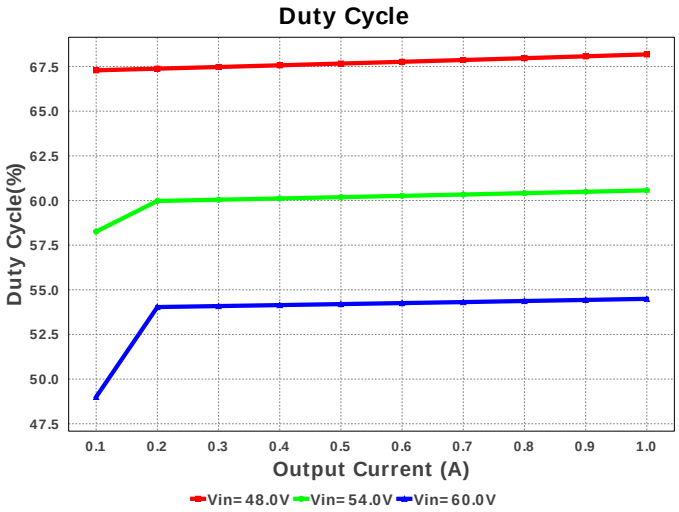


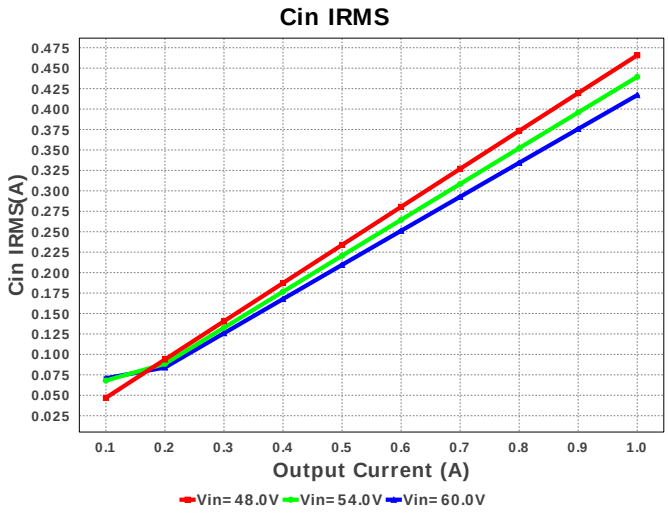
Electrical BOM

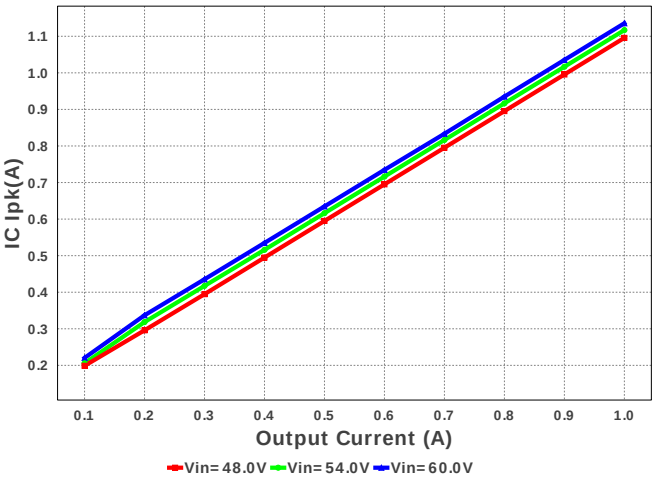
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cb	MuRata	GRM155R61C223KA01D Series= X5R	Cap= 22.0 nF VDC= 16.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
2.	Cbyp	Taiyo Yuden	EMK212B7474KD-T Series= X7R	Cap= 470.0 nF VDC= 16.0 V IRMS= 0.0 A	1	$0.02	0805 7 mm²
3.	Cff	Kemet	C1206C822K5RACTU Series= X7R	Cap= 8.2 nF ESR= 184.0 mOhm VDC= 50.0 V IRMS= 437.0 mA	1	$0.06	1206 11 mm²
4.	Cin	TDK	C3216X7R2A105M160AA Series= X7R	Cap= 1.0 uF ESR= 7.5 mOhm VDC= 100.0 V IRMS= 5.9235 A	1	$0.11	1206 11 mm²
5.	Cinx	TDK	C2012X7R2A104K Series= 285	Cap= 100.0 nF ESR= 15.726 mOhm VDC= 100.0 V IRMS= 0.0 A	1	$0.03	0805 7 mm²
6.	Cout	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 mm²
7.	Css	Kemet	C0805C472K5RACTU Series= X7R	Cap= 4.7 nF ESR= 279.0 mOhm VDC= 50.0 V IRMS= 321.0 mA	1	$0.01	0805 7 mm²
8.	D1	Diodes Inc.	DFLS1100-7	VF@Io= 770.0 mV VRRM= 100.0 V	1	$0.19	PowerDI123 13 mm²

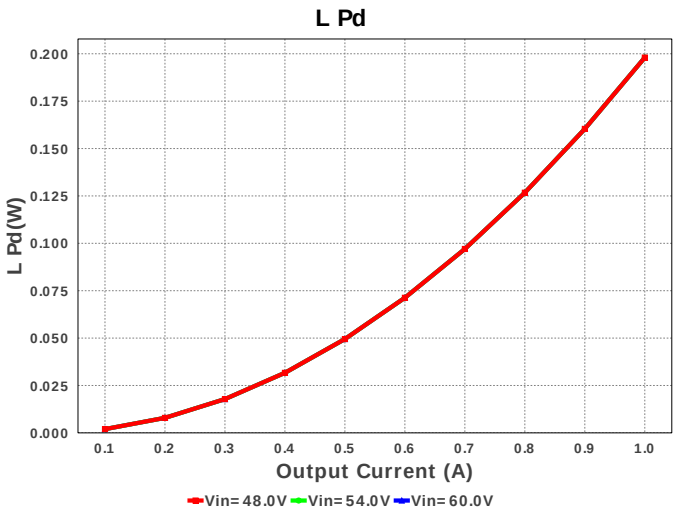
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
9.	L1	Bourns	SRR1260-101M	L= 100.0 µH DCR= 180.0 mOhm	1	$0.41	 SRR1260 210 mm²
10.	Rfbb	Vishay-Dale	CRCW0402432RFKED Series= CRCW..e3	Res= 432.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
11.	Rfbt	Yageo America	RC1206FR-075K1L Series= ?	Res= 5.1 kOhm Power= 250.0 mW Tolerance= 0.01%	1	$0.01	 1206 11 mm²
12.	Ron	Vishay-Dale	CRCW0402412KFKED Series= CRCW..e3	Res= 412.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
13.	Rseries	Panasonic	ERJ-2BSFR15X Series= 226	Res= 150.0 mOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.06	 0402 3 mm²
14.	U1	Texas Instruments	LM5010AMH/NOPB	Switcher	1	$1.76	 PWP0014A 59 mm²

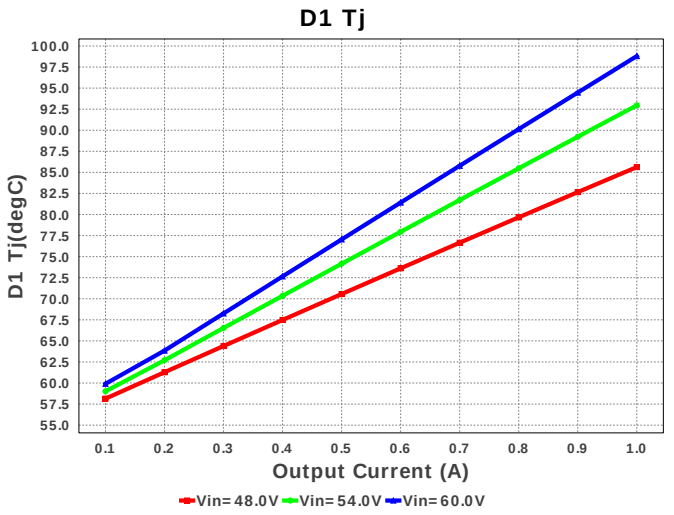


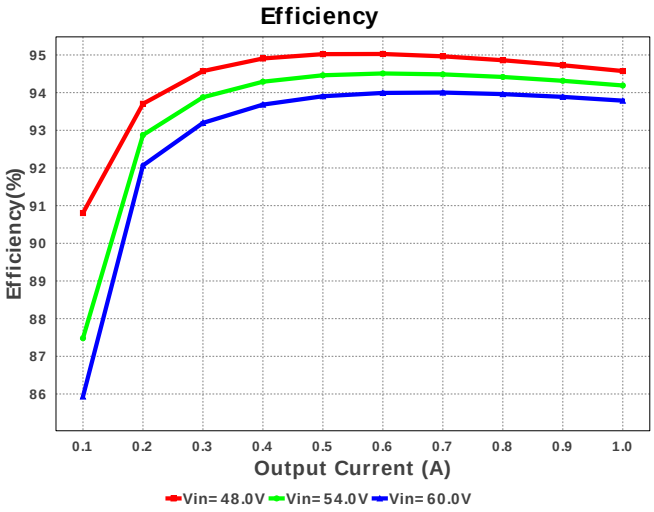


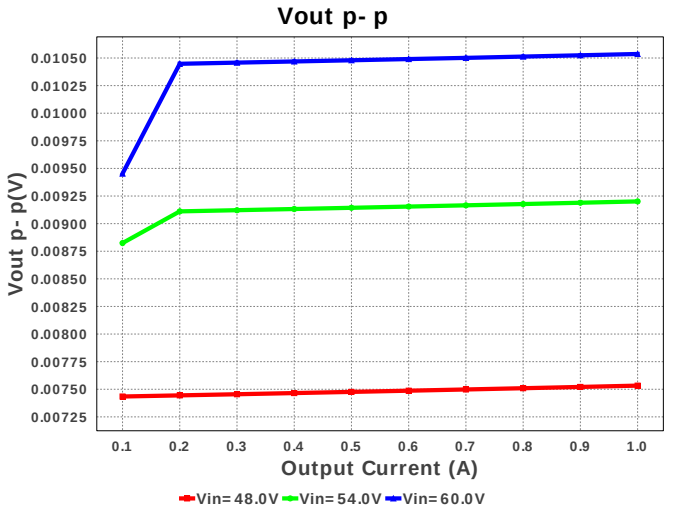


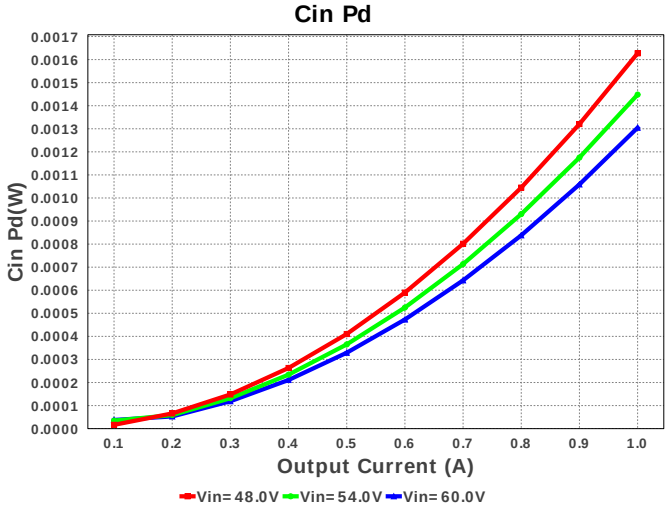


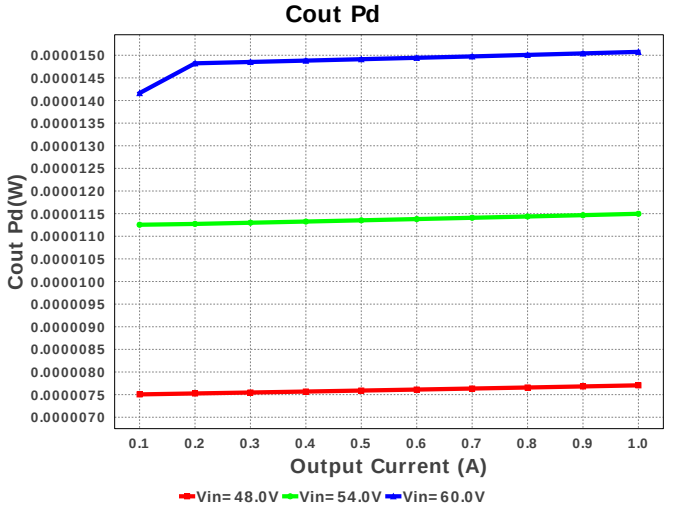


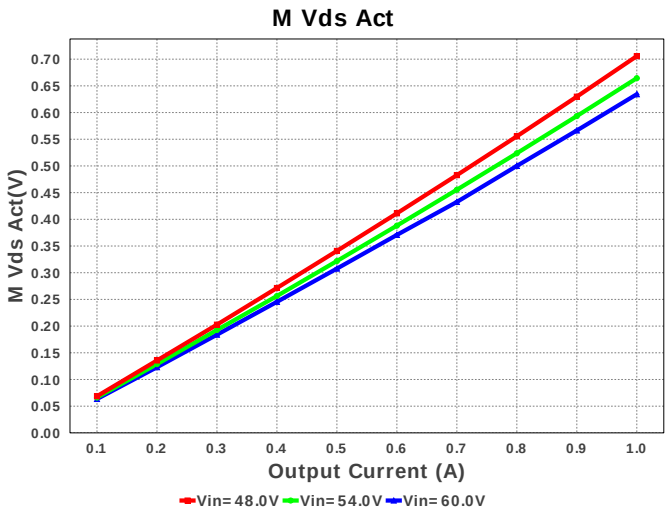


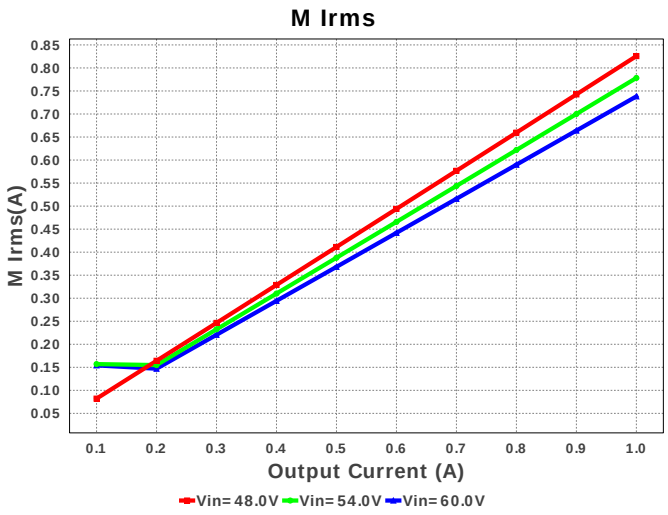


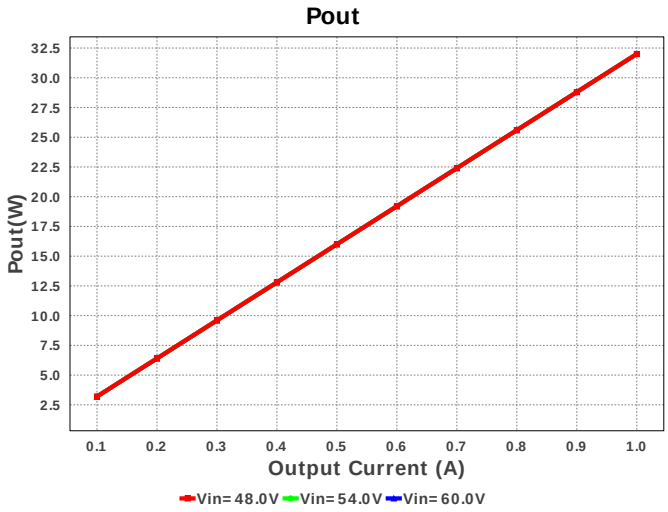


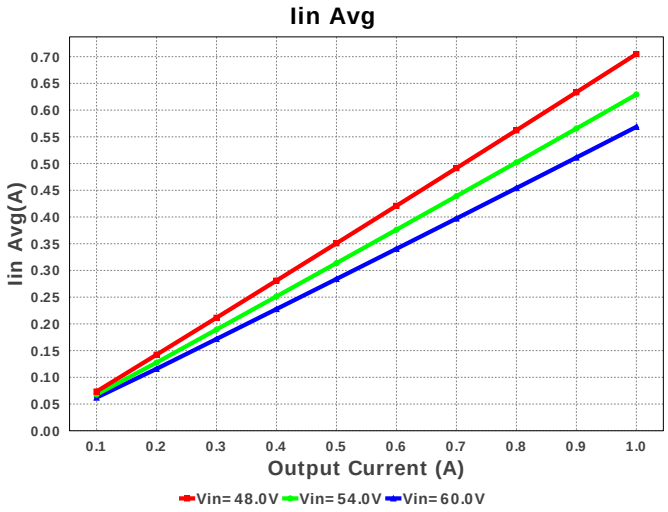


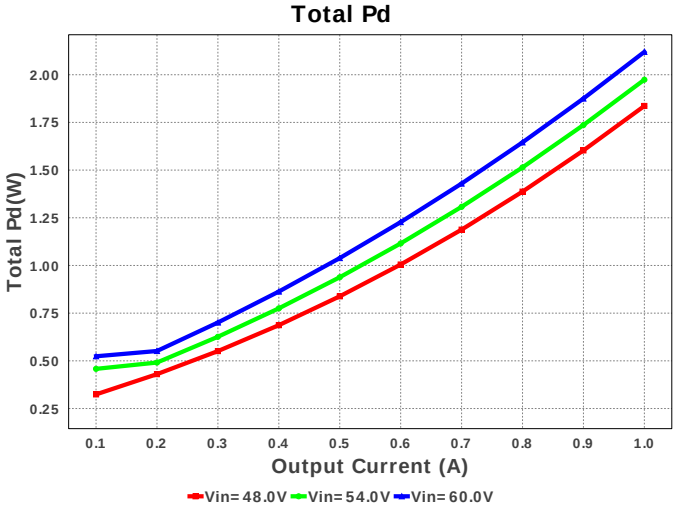


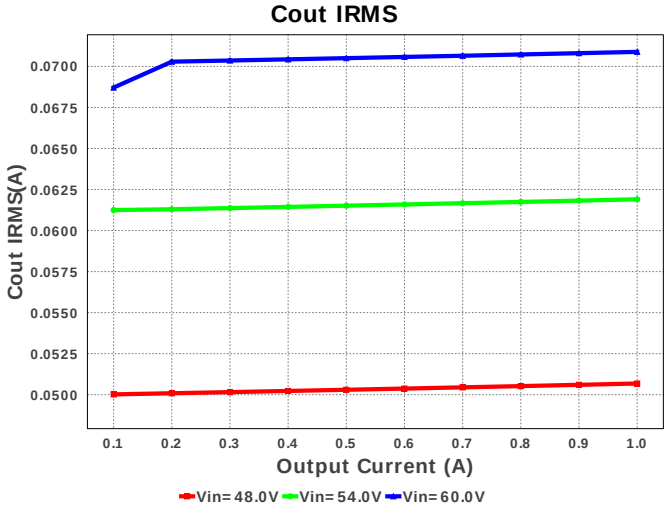


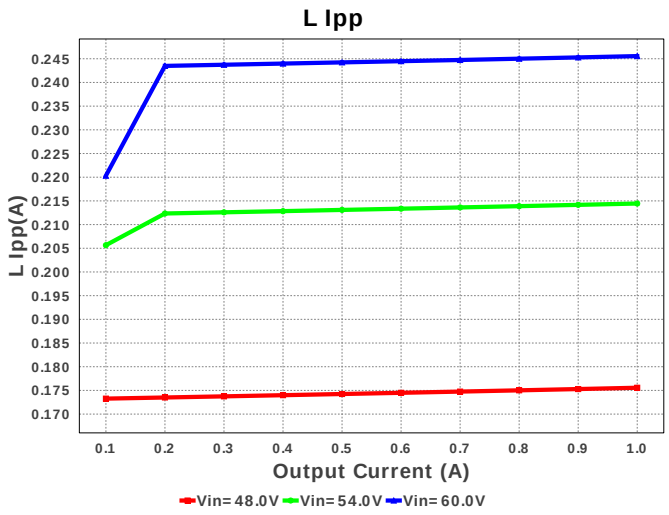


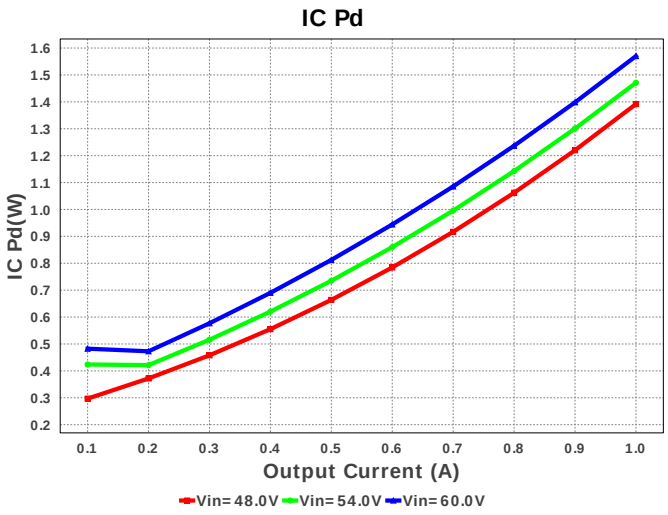


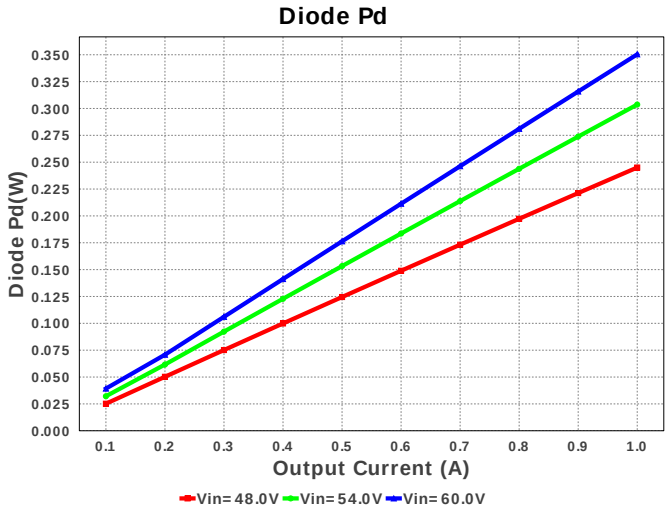












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	417.075 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	70.887 mA	Current	Output capacitor RMS ripple current
3.	IC Ipk	1.123 A	Current	Peak switch current in IC
4.	Iin Avg	568.66 mA	Current	Average input current
5.	L Ipp	245.56 mA	Current	Peak-to-peak inductor ripple current
6.	M1 Irms	738.197 mA	Current	Q Iavg
7.	BOM Count	14	General	Total Design BOM count
8.	FootPrint	358.0 mm^2	General	Total Foot Print Area of BOM components
9.	Frequency	621.359 kHz	General	Switching frequency
10.	IC Tolerance	50.0 mV	General	IC Feedback Tolerance
11.	M Vds Act	634.286 mV	General	Voltage drop across the MosFET
12.	Pout	32.0 W	General	Total output power
13.	Total BOM	$2.79	General	Total BOM Cost
14.	D1 Tj	98.8 degC	Op_Point	D1 junction temperature
15.	Vout OP	32.0 V	Op_Point	Operational Output Voltage
16.	Duty Cycle	54.493 %	Op_point	Duty cycle
17.	Efficiency	93.787 %	Op_point	Steady state efficiency
18.	IC Tj	117.802 degC	Op_point	IC junction temperature
19.	ICThetaJA	40.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
20.	IOUT_OP	1.0 A	Op_point	Iout operating point
21.	VIN_OP	60.0 V	Op_point	Vin operating point
22.	Vout p-p	10.536 mV	Op_point	Peak-to-peak output ripple voltage
23.	Cin Pd	1.305 mW	Power	Input capacitor power dissipation
24.	Cout Pd	15.075 µW	Power	Output capacitor power dissipation
25.	Diode Pd	350.401 mW	Power	Diode power dissipation
26.	IC Pd	1.57 W	Power	IC power dissipation
27.	L Pd	198.0 mW	Power	Inductor power dissipation
28.	Total Pd	2.12 W	Power	Total Power Dissipation

Design Inputs

#	Name	Value	Description
1.	Iout	1.0 A	Maximum Output Current
2.	Iout1	1.0 Amps	Output Current #1
3.	VinMax	60.0 V	Maximum input voltage
4.	VinMin	48.0 V	Minimum input voltage
5.	Vout	32.0 V	Output Voltage
6.	Vout1	32.0 Volt	Output Voltage #1
7.	base_pn	LM5010A	Base Product Number
8.	source	DC	Input Source Type
9.	Ta	55.0 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.