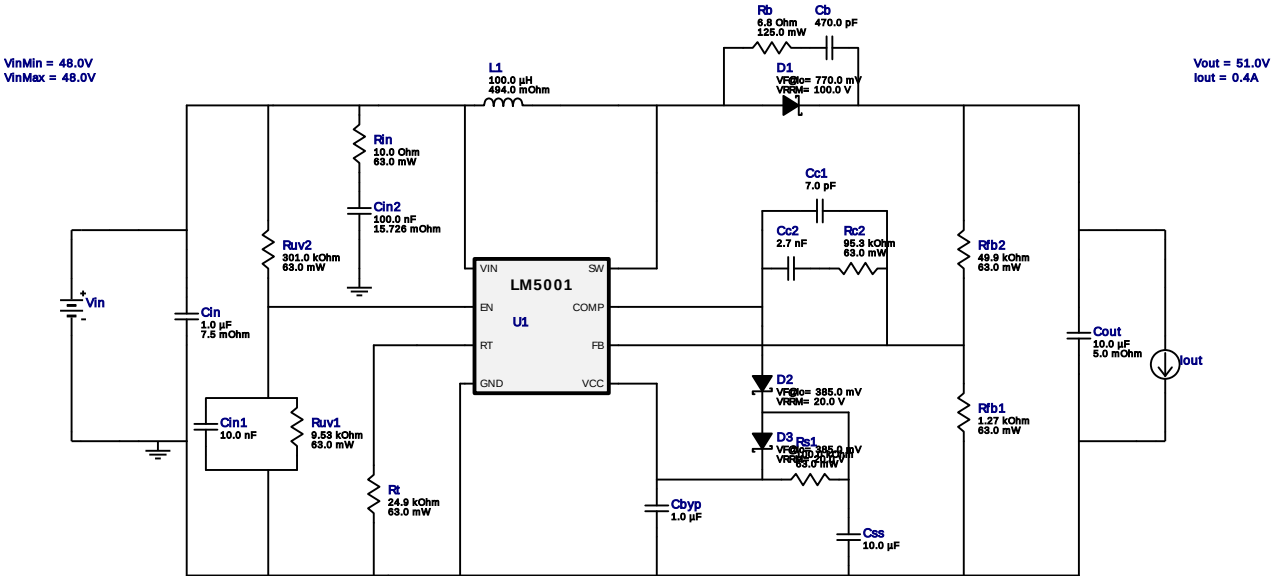
WEBENCH® Design Report

VinMin = 48.0V
VinMax = 48.0V
Vout = 51.0V
Iout = 0.4A

Device = LM5001SD/NOPB
Topology = Boost
Created = 8/12/15 10:22:54 AM
BOM Cost = $3.12
Footprint = 267.0 mm^2
BOM Count = 23
Total Pd = 0.95W

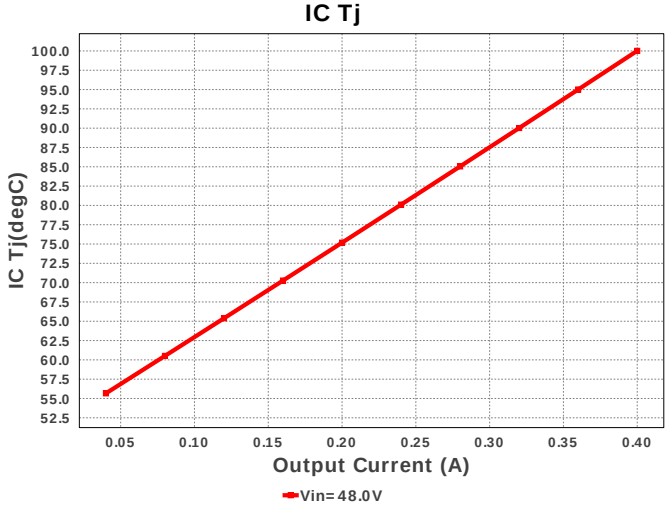
Design : 463344/551 LM5001SD/NOPB
LM5001SD/NOPB 48.0V-48.0V to 51.00V @ 0.4A

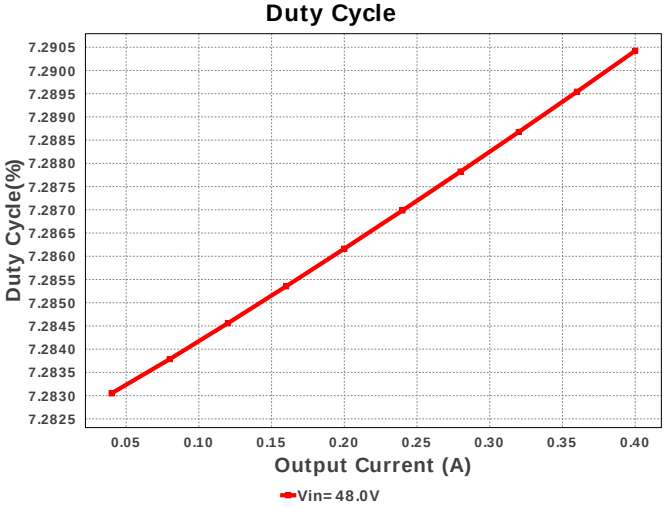


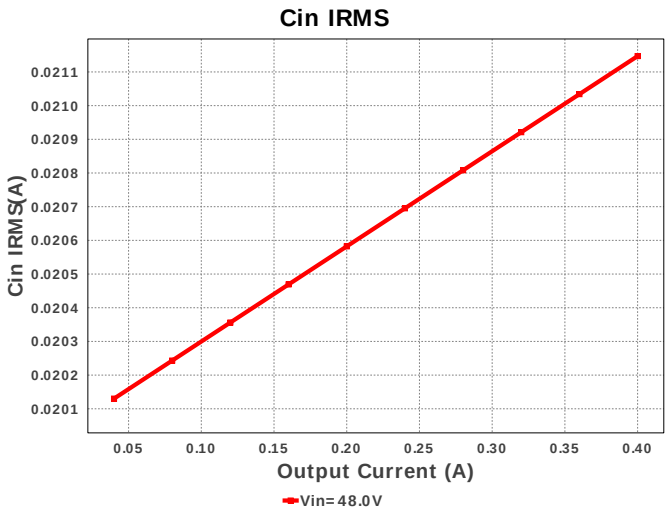
Electrical BOM

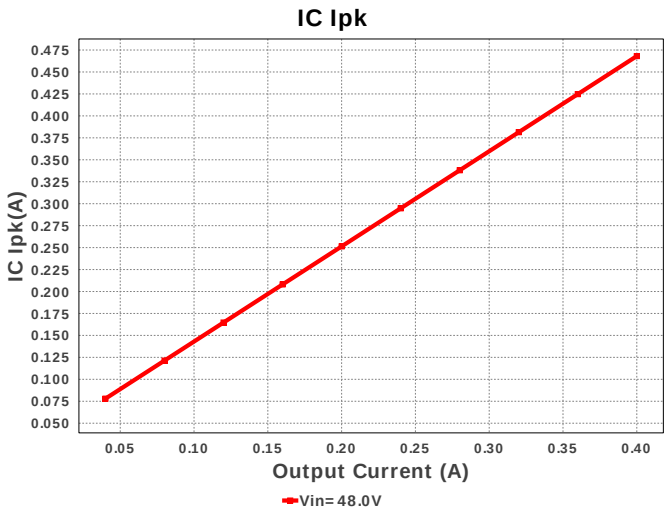
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cb	MuRata	GRM155R72A471KA01D Series= X7R	Cap= 470.0 pF VDC= 100.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm^2
2.	Cbyp	MuRata	GRM21BR61C105KA01L Series= X5R	Cap= 1.0 uF VDC= 16.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
3.	Cc1	Yageo America	CC0805DRNP09BN7R0 Series= C0G/NP0	Cap= 7.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
4.	Cc2	Yageo America	CC0805KRX7R9BB272 Series= X7R	Cap= 2.7 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
5.	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 mm^2
6.	Cin1	MuRata	GRM216R71H103KA01D Series= X7R	Cap= 10.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
7.	Cin2	TDK	C2012X7R2A104K Series= X7R	Cap= 100.0 nF ESR= 15.726 mOhm VDC= 100.0 V IRMS= 0.0 A	1	$0.03	0805 7 mm^2
8.	Cout	TDK	C5750X7S2A106M Series= X7S	Cap= 10.0 uF ESR= 5.0 mOhm VDC= 100.0 V IRMS= 6.45 A	1	$0.84	2220 54 mm^2
9.	Css	MuRata	GRM21BC81A106KE18L Series= X6S	Cap= 10.0 uF VDC= 10.0 V IRMS= 0.0 A	1	$0.03	0805 7 mm^2

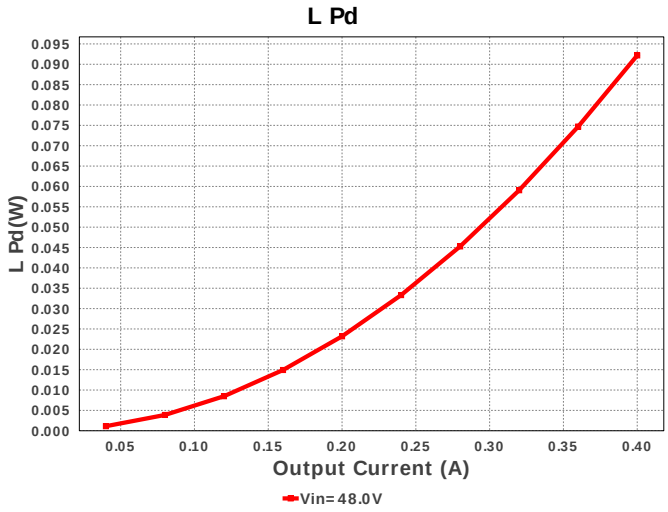
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	D1	Diodes Inc.	DFLS1100-7	VF@Io= 770.0 mV VRRM= 100.0 V	1	$0.14	PowerDI123 13 mm²
11.	D2	ON Semiconductor	MBR0520LT1G	VF@Io= 385.0 mV VRRM= 20.0 V	1	$0.06	SOD-123 13 mm²
12.	D3	ON Semiconductor	MBR0520LT1G	VF@Io= 385.0 mV VRRM= 20.0 V	1	$0.06	SOD-123 13 mm²
13.	L1	Bourns	SRN6045-101M	L= 100.0 µH DCR= 494.0 mOhm	1	$0.16	SRN6045 64 mm²
14.	Rb	Yageo America	RC0805JR-076R8L Series= ?	Res= 6.8 Ohm Power= 125.0 mW Tolerance= 0.05%	1	$0.01	0805 7 mm²
15.	Rc2	Vishay-Dale	CRCW040295K3FKED Series= CRCW..e3	Res= 95.3 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
16.	Rfb1	Vishay-Dale	CRCW04021K27FKED Series= CRCW..e3	Res= 1.27 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
17.	Rfb2	Vishay-Dale	CRCW040249K9FKED Series= CRCW..e3	Res= 49.9 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
18.	Rin	Vishay-Dale	CRCW040210R0FKED Series= CRCW..e3	Res= 10.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
19.	Rs1	Vishay-Dale	CRCW0402100KFKED Series= CRCW..e3	Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
20.	Rt	Vishay-Dale	CRCW040224K9FKED Series= CRCW..e3	Res= 24.9 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
21.	Ruv1	Vishay-Dale	CRCW04029K53FKED Series= CRCW..e3	Res= 9.53 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
22.	Ruv2	Vishay-Dale	CRCW0402301KFKED Series= CRCW..e3	Res= 301.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
23.	U1	Texas Instruments	LM5001SD/NOPB	Switcher	1	$1.55	SDC08A 25 mm²

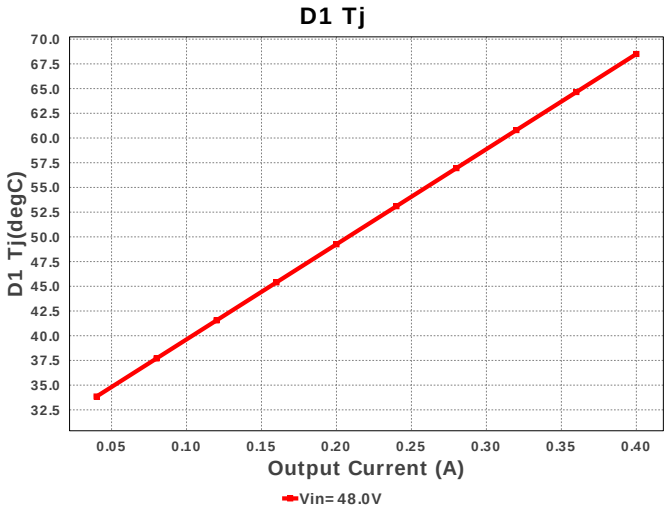


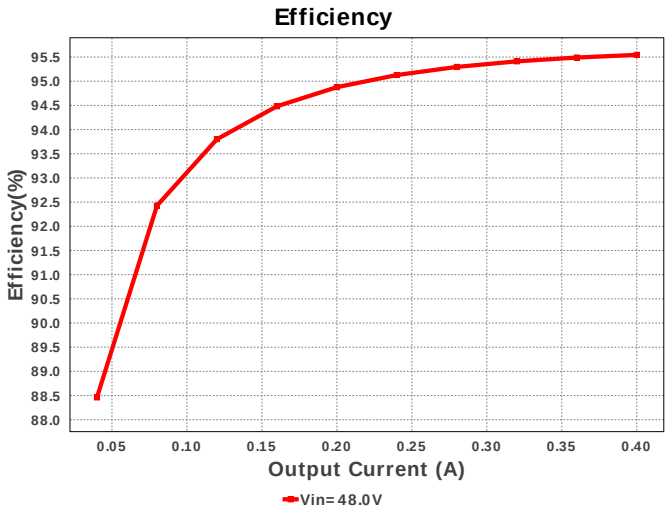


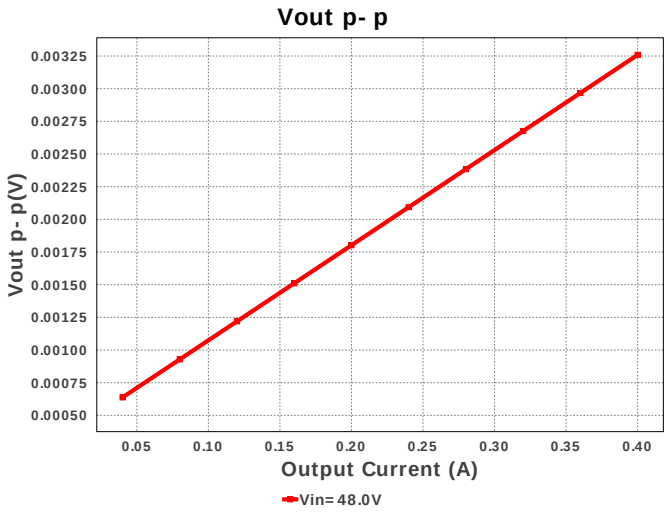


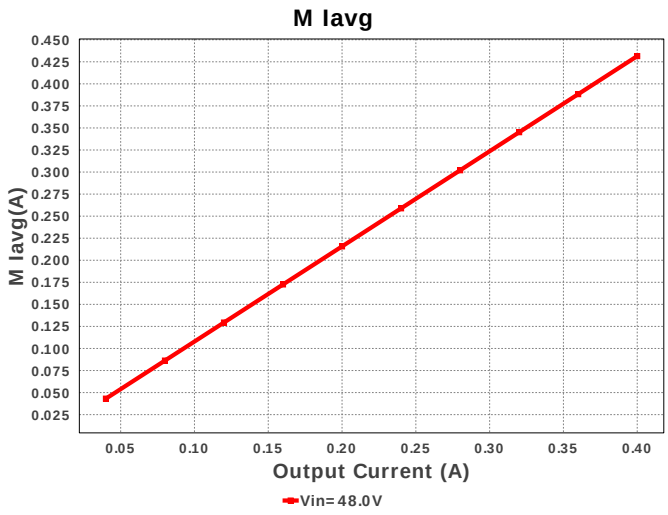


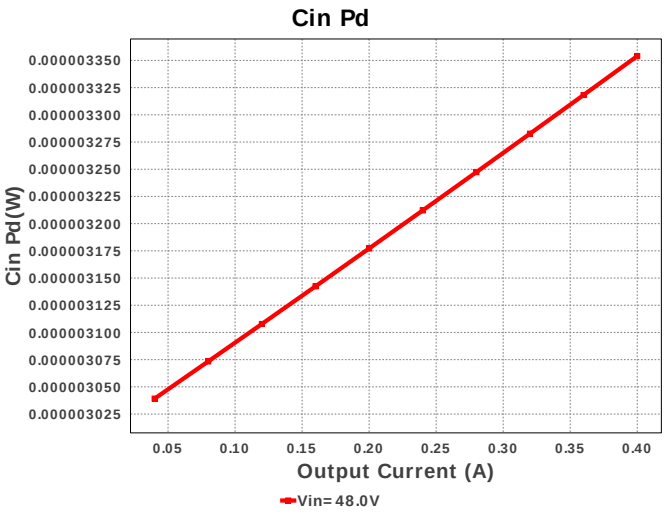


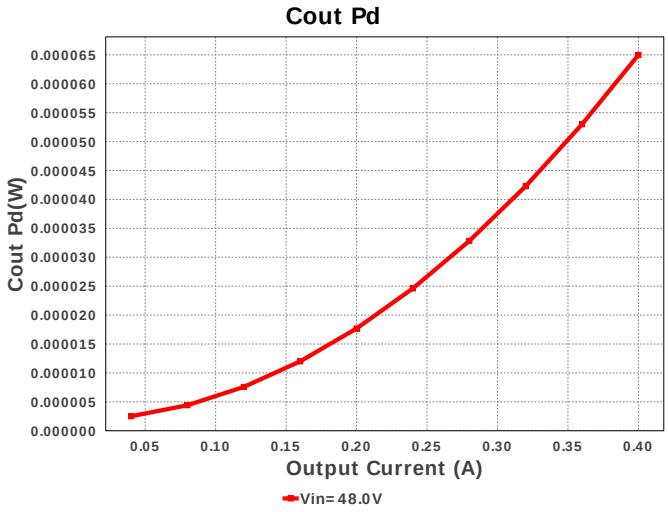


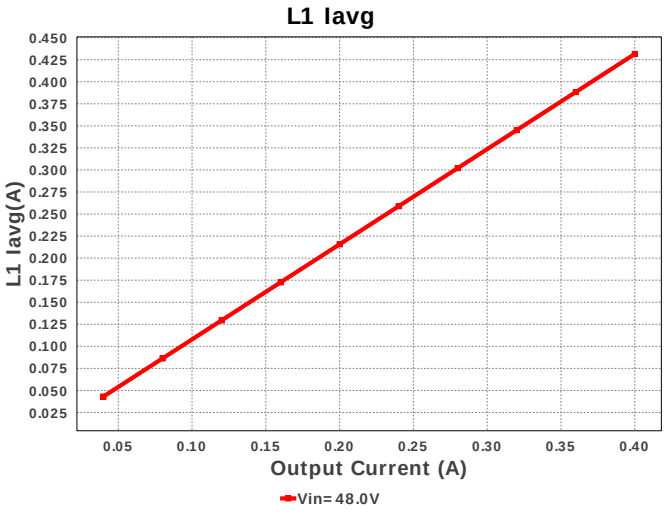


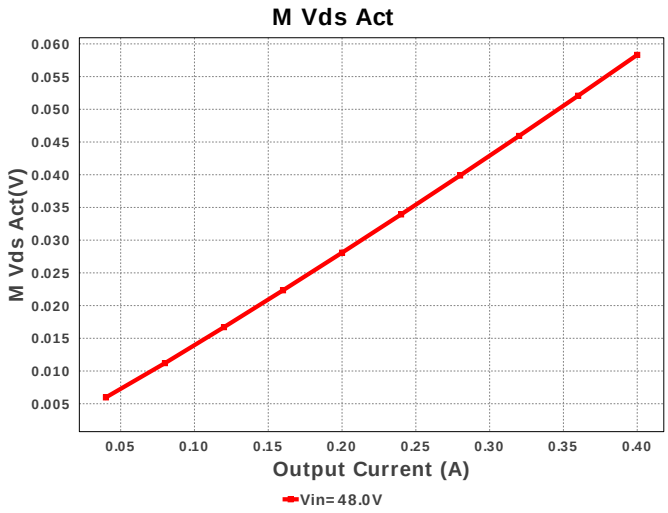


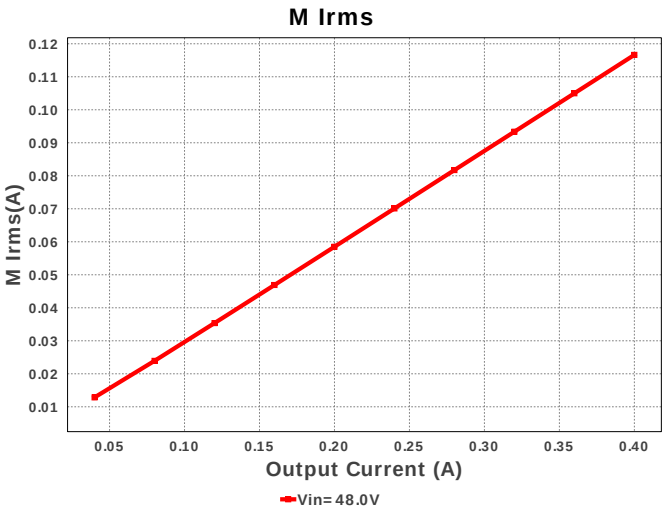


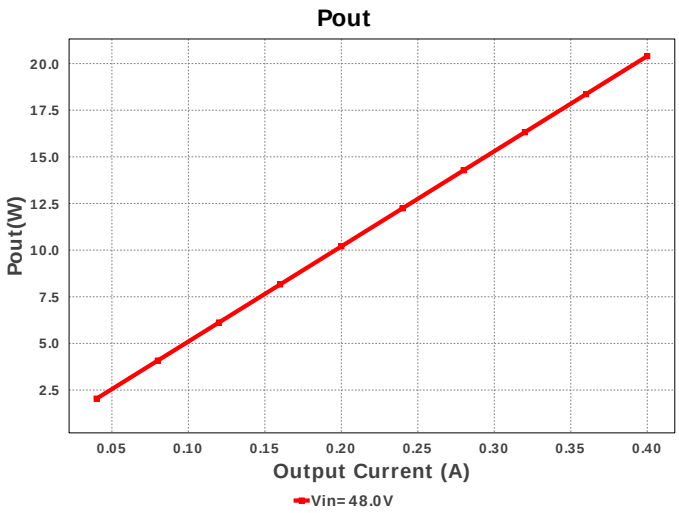


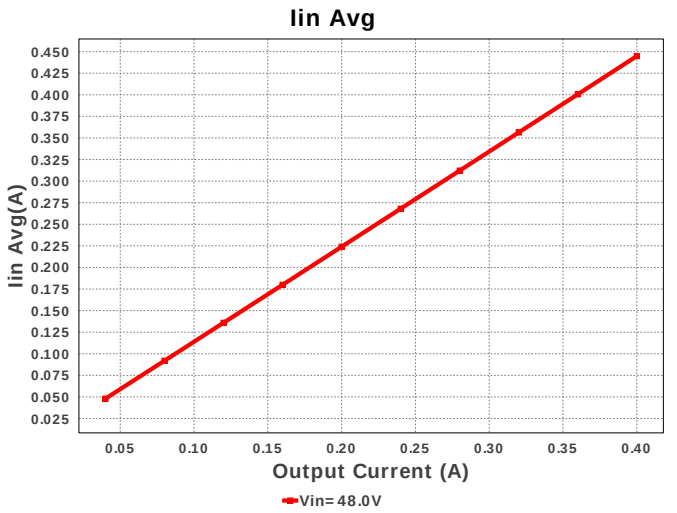


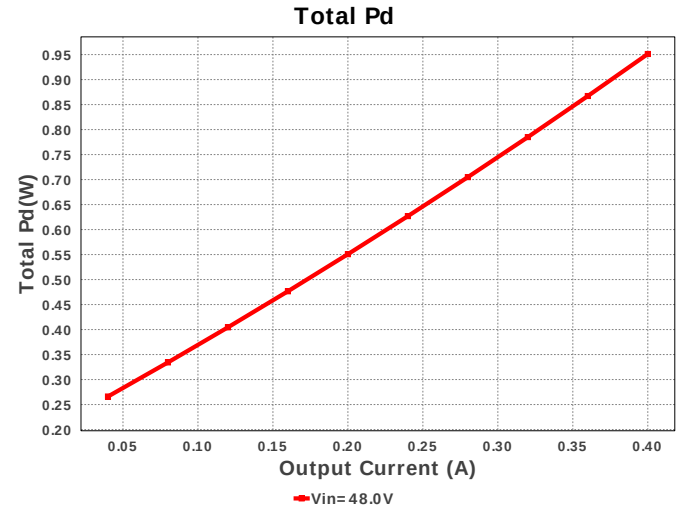


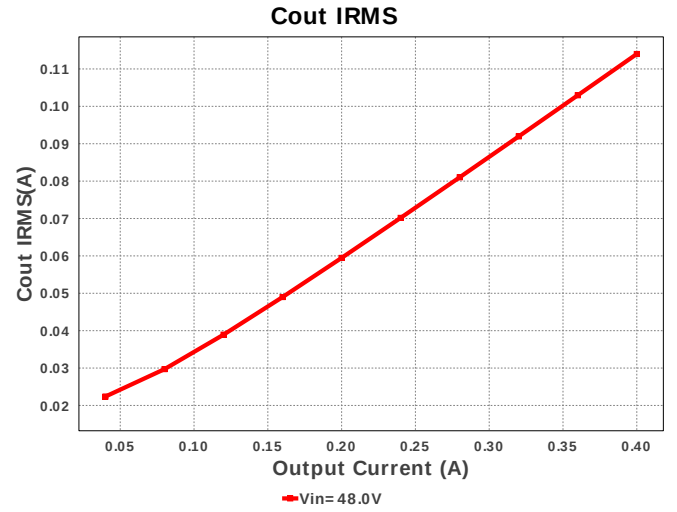


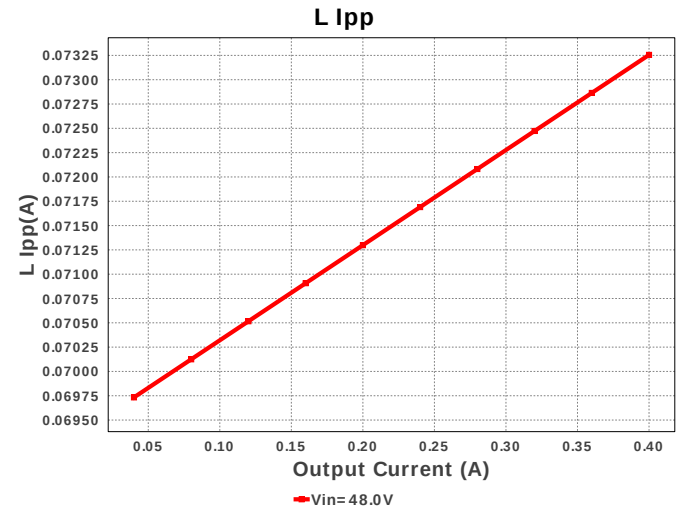


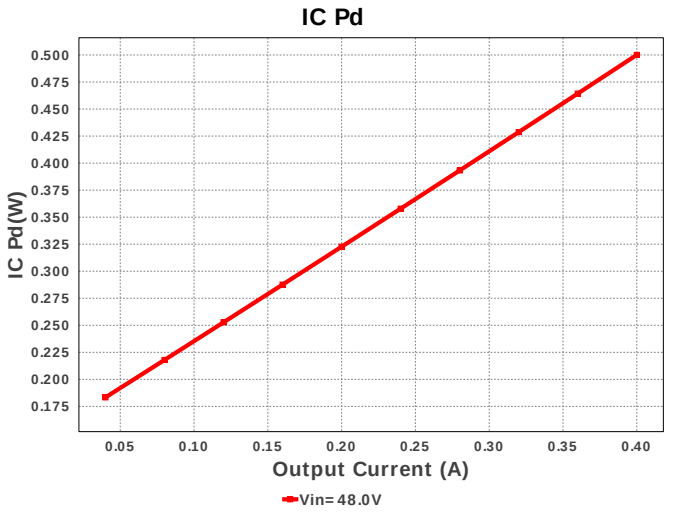


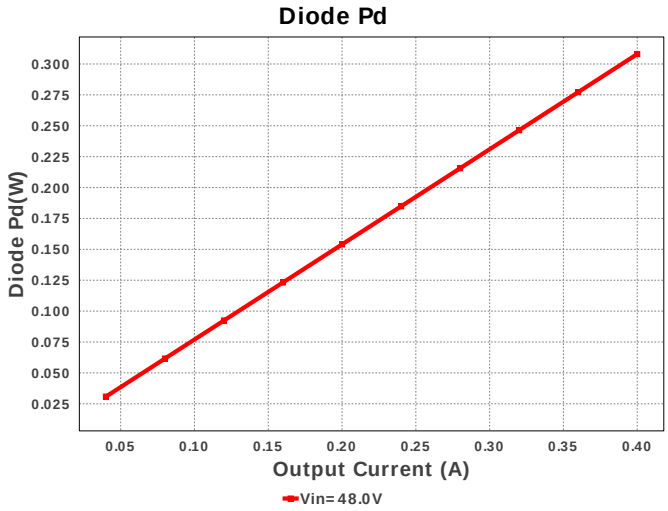












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	21.147 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	113.997 mA	Current	Output capacitor RMS ripple current
3.	IC Ipk	468.08 mA	Current	Peak switch current in IC
4.	Iin Avg	444.81 mA	Current	Average input current
5.	L Ipp	73.256 mA	Current	Peak-to-peak inductor ripple current
6.	L1 Iavg	431.452 mA	Current	Inductor average current
7.	M Iavg	431.452 mA	Current	MOSFET Average current
8.	M1 Irms	116.63 mA	Current	Q Iavg
9.	BOM Count	23	General	Total Design BOM count
10.	FootPrint	267.0 mm^2	General	Total Foot Print Area of BOM components
11.	Frequency	504.092 kHz	General	Switching frequency
12.	IC Tolerance	19.0 mV	General	IC Feedback Tolerance
13.	M Vds Act	53.648 mV	General	Voltage drop across the MosFET
14.	Pout	20.4 W	General	Total output power
15.	Total BOM	$3.12	General	Total BOM Cost
16.	D1 Tj	68.5 degC	Op_Point	D1 junction temperature
17.	Vout OP	51.0 V	Op_Point	Operational Output Voltage
18.	Cross Freq	30.318 kHz	Op_point	Bode plot crossover frequency
19.	Duty Cycle	7.29 %	Op_point	Duty cycle
20.	Efficiency	95.547 %	Op_point	Steady state efficiency
21.	IC Tj	49.983 degC	Op_point	IC junction temperature
22.	ICThetaJA	40.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
23.	IOUT_OP	400.0 mA	Op_point	Iout operating point
24.	Phase Marg	55.354 deg	Op_point	Bode Plot Phase Margin
25.	VIN_OP	48.0 V	Op_point	Vin operating point
26.	Vout p-p	3.735 mV	Op_point	Peak-to-peak output ripple voltage
27.	Cin Pd	3.354 µW	Power	Input capacitor power dissipation
28.	Cout Pd	64.977 µW	Power	Output capacitor power dissipation
29.	Diode Pd	308.0 mW	Power	Diode power dissipation
30.	IC Pd	499.564 mW	Power	IC power dissipation
31.	L Pd	92.179 mW	Power	Inductor power dissipation
32.	Total Pd	950.755 mW	Power	Total Power Dissipation

Design Inputs

#	Name	Value	Description
1.	Iout	400.0 m	Maximum Output Current
2.	Iout1	400.0 m	Output Current #1
3.	VinMax	48.0	Maximum input voltage
4.	VinMin	48.0	Minimum input voltage
5.	Vout	51.0	Output Voltage
6.	Vout1	51.0	Output Voltage #1
7.	base_pn	LM5001	Base Product Number
8.	source	DC	Input Source Type
9.	Ta	30.0	Ambient temperature

Design Assistance

1. The LM5001 high voltage switch mode regulator features all of the functions necessary to implement efficient high voltage Boost, Flyback, SEPIC and Forward converters, using few external components. This easy to use regulator integrates a 75 Volt N-Channel MOSFET with a 1 Amp peak current limit. Current mode control provides inherently simple loop compensation and line-voltage feed-forward for superior

rejection of input transients. The switching frequency is set with a single resistor and is programmable up to 1.5MHz. The oscillator can also be synchronized to an external clock. Additional protection features include: current limit, thermal shutdown, under-voltage lockout and remote shutdown capability. The device is available in both SO-8 and LLP-8 packages.

2. **LM5001** Product Folder : http://www.ti.com/product/LM5001 : contains the data sheet and other resources.