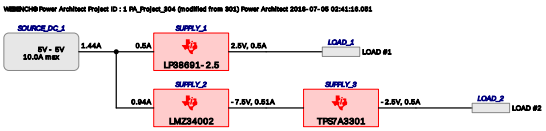


WEBENCH® Power Architect

Project Report

Project : 4406513/1 : PA_Project_304 (modified from 301)
Created : 2016-07-05 02:41:16.051
Optimize project optFactor=3

Project Summary

1.	Total System Efficiency	33.006 %
2.	Total System BOM Count	18.0
3.	Total System Footprint	418.0 mm2
4.	Total System BOM Cost	$0.00
5.	Total System Power Dissipation	5.074 W

--> Launch WEBENCH Power Architect.

Sequencer Flag Table

Supply	Sequencer Flag	Load	Load Name
SUPPLY_1	0	LOAD_1	LOAD #1
SUPPLY_3	0	LOAD_2	LOAD #2
SUPPLY_2	NA		

Power Supplies

#	Name	NSID	Description	Vout	Iout	Efficiency	Foot-print	Cost	Design	Page
1.	SUPPLY_1	LP38691-2.5	LDO : Very low quiescent current	2.5 V	0.5 A	50%	22	$0.52	29	4
2.	SUPPLY_2	LMZ34002	Switcher : 4.5 - 40V Input, 15W, Negative Output,Integrated Power Solution	-7.5 V	0.505 A	80.7%	248	$0.00	31	11
3.	SUPPLY_3	TPS7A3301	LDO : -36-V, -1-A,Ultralow-NoiseNegativeVoltageRegulator	-2.5 V	0.5 A	30%	156	$0.00	30	7

Power Loads

#	Name	VLoad	ILoad	Description
1.	LOAD #1	2.5 V	0.5 A	
2.	LOAD #2	-2.5 V	0.5 A	

Project Diagram

Electrical Procurement BOM

Manufacturer	Part Number	Description	Quantity	Budgetary Price	Footprint (mm^2)
Panasonic	16SVPC100M	SM_RADIAL_6.3AMM	1	$0.29	80
TDK	C1005X5R0J105M	0402	3	$0.01	9
TDK	C3216X5R1A476M	1206	1	$0.00	11
Yageo America	CC0603MRX5R5BB106	0603	1	$0.03	5
Vishay-Dale	CRCW0402200KFKED	0402	1	$0.01	3
Vishay-Dale	CRCW0402215KFKED	0402	1	$0.00	3
Vishay-Dale	CRCW0402226KFKED	0402	1	$0.01	3
Vishay-Dale	CRCW040286K6FKED	0402	2	$0.01	6
MuRata	GRM033R61A103KA01D	0201	1	$0.01	2
MuRata	GRM188R61A105KA61D	0603	2	$0.01	5
MuRata	GRM21BR61E475MA12L	0805	1	$0.02	7
Texas Instruments	LMZ34002RKGR	RKG0041A	1	$6.75	143
Texas Instruments	LP38691SDX-2.5/NOPB	SDE06A	1	$0.50	16
Texas Instruments	TPS7A3301KC	TA07B	1	$3.00	121
Total			18	$10.69	413.082

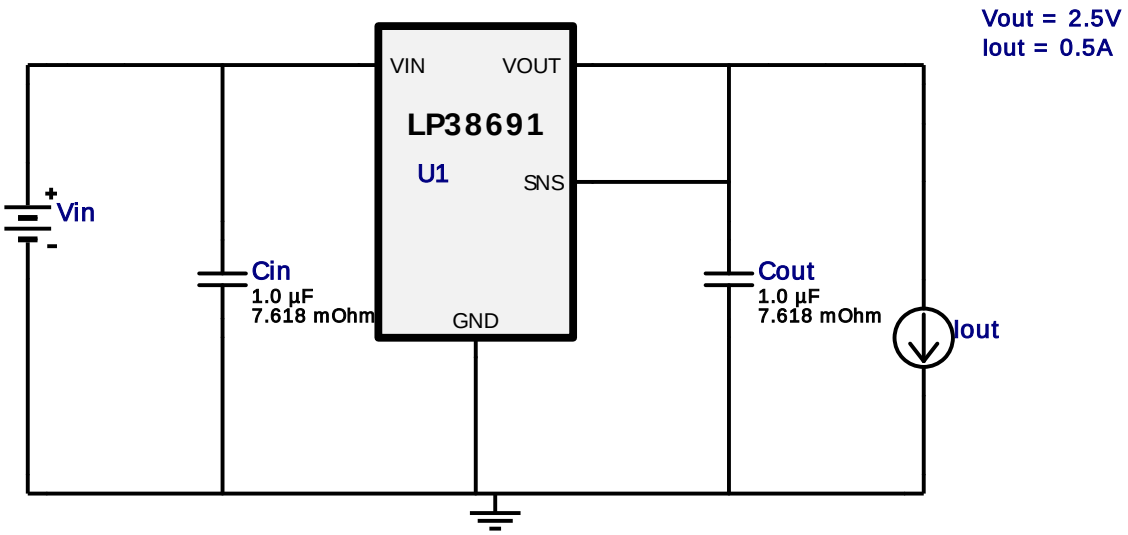
TEXAS INSTRUMENTS

WEBENCH® Design Report

Vout = 2.5V
Iout = 0.5A

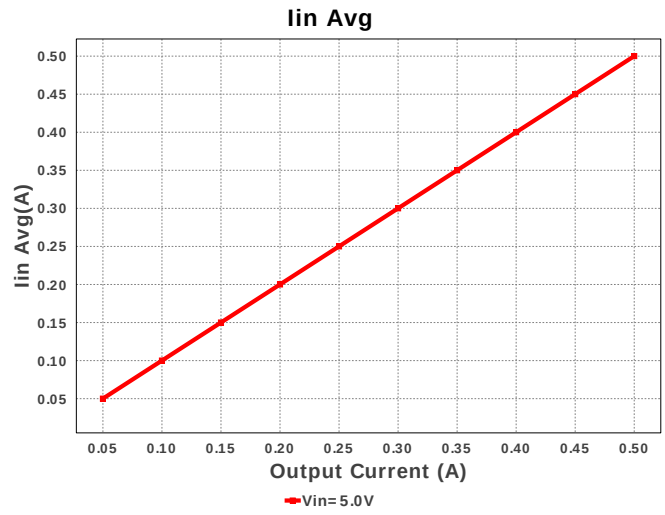
Device = LP38691SDX-2.5/NOPB
Topology = LDO
Created = 7/5/16 2:41:15 AM
BOM Cost = $0.52
BOM Count = 3
Total Pd = 1.25W

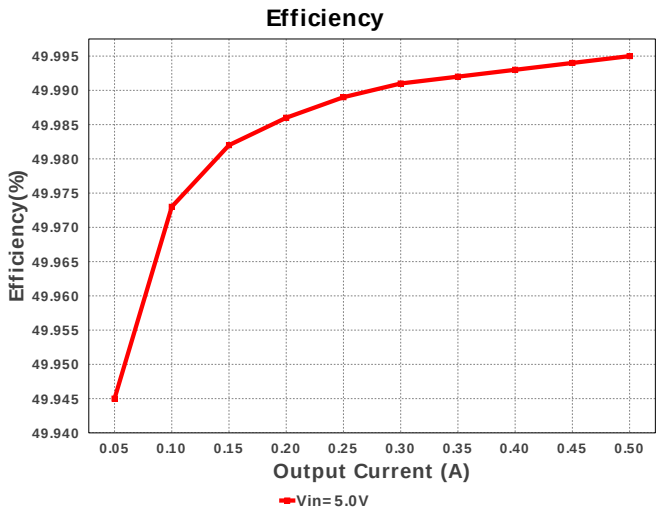
Design : 4406513/29 LP38691SDX-2.5/NOPB
LP38691SDX-2.5/NOPB 5.0V-5.0V to 2.50V @ 0.5A

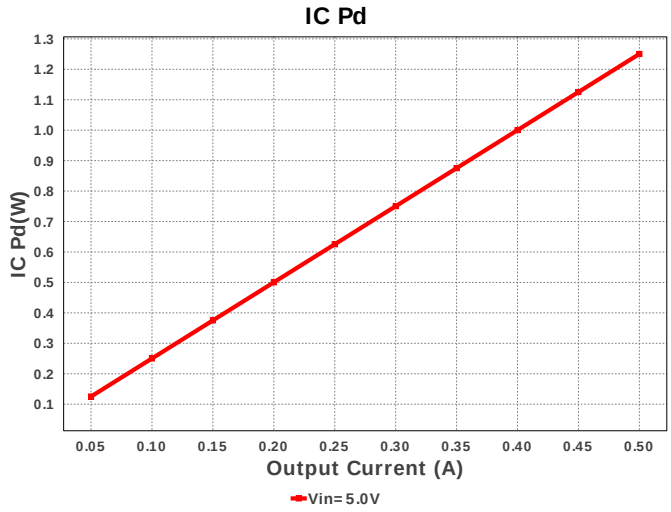


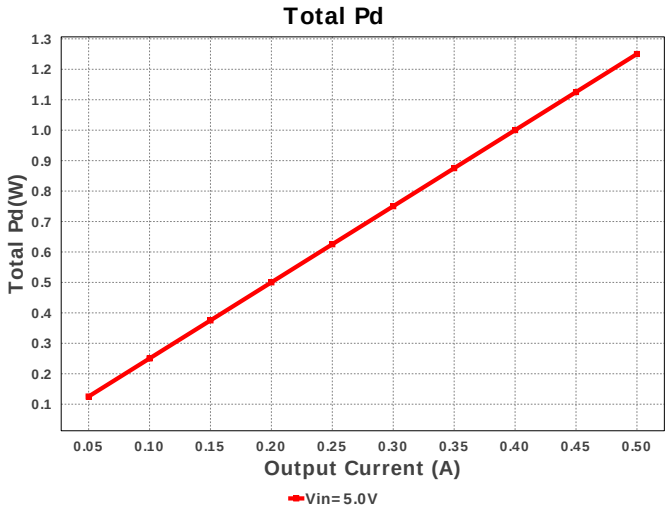
Electrical BOM

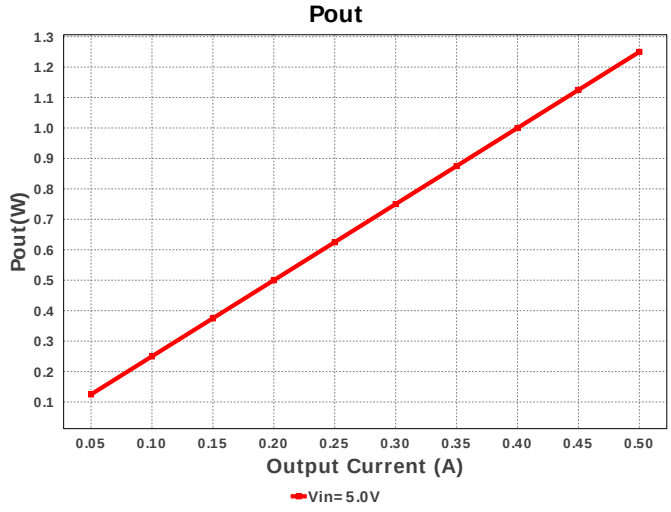
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cin	TDK	C1005X5R0J105M Series= X5R	Cap= 1.0 uF ESR= 7.618 mOhm VDC= 6.3 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
2.	Cout	TDK	C1005X5R0J105M Series= X5R	Cap= 1.0 uF ESR= 7.618 mOhm VDC= 6.3 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
3.	U1	Texas Instruments	LP38691SDX-2.5/NOPB	Switcher	1	$0.50	SDE06A 16 mm²

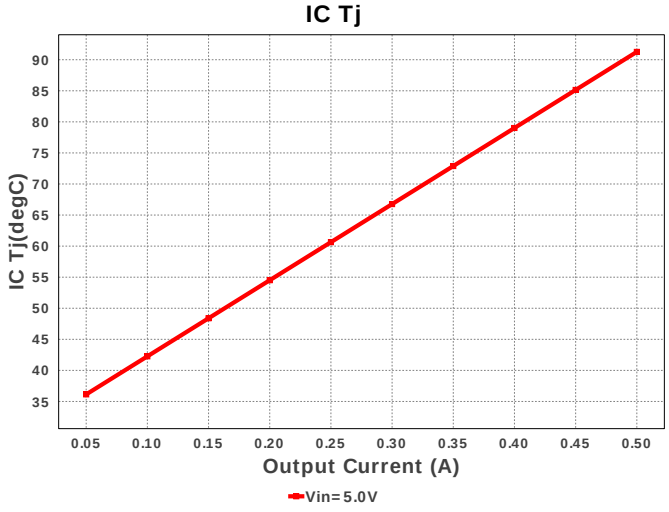


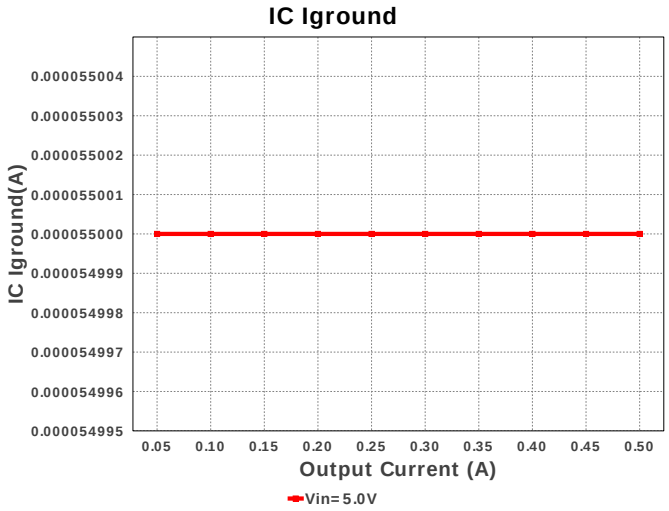


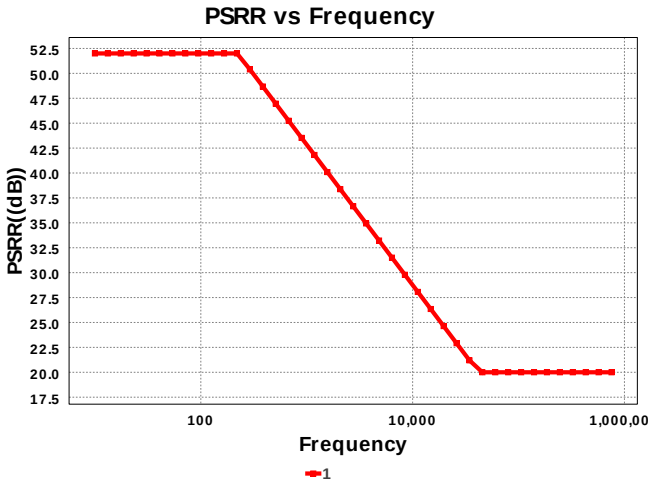












Operating Values

#	Name	Value	Category	Description
1.	IC Iground	55.0 µA	Current	IC ground current
2.	Iin Avg	500.06 mA	Current	Average input current
3.	BOM Count	3	General	Total Design BOM count
4.	FootPrint	22.0 mm^2	General	Total Foot Print Area of BOM components
5.	IC Tolerance	100.0 mV	General	IC Feedback Tolerance
6.	Pout	1.25 W	General	Total output power
7.	Total BOM	$0.52	General	Total BOM Cost
8.	Vin p-p	50.0 mV	Op_Point	Input Source ripple voltage
9.	Vout OP	2.5 V	Op_Point	Operational Output Voltage
10.	Efficiency	49.995 %	Op_point	Steady state efficiency
11.	IC Tj	91.263 degC	Op_point	IC junction temperature
12.	ICThetaJA	49.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
13.	IOUT_OP	500.0 mA	Op_point	Iout operating point
14.	Input Ripple Frequency	100.0 kHz	Op_point	Input Source Ripple Frequency for PSRR Calculation
15.	PSRR est.	-20.0 dB	Op_point	Power Supply Rejection Ratio, estimated
16.	VIN_OP	5.0 V	Op_point	Vin operating point
17.	Vout p-p	5.0 mV	Op_point	Peak-to-peak output ripple voltage
18.	IC Pd	1.25 W	Power	IC power dissipation
19.	Total Pd	1.25 W	Power	Total Power Dissipation
20.	Vout Tolerance	4.0 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	500.0 m	Maximum Output Current
2.	VinMax	5.0	Maximum input voltage
3.	VinMin	5.0	Minimum input voltage
4.	Vout	2.5	Output Voltage
5.	base_pn	LP38691	Texas Instruments Base Part Number
6.	source	DC	Input Source Type
7.	ta	30.0	Ambient temperature

Design Assistance

1. LP38691 Product Folder : http://www.ti.com/product/lp38691 : contains the data sheet and other resources.

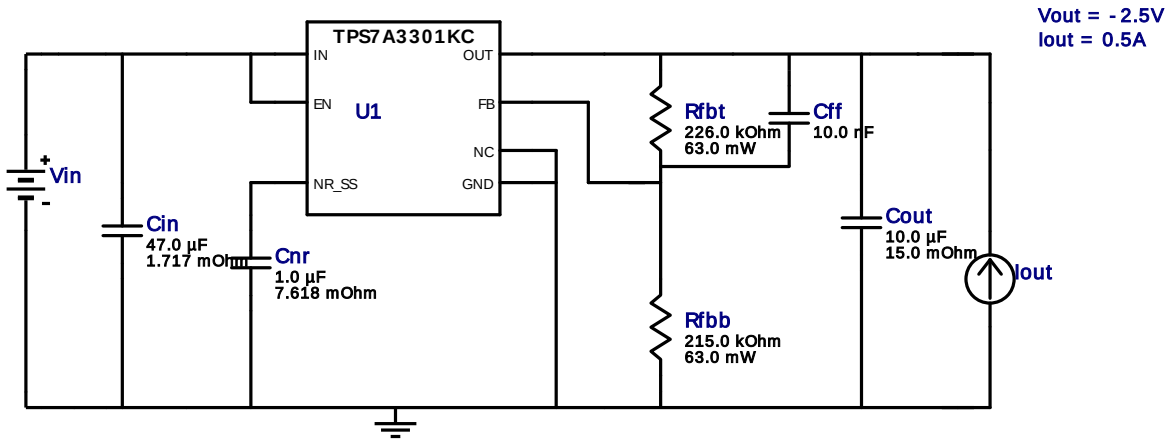
TEXAS INSTRUMENTS

WEBENCH® Design Report

Vout = -2.5V
Iout = 0.5A

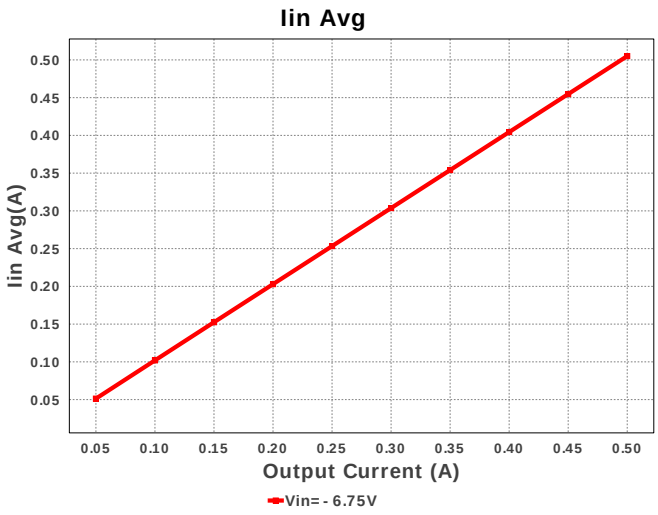
Device = TPS7A3301KC
Topology = LDO
Created = 7/5/16 2:41:15 AM
BOM Cost = $0.00
BOM Count = 7
Total Pd = 2.92W

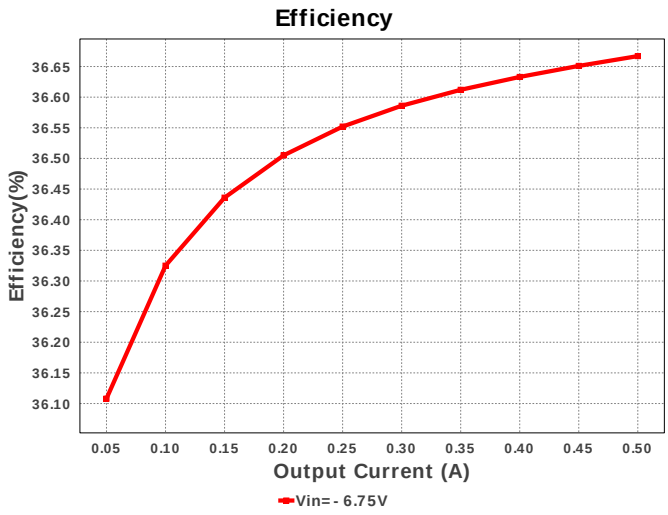
Design : 4406513/30 TPS7A3301KC
TPS7A3301KC -6.75V--8.25V to -2.50V @ 0.5A

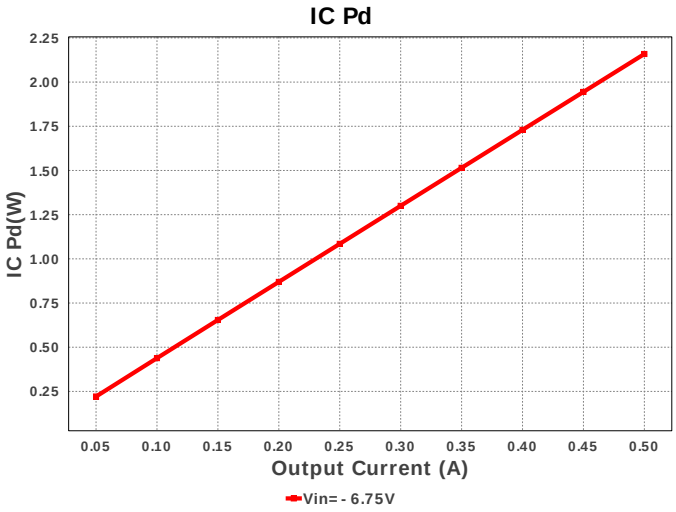


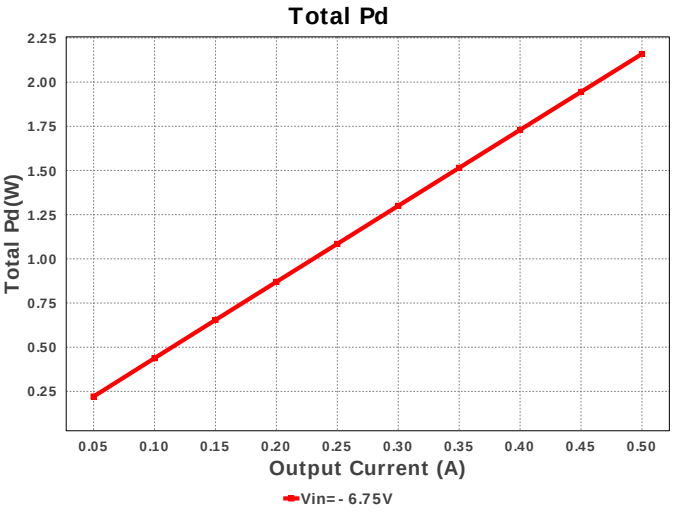
Electrical BOM

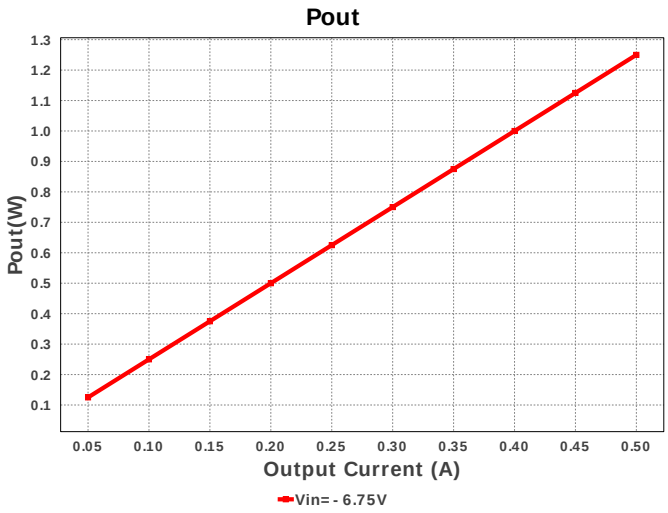
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cff	MuRata	GRM033R61A103KA01D Series= X5R	Cap= 10.0 nF VDC= 10.0 V IRMS= 0.0 A	1	$0.01	0201 2 mm²
2.	Cin	TDK	C3216X5R1A476M Series= X5R	Cap= 47.0 uF ESR= 1.717 mOhm VDC= 10.0 V IRMS= 0.0 A	1	NA	1206 11 mm²
3.	Cnr	TDK	C1005X5R0J105M Series= X5R	Cap= 1.0 uF ESR= 7.618 mOhm VDC= 6.3 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
4.	Cout	Yageo America	CC0603MRX5R5BB106 Series= X5R	Cap= 10.0 uF ESR= 15.0 mOhm VDC= 6.3 V IRMS= 0.0 A	1	$0.03	0603 5 mm²
5.	Rfbb	Vishay-Dale	CRCW0402215KFKED Series= CRCW..e3	Res= 215.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	NA	0402 3 mm²
6.	Rfbt	Vishay-Dale	CRCW0402226KFKED Series= CRCW..e3	Res= 226.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
7.	U1	Texas Instruments	TPS7A3301KC	Switcher	1	$3.00	TA07B 121 mm²

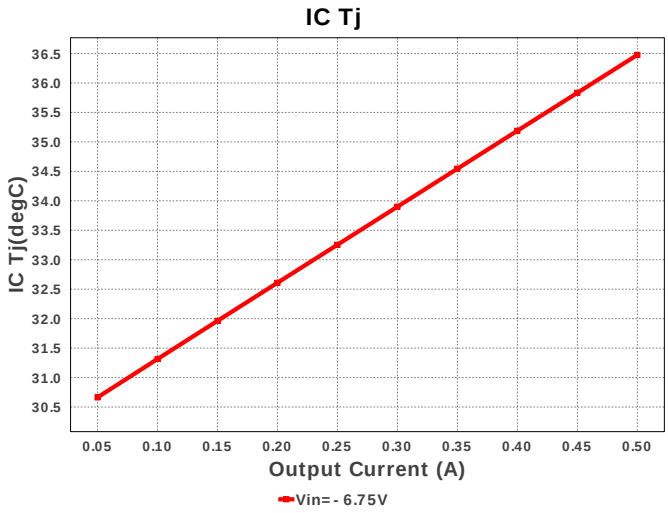


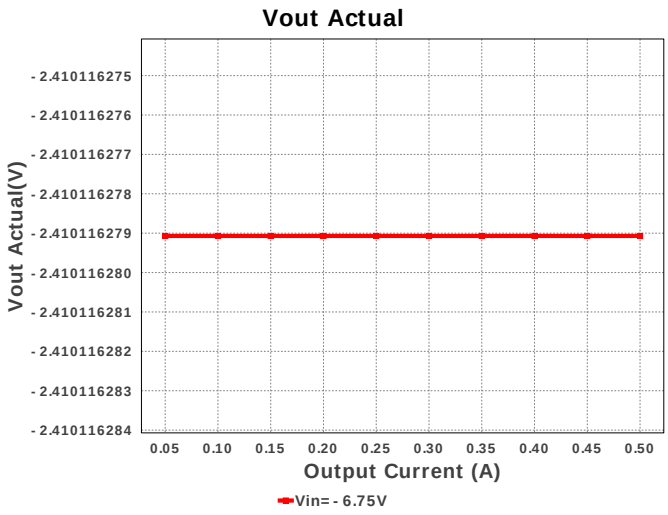


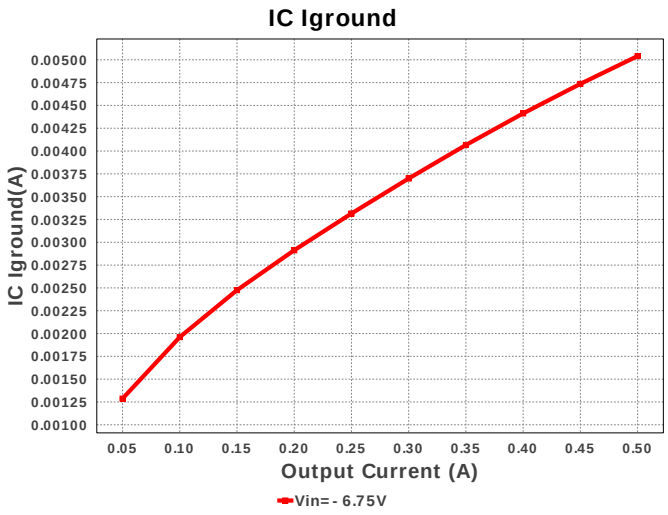


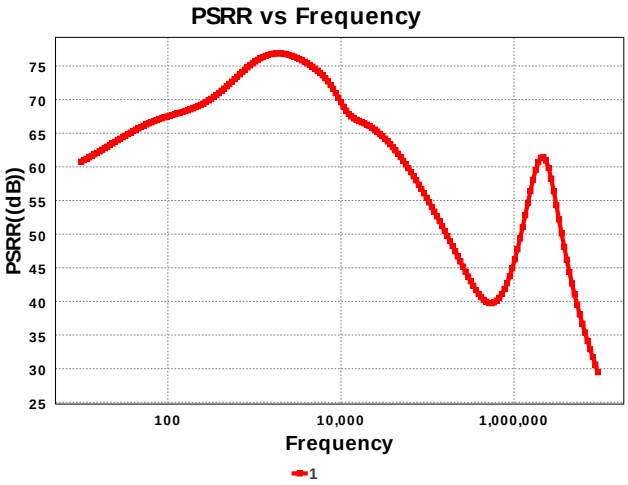












Operating Values

#	Name	Value	Category	Description
1.	IC Iground	5.048 mA	Current	IC ground current
2.	Iin Avg	505.05 mA	Current	Average input current
3.	BOM Count	7	General	Total Design BOM count
4.	FootPrint	148.0 mm^2	General	Total Foot Print Area of BOM components
5.	IC Tolerance	29.4 mV	General	IC Feedback Tolerance
6.	Output Noise RMS	22.762 µV	General	Noise RMS
7.	Pout	1.25 W	General	Total output power
8.	Total BOM	$0.0	General	Total BOM Cost
9.	Vin p-p	20.229 mV	Op_Point	Input Source ripple voltage
10.	Vout Actual	-2.41 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
11.	Vout OP	-2.5 V	Op_Point	Operational Output Voltage
12.	Efficiency	30.0 %	Op_point	Steady state efficiency
13.	IC Tj	38.75 degC	Op_point	IC junction temperature
14.	ICThetaJA	3.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
15.	IOUT_OP	500.0 mA	Op_point	Iout operating point
16.	Input Ripple Frequency	800.0 kHz	Op_point	Input Source Ripple Frequency for PSRR Calculation
17.	PSRR est.	-42.193 dB	Op_point	Power Supply Rejection Ratio, estimated
18.	VIN_OP	-8.25 V	Op_point	Vin operating point
19.	Vout p-p	157.165 µV	Op_point	Peak-to-peak output ripple voltage
20.	IC Pd	2.917 W	Power	IC power dissipation
21.	Total Pd	2.917 W	Power	Total Power Dissipation
22.	Vout Tolerance	1.493 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	500.0 m	Maximum Output Current
2.	VinMax	-8.25	Maximum input voltage
3.	VinMin	-6.75	Minimum input voltage
4.	Vout	-2.5	Output Voltage

#	Name	Value	Description
5.	base_pn	TPS7A3301	Texas Instruments Base Part Number
6.	source	DC	Input Source Type
7.	ta	30.0	Ambient temperature

Design Assistance

1.

2. TPS7A3301 Product Folder : http://www.ti.com/product/tps7a33 : contains the data sheet and other resources.

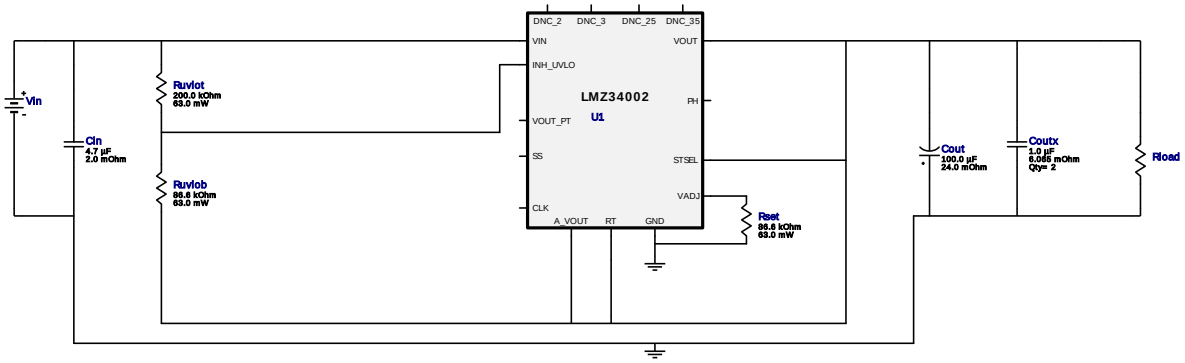
TEXAS INSTRUMENTS

WEBENCH® Design Report

Vout = -7.5V
Iout = 0.51A

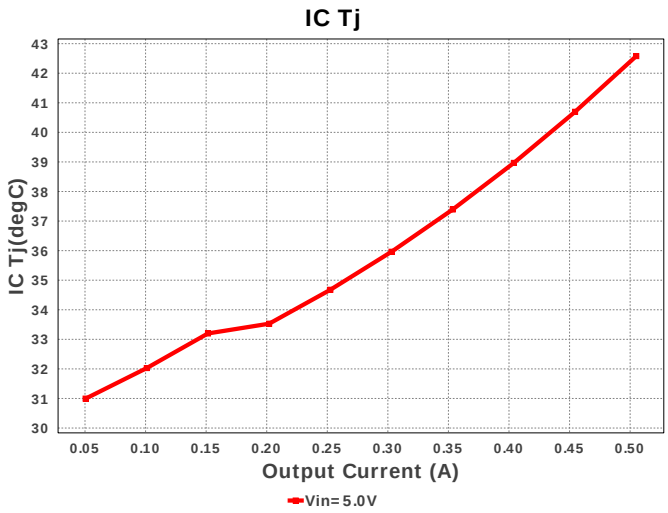
Device = LMZ34002RKGR
Topology = Inverting_Buck_Boost
Created = 7/5/16 2:41:15 AM
BOM Cost = $7.11
BOM Count = 8
Total Pd = 0.91W

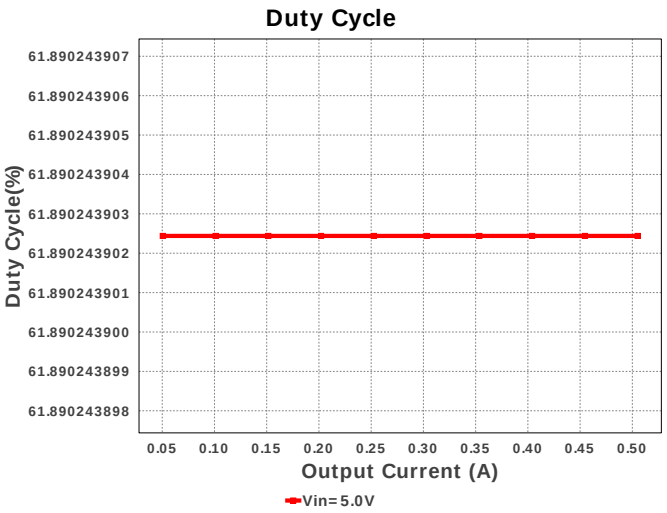
Design : 4406513/31 LMZ34002RKGR
LMZ34002RKGR 5.0V-5.0V to -7.50V @ 0.50505A

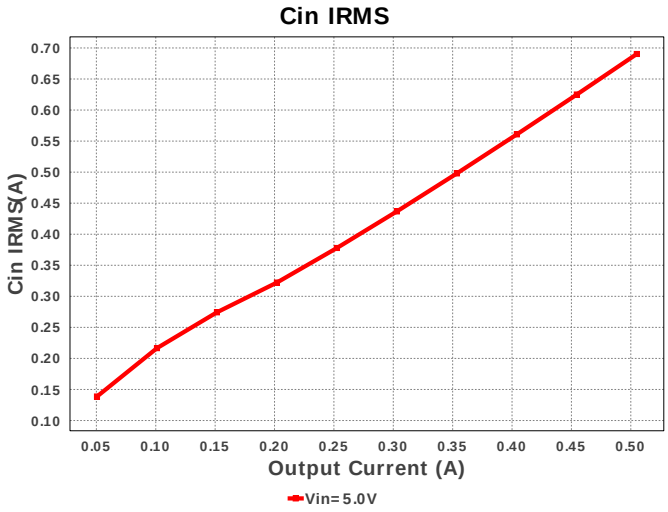


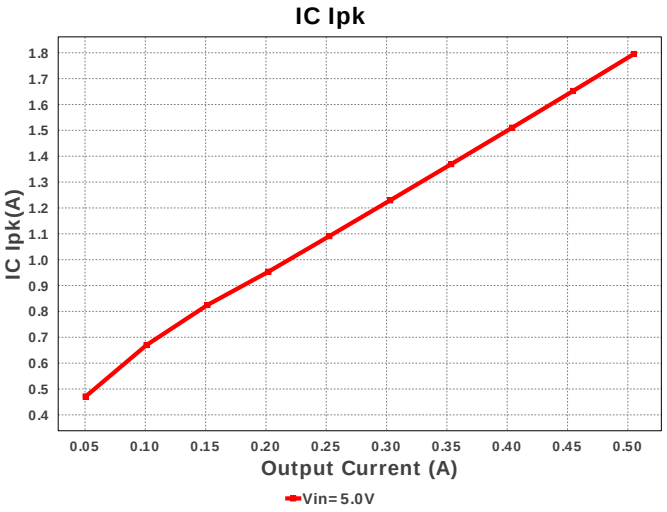
Electrical BOM

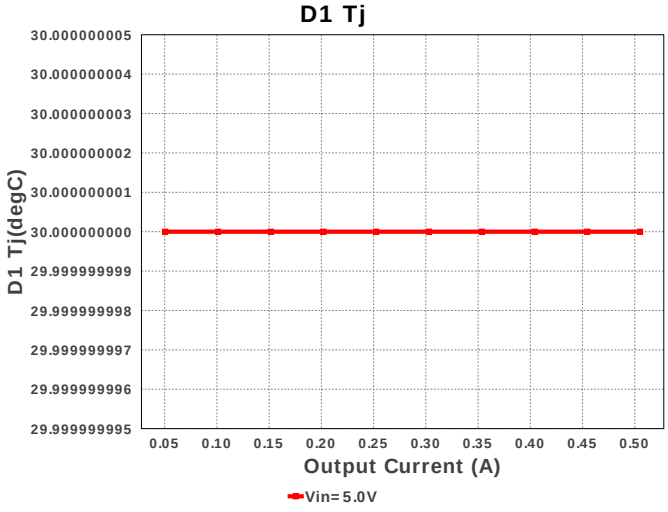
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cin	MuRata	GRM21BR61E475MA12L Series= X5R	Cap= 4.7 uF ESR= 2.0 mOhm VDC= 25.0 V IRMS= 7.29 A	1	$0.02	0805 7 mm^2
2.	Cout	Panasonic	16SVPC100M Series= SVPC	Cap= 100.0 uF ESR= 24.0 mOhm VDC= 16.0 V IRMS= 2.49 A	1	$0.29	SM_RADIAL_6.3AMM 80 mm^2
3.	Coutx	MuRata	GRM188R61A105KA61D Series= X5R	Cap= 1.0 uF ESR= 6.065 mOhm VDC= 10.0 V IRMS= 1.30675 A	2	$0.01	0603 5 mm^2
4.	Rset	Vishay-Dale	CRCW040286K6FKED Series= CRCW..e3	Res= 86.6 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
5.	Ruvlob	Vishay-Dale	CRCW040286K6FKED Series= CRCW..e3	Res= 86.6 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
6.	Ruvlot	Vishay-Dale	CRCW0402200KFKED Series= CRCW..e3	Res= 200.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
7.	U1	Texas Instruments	LMZ34002RKGR	Switcher	1	$6.75	RKG0041A 143 mm^2

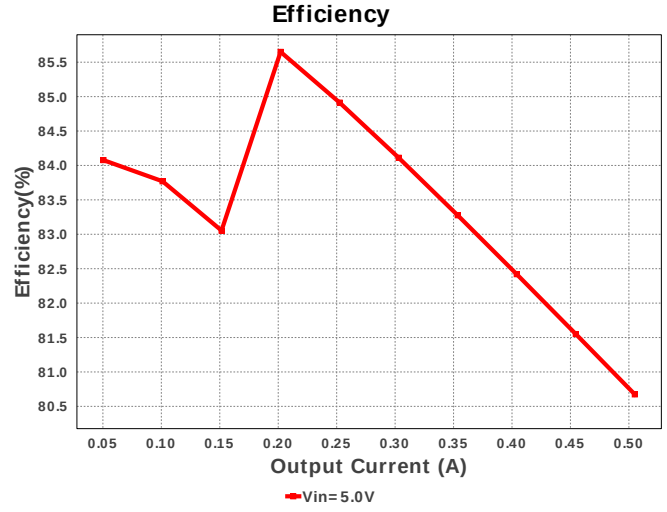


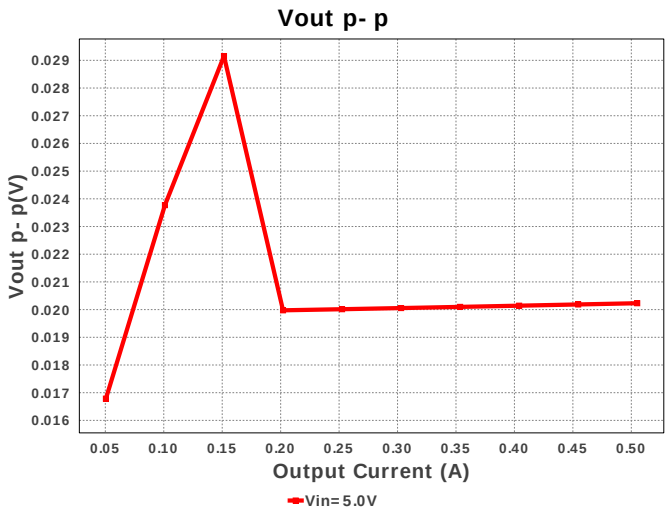


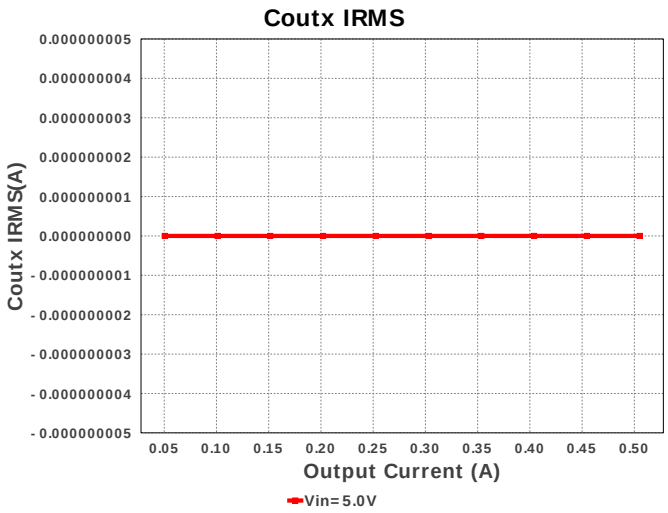


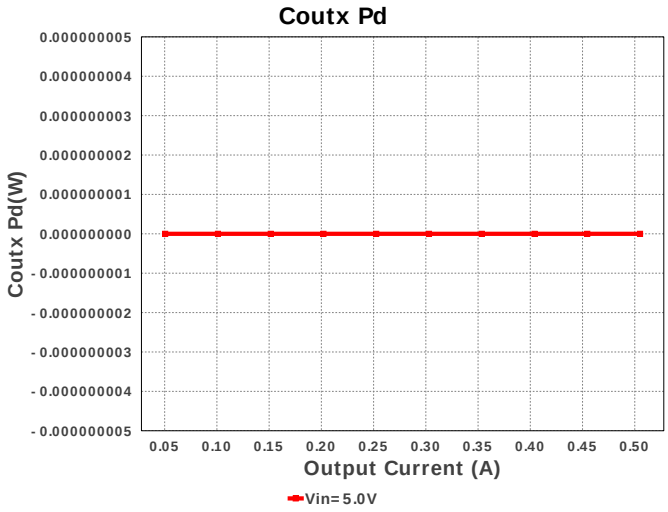


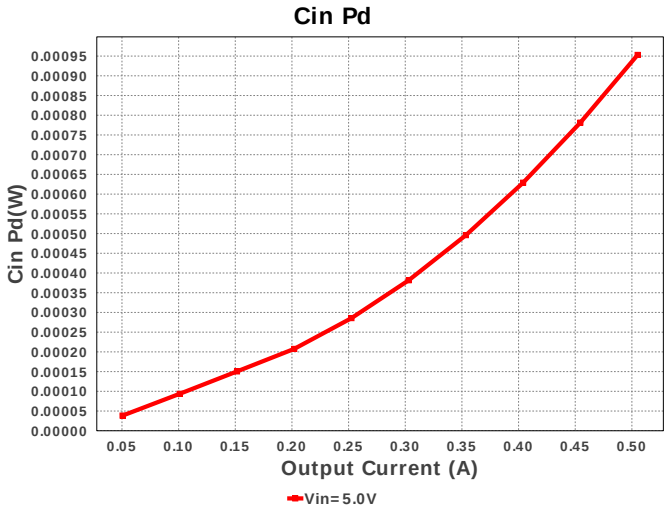


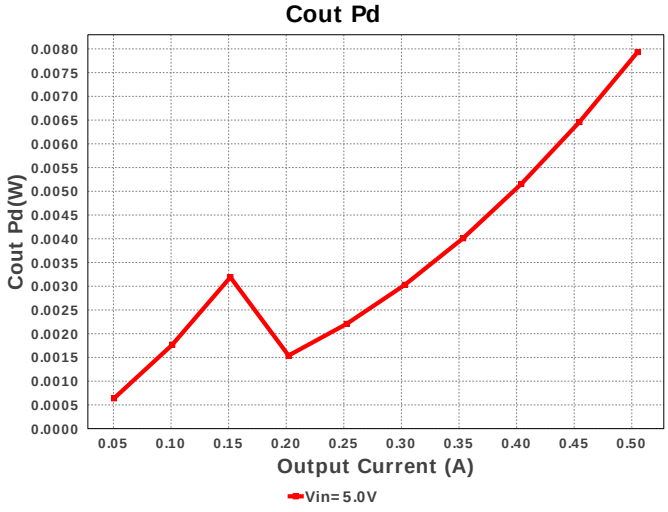


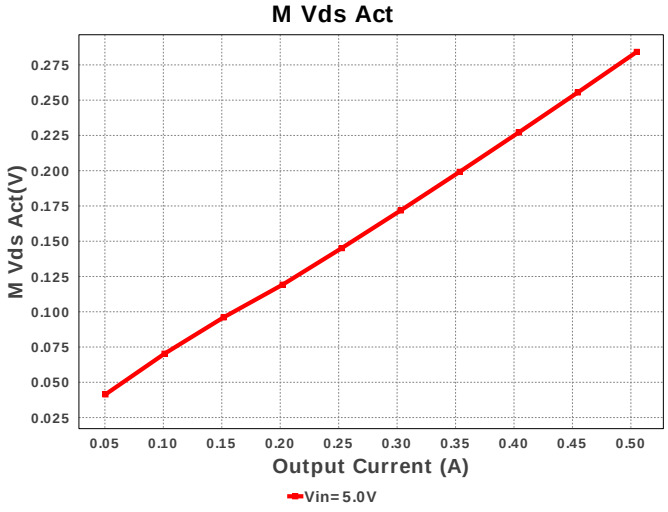


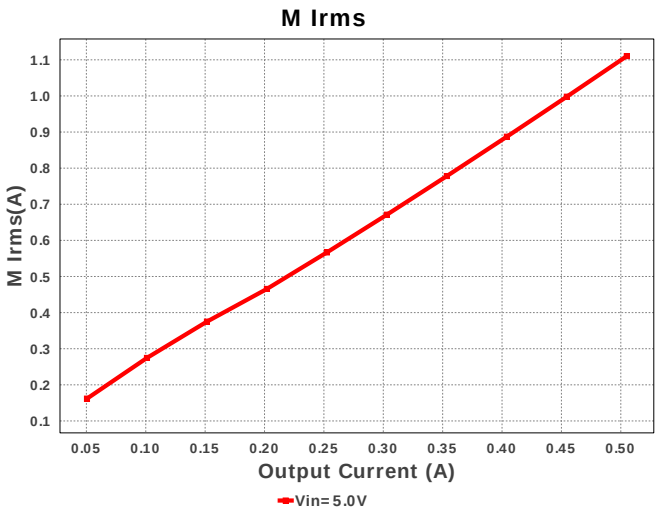


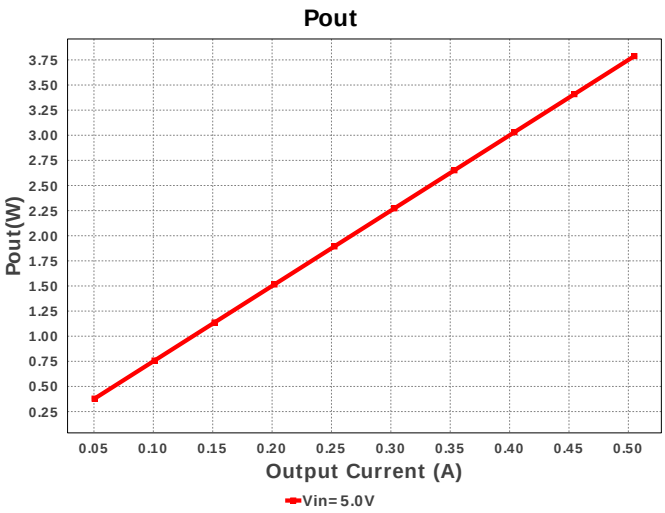


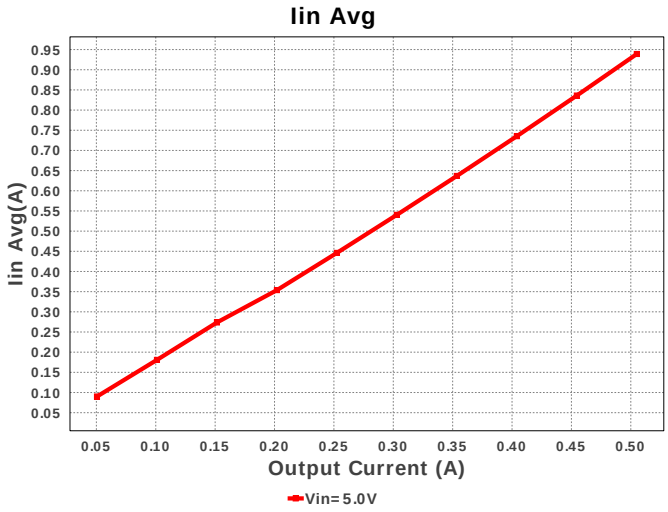


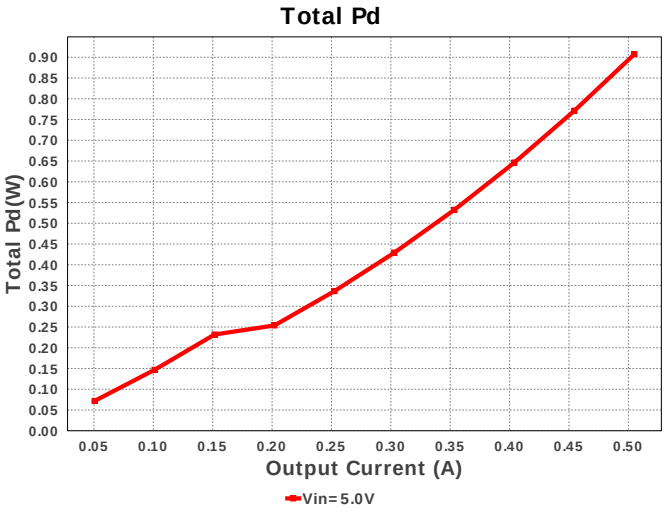


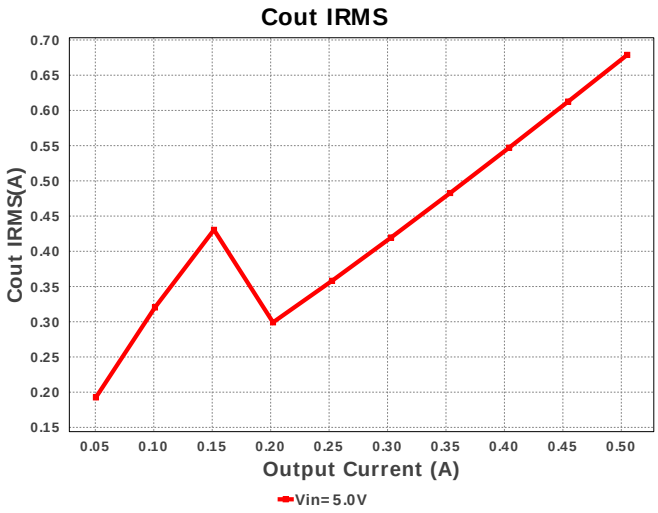


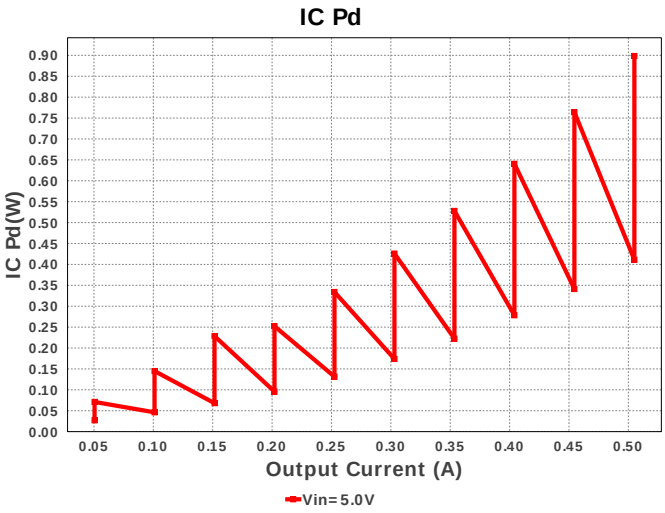


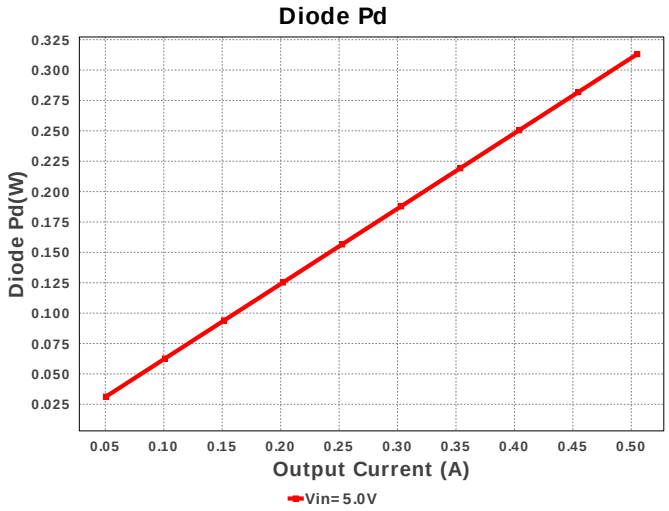


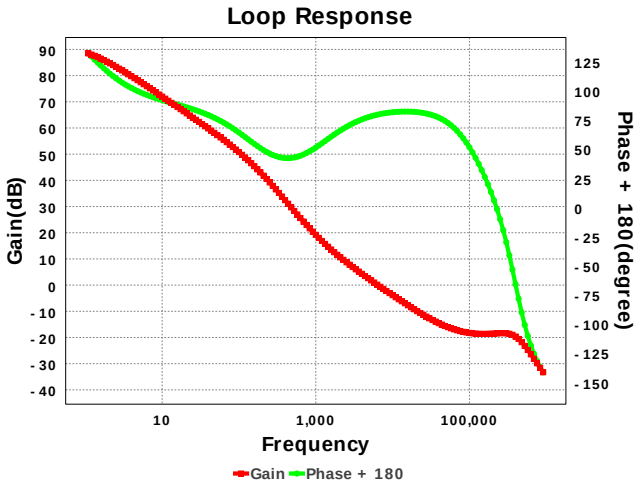












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	690.296 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	678.874 mA	Current	Output capacitor RMS ripple current
3.	Coutx IRMS	2.613 A	Current	Output capacitor_x RMS ripple current
4.	IC Ipk	1.795 A	Current	Peak switch current in IC
5.	Iin Avg	939.06 mA	Current	Average input current
6.	M Irms	1.11 A	Current	MOSFET RMS current
7.	BOM Count	8	General	Total Design BOM count
8.	FootPrint	248.0 mm^2	General	Total Foot Print Area of BOM components
9.	Frequency	800.0 kHz	General	Switching frequency
10.	IC Tolerance	16.0 mV	General	IC Feedback Tolerance
11.	M Vds Act	284.237 mV	General	Voltage drop across the MosFET
12.	Pout	3.788 W	General	Total output power
13.	Total BOM	$7.11	General	Total BOM Cost
14.	D1 Tj	30.0 degC	Op_Point	D1 junction temperature
15.	Vout OP	-7.5 V	Op_Point	Operational Output Voltage
16.	Cross Freq	6.405 kHz	Op_point	Bode plot crossover frequency
17.	Duty Cycle	61.89 %	Op_point	Duty cycle
18.	Efficiency	80.674 %	Op_point	Steady state efficiency
19.	IC Tj	42.579 degC	Op_point	IC junction temperature
20.	ICThetaJA	14.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
21.	IOUT_OP	505.05 mA	Op_point	Iout operating point
22.	Phase Marg	80.71 deg	Op_point	Bode Plot Phase Margin
23.	VIN_OP	5.0 V	Op_point	Vin operating point
24.	Vout p-p	20.229 mV	Op_point	Peak-to-peak output ripple voltage
25.	Cin Pd	953.016 µW	Power	Input capacitor power dissipation
26.	Cout Pd	7.171 mW	Power	Output capacitor power dissipation
27.	Coutx Pd	786.325 µW	Power	Output capacitor_x power loss
28.	Diode Pd	313.131 mW	Power	Diode power dissipation
29.	IC Pd	411.116 mW	Power	IC power dissipation
30.	IC Pd	898.52 mW	Power	IC power dissipation
31.	Total Pd	907.414 mW	Power	Total Power Dissipation
32.	Vout Tolerance	213.333 m%		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	505.05 m	Maximum Output Current
2.	VinMax	5.0	Maximum input voltage
3.	VinMin	5.0	Minimum input voltage
4.	Vout	-7.5	Output Voltage
5.	base_pn	LMZ34002	Texas Instruments Base Part Number
6.	source	DC	Input Source Type
7.	ta	30.0	Ambient temperature

Design Assistance

1. LMZ34002 Product Folder : http://www.ti.com/product/LMZ34002 : contains the data sheet and other resources.