

WEBENCH® Power Architect

Project Report

Project : 4354344/8 : PA_Project_304 (modified from 301)

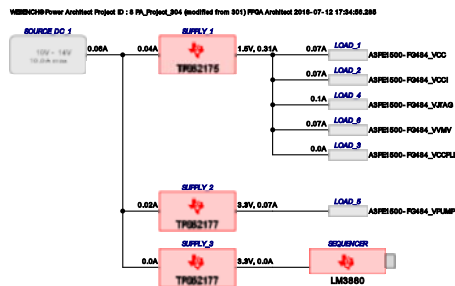
Created : 2016-07-12 17:34:56.285

Optimize project optFactor=3

Project Summary

1. Total System Efficiency	80.383 %
2. Total System BOM Count	22.0
3. Total System Footprint	254.0 mm ²
4. Total System BOM Cost	\$3.12
5. Total System Power Dissipation	170.5 mW

--> Launch WEBENCH Power Architect.



My Comments

No comments

Sequencer Flag Table

Supply	Sequencer Flag	Load	Load Name
SUPPLY_1	0	LOAD_1	A3PE1500-FG484_VCC
SUPPLY_1	0	LOAD_2	A3PE1500-FG484_VCCI
SUPPLY_1	0	LOAD_4	A3PE1500-FG484_VJTAG
SUPPLY_1	0	LOAD_6	A3PE1500-FG484_VVMV
SUPPLY_1	0	LOAD_3	A3PE1500-FG484_VCCPLL
SUPPLY_2	1	LOAD_5	A3PE1500-FG484_VPUMP
SUPPLY_3	NA		
SEQUENCER	NA		

Power Supplies

#	Name	NSID	Description	Vout	Iout	Efficiency	Foot-print	Cost	Design	Page
1.	SUPPLY_1	TPS62175	Switcher : High Light-Load Efficiency Buck Converter	1.5 V	0.312 A	79.4%	87	\$0.92	30	4
2.	SUPPLY_2	TPS62177	Switcher : Fixed 3.3Vout, High Light-Load Efficiency Buck Converter	3.3 V	0.07 A	82.8%	74	\$0.86	31	10
3.	SUPPLY_3	TPS62177	Switcher : Fixed 3.3Vout, High Light-Load Efficiency Buck Converter	3.3 V	0.001 A	75.3%	74	\$0.86	33	17
4.	SEQUENCER	LM3880	Sequencer : Power Sequencer	3.3 V	0.001 A	0%	19	\$0.48	32	15

Power Loads

#	Name	VLoad	ILoad	Description
1.	A3PE1500-FG484_VCC	1.5 V	0.07 A	VoutRipple=10%
2.	A3PE1500-FG484_VCCI	1.5 V	0.07 A	VoutRipple=10%, Up Sequence Order=0 delay=2.0 mSec, Down Sequence Order=0 delay=2.0 mSec
3.	A3PE1500-FG484_VJTAG	1.5 V	0.1 A	VoutRipple=10%, Up Sequence Order=0 delay=2.0 mSec, Down Sequence Order=0 delay=2.0 mSec
4.	A3PE1500-FG484_VVMV	1.5 V	0.07 A	VoutRipple=10%, Up Sequence Order=0 delay=2.0 mSec, Down Sequence Order=0 delay=2.0 mSec
5.	A3PE1500-FG484_VCCPLL	1.5 V	0.0017 A	VoutRipple=14%, Up Sequence Order=0 delay=2.0 mSec, Down Sequence Order=0 delay=2.0 mSec
6.	A3PE1500-FG484_VPUMP	3.3 V	0.07 A	VoutRipple=9%, Up Sequence Order=0 delay=2.0 mSec, Down Sequence Order=0 delay=2.0 mSec

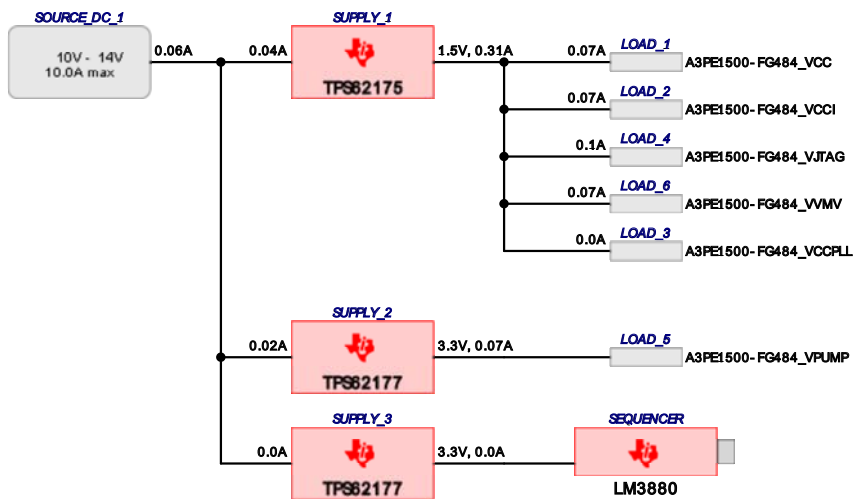
FPGAs, Processors

#	Manufacturer	Part Number	Name	Series	Description
1.	Actel	A3PE1500-FG484	FPGA_1	ProASIC3E	FPGA Actel ProASIC3E A3PE1500-FG484

http://www.actel.com/documents/PA3E_DS.pdf

Project Diagram

WEBENCH® Power Architect Project ID : 8_PA_Project_304 (modified from 301) FPGA Architect 2016-07-12 17:34:56.285



Electrical Procurement BOM

Manufacturer	Part Number	Description	Quantity	Budgetary Price	Footprint (mm ²)
Vishay-Dale	CRCW0402100KFKED	0402	6	\$0.01	18
Vishay-Dale	CRCW0402332KFKED	0402	1	\$0.01	3
Vishay-Dale	CRCW0402383KFKED	0402	1	\$0.01	3
MuRata	GRM188R61C225KE15D	0603	3	\$0.02	14
MuRata	GRM21BC80G226ME39L	0805	2	\$0.04	7
MuRata	GRM21BR60J226ME39L	0805	2	\$0.04	14
Texas Instruments	LM3880MF-1AE/NOPB	R-PDSO- G6	1	\$0.45	10
Bourns	SDR0503-100ML	SDR0503	3	\$0.19	143
Texas Instruments	TPS62175DQCR	R- PWSON- N10	1	\$0.60	12
Texas Instruments	TPS62177DQCR	R- PWSON- N10	2	\$0.60	24
Total			22	\$2.46	246700000000000002

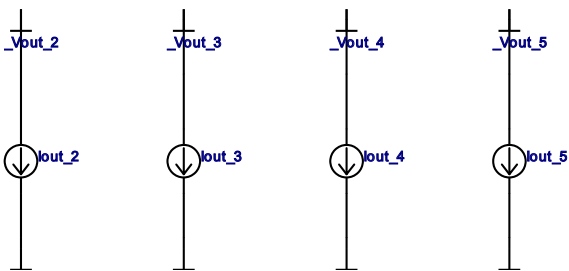
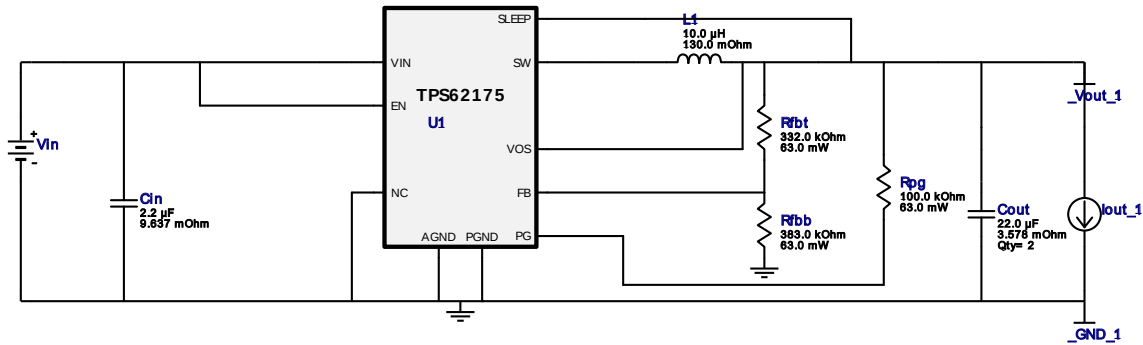


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Iout = 0.31A

Device = TPS62175DQCR
Topology = Buck
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BOM Cost = \$0.92
BOM Count = 8
Total Pd = 0.12W

WEBENCH® Design Report

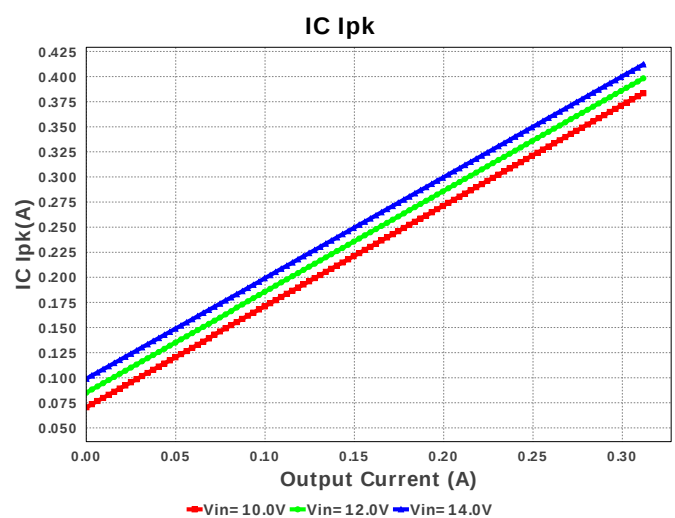
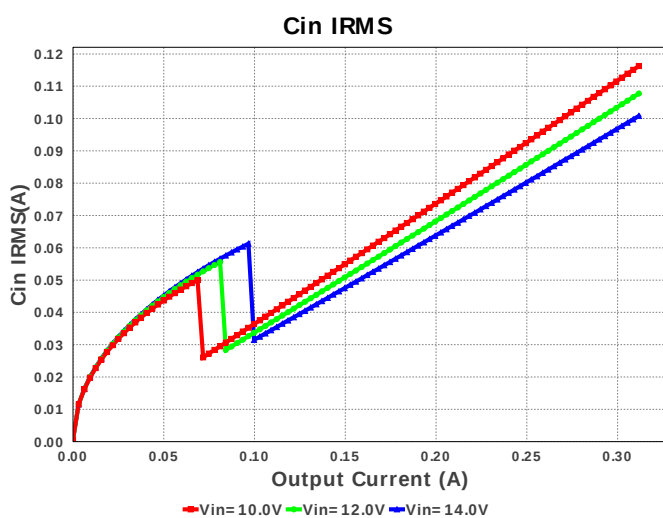
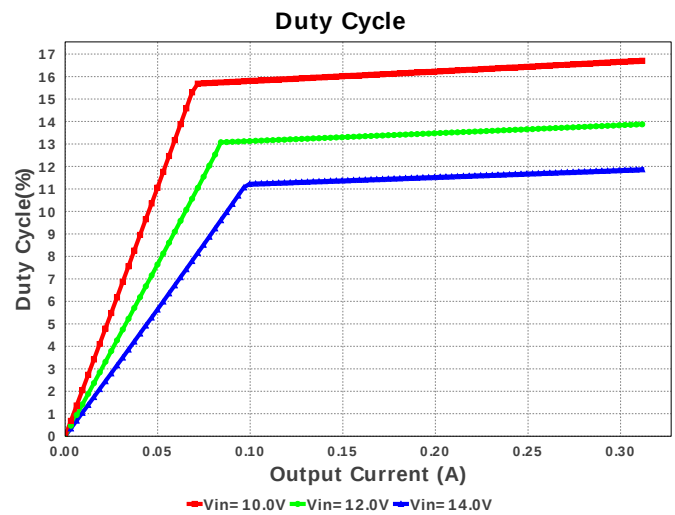
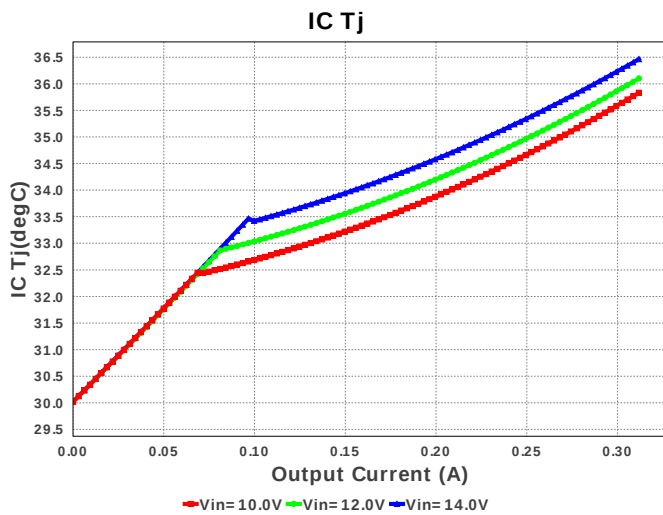
Design : 4354344/30 TPS62175DQCR
TPS62175DQCR 10.0V-14.0V to 1.50V @ 0.3117A

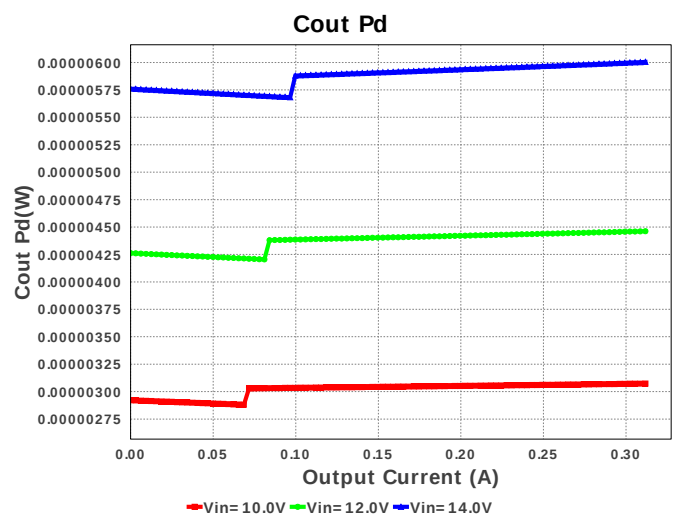
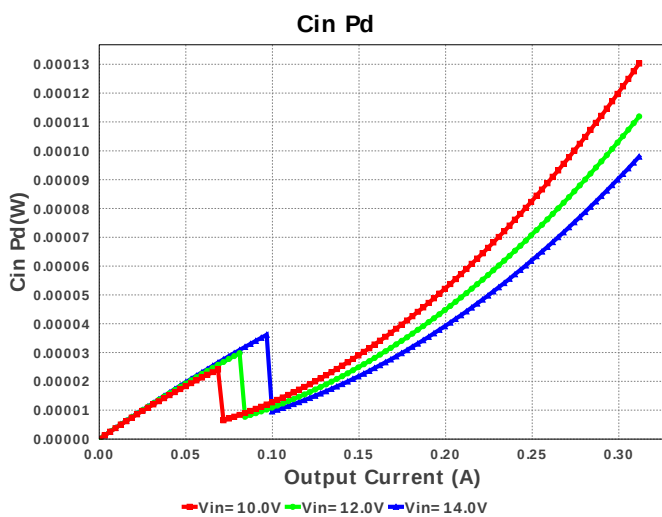
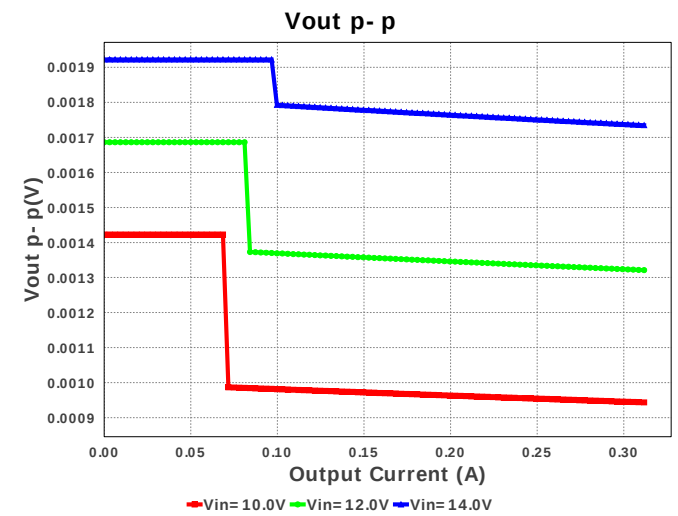
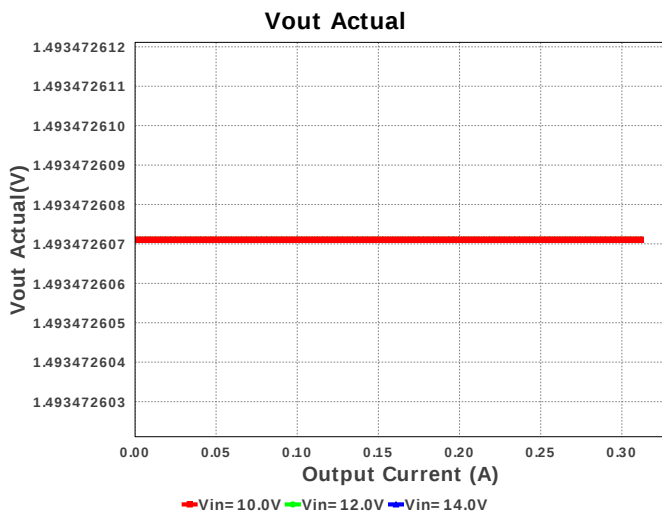
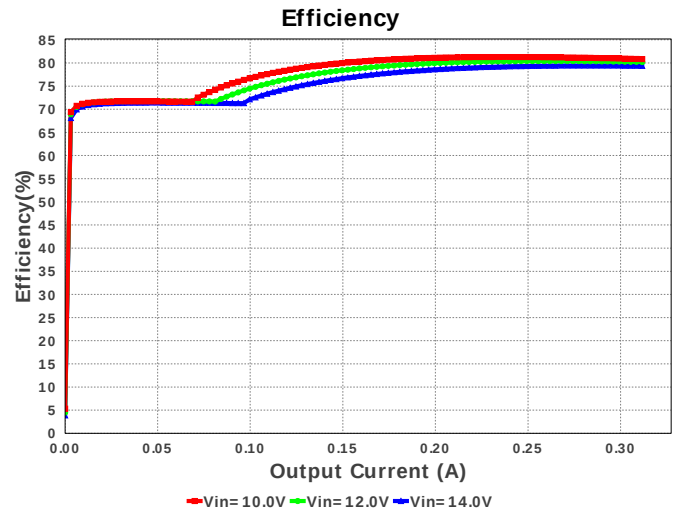
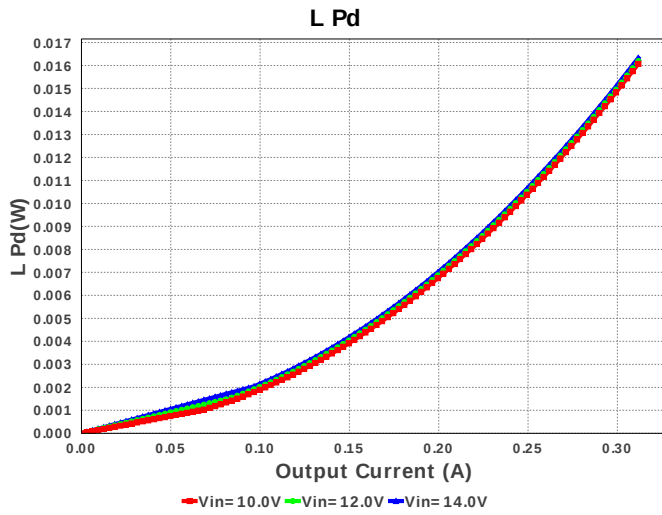


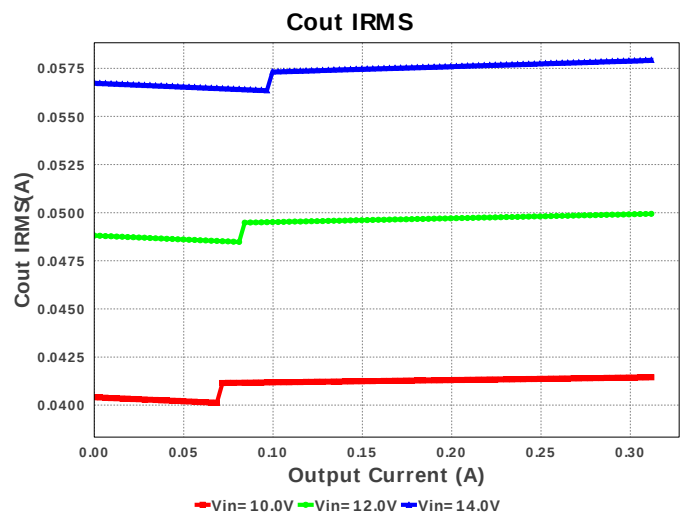
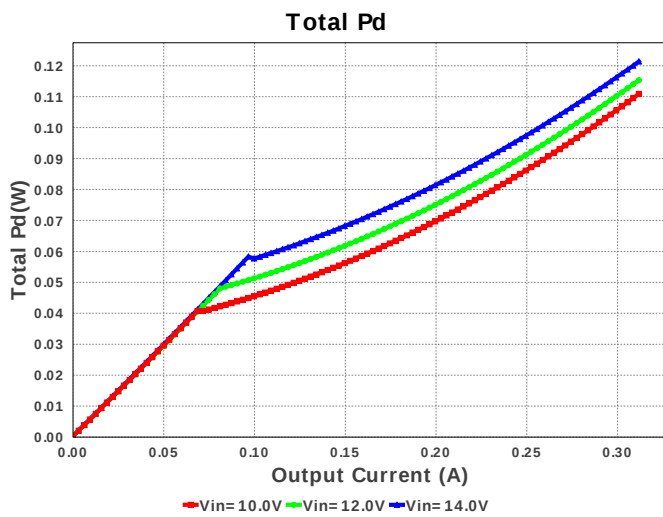
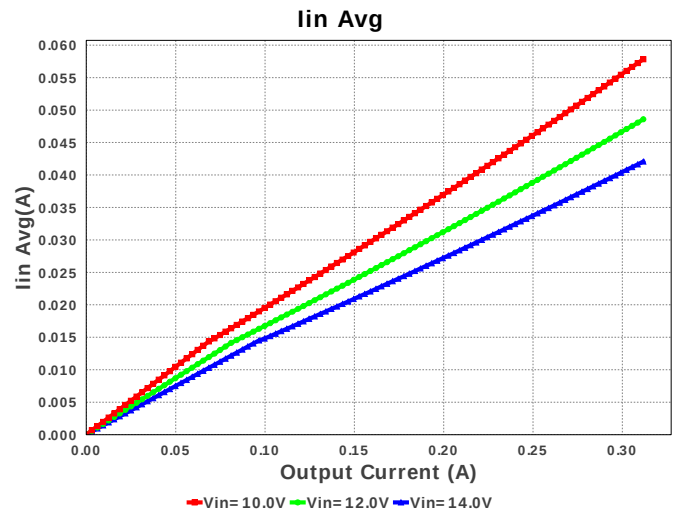
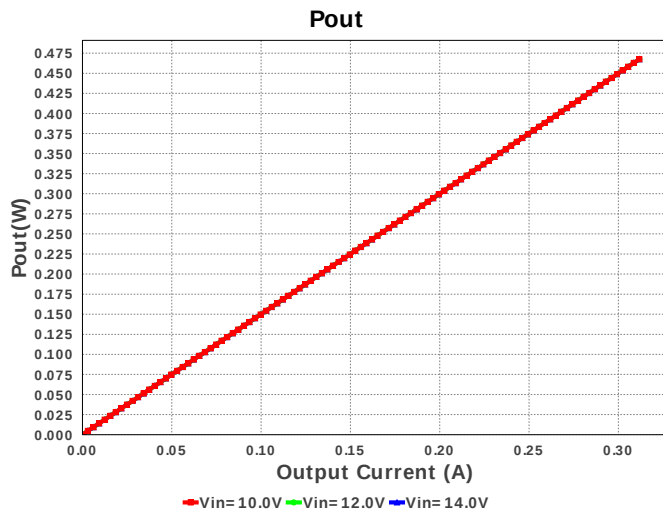
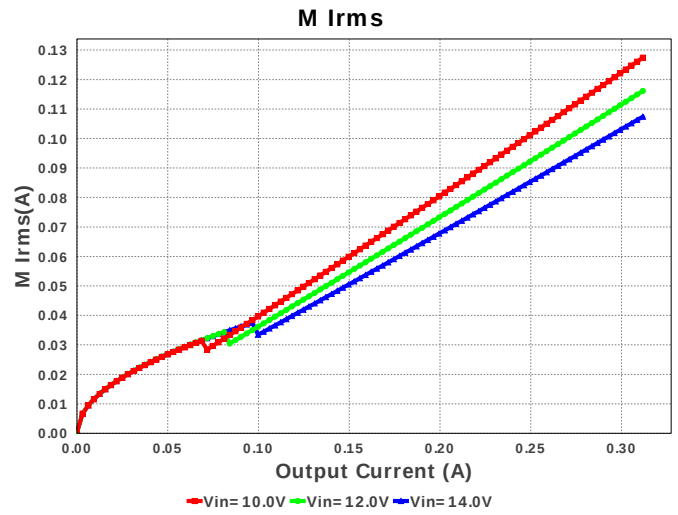
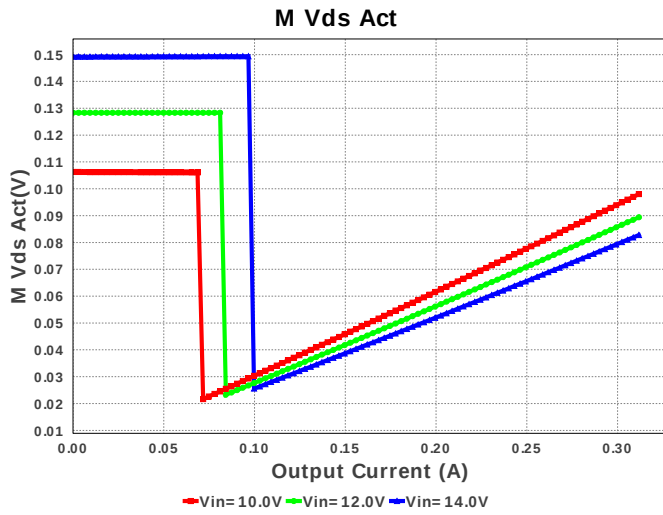
Electrical BOM

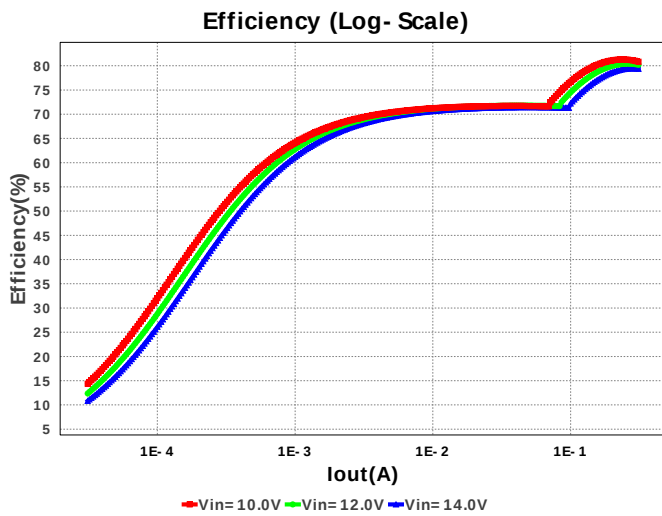
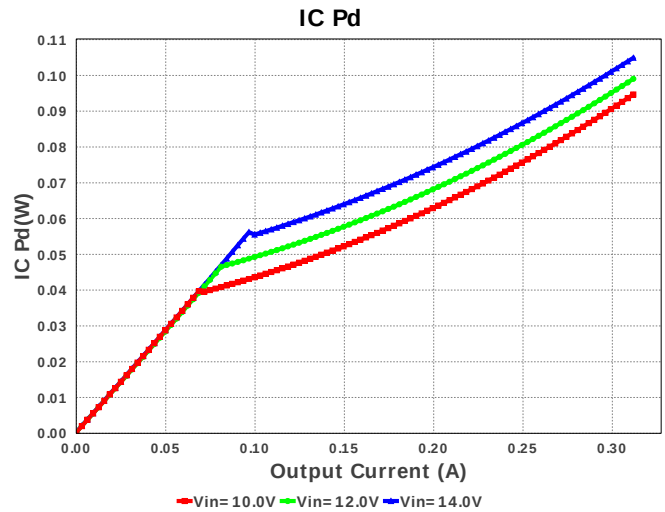
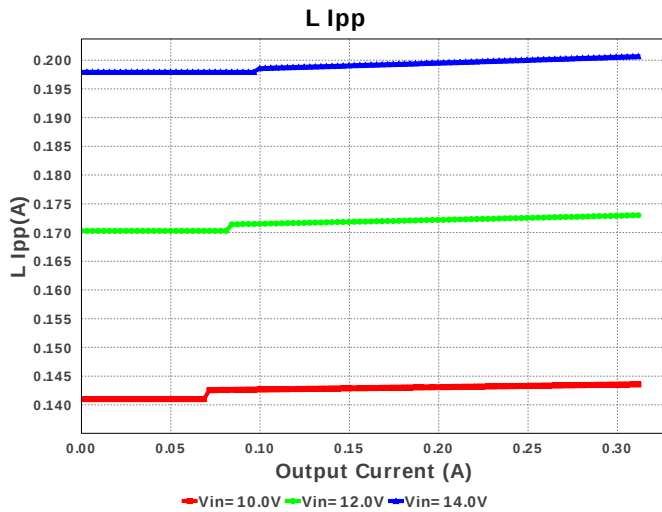
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cin	MuRata	GRM188R61C225KE15D Series= X5R	Cap= 2.2 uF ESR= 9.637 mOhm VDC= 16.0 V IRMS= 1.20373 A	1	\$0.02	0603 5 mm ²
2.	Cout	MuRata	GRM21BC80G226ME39L Series= X6S	Cap= 22.0 uF ESR= 3.578 mOhm VDC= 4.0 V IRMS= 3.29633 A	2	\$0.04	0805 7 mm ²
3.	L1	Bourns	SDR0503-100ML	L= 10.0 uH DCR= 130.0 mOhm	1	\$0.19	SDR0503 48 mm ²
4.	Rfbb	Vishay-Dale	CRCW0402383KFKED Series= CRCW..e3	Res= 383.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
5.	Rfbb	Vishay-Dale	CRCW0402332KFKED Series= CRCW..e3	Res= 332.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
6.	Rpg	Vishay-Dale	CRCW0402100KFKED Series= CRCW..e3	Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
7.	U1	Texas Instruments	TPS62175DQCR	Switcher	1	\$0.60	 R-PWSON-N10 12 mm ²









Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	100.82 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	57.936 mA	Current	Output capacitor RMS ripple current
3.	IC Ipk	412.048 mA	Current	Peak switch current in IC
4.	Iin Avg	42.066 mA	Current	Average input current
5.	L Ipp	200.7 mA	Current	Peak-to-peak inductor ripple current
6.	M1 Irms	107.396 mA	Current	Q lavg
7.	BOM Count	8	General	Total Design BOM count
8.	FootPrint	87.0 mm ²	General	Total Foot Print Area of BOM components
9.	Frequency	739.398 kHz	General	Switching frequency
10.	IC Tolerance	24.0 mV	General	IC Feedback Tolerance
11.	M Vds Act	82.763 mV	General	Voltage drop across the MosFET
12.	Pout	467.55 mW	General	Total output power
13.	Total BOM	\$0.92	General	Total BOM Cost
14.	Vout Actual	1.493 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
15.	Vout OP	1.5 V	Op_Point	Operational Output Voltage
16.	Duty Cycle	11.872 %	Op_point	Duty cycle
17.	Efficiency	79.391 %	Op_point	Steady state efficiency
18.	IC Tj	36.464 degC	Op_point	IC junction temperature
19.	ICThetaJA	61.6 degC/W	Op_point	IC junction-to-ambient thermal resistance
20.	IOUT_OP	311.7 mA	Op_point	Iout operating point
21.	VIN_OP	14.0 V	Op_point	Vin operating point
22.	Vout p-p	921.499 μ V	Op_point	Peak-to-peak output ripple voltage
23.	Cin Pd	97.958 μ W	Power	Input capacitor power dissipation
24.	Cout Pd	6.005 μ W	Power	Output capacitor power dissipation
25.	IC Pd	104.935 mW	Power	IC power dissipation
26.	L Pd	16.333 mW	Power	Inductor power dissipation
27.	Total Pd	121.371 mW	Power	Total Power Dissipation
28.	Vout Tolerance	3.966 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	311.7 m	Maximum Output Current
2.	VinMax	14.0	Maximum input voltage
3.	VinMin	10.0	Minimum input voltage
4.	Vout	1.5	Output Voltage
5.	base_pn	TPS62175	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	30.0	Ambient temperature

Design Assistance

1. **TPS62175** Product Folder : <http://www.ti.com/product/TPS62175> : contains the data sheet and other resources.

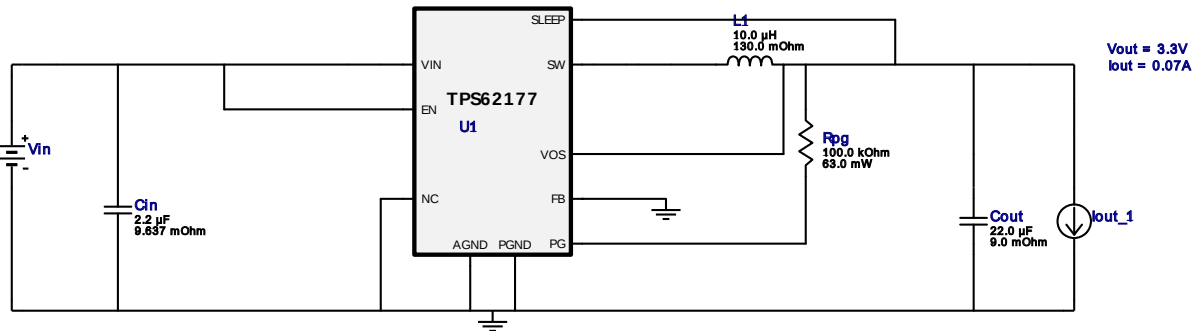


Vout = 3.3V
Iout = 0.07A

Device = TPS62177DQCR
Topology = Buck
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BOM Cost = \$0.86
BOM Count = 5
Total Pd = 0.05W

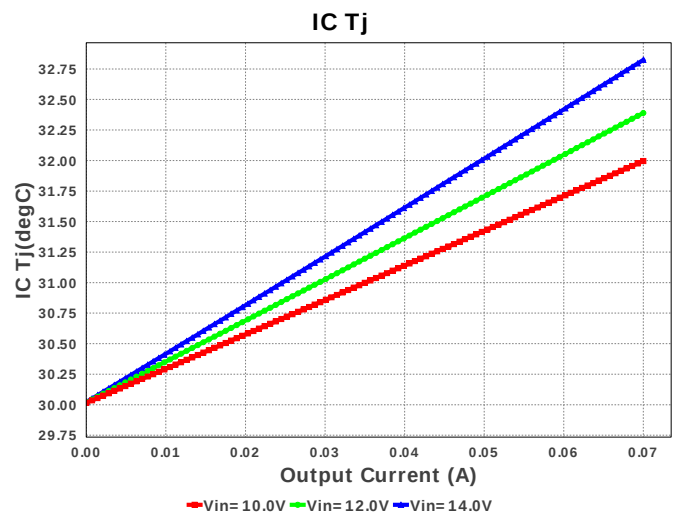
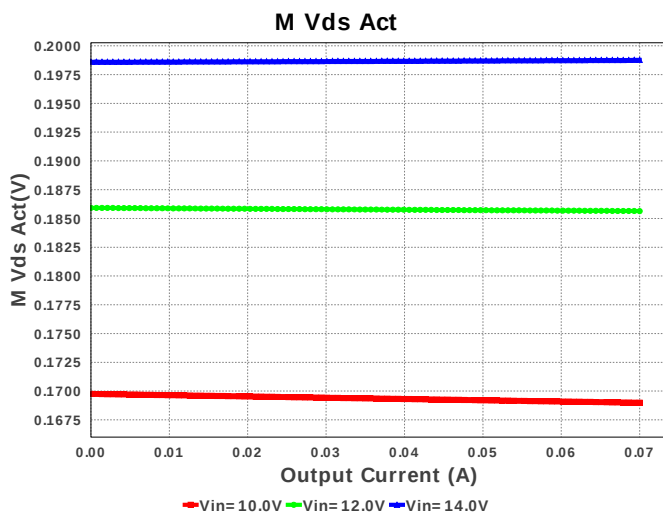
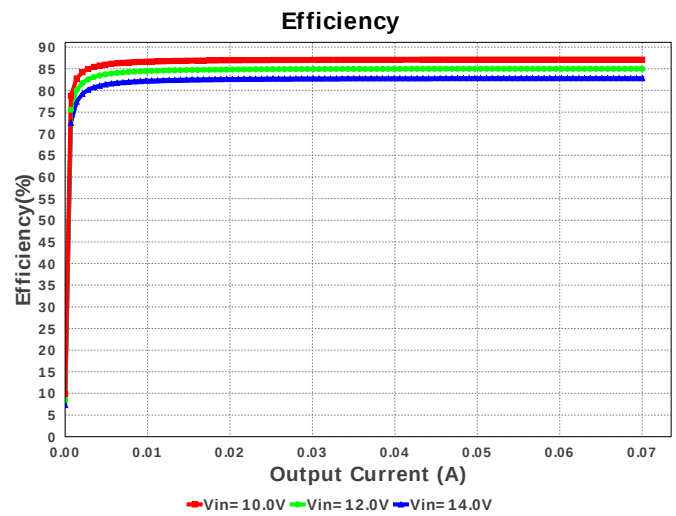
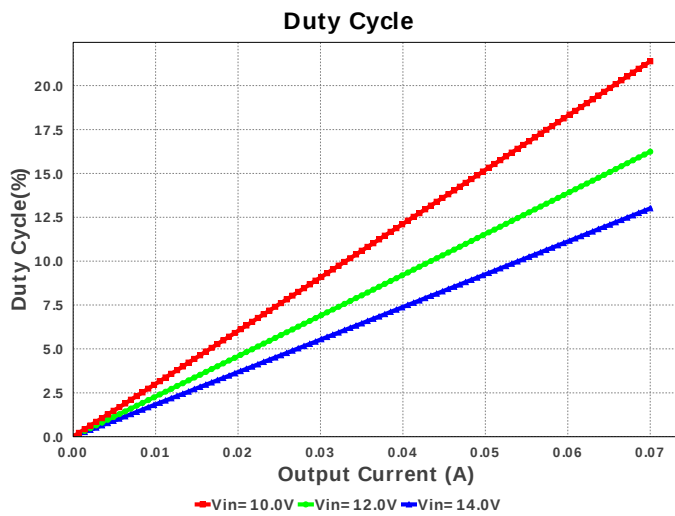
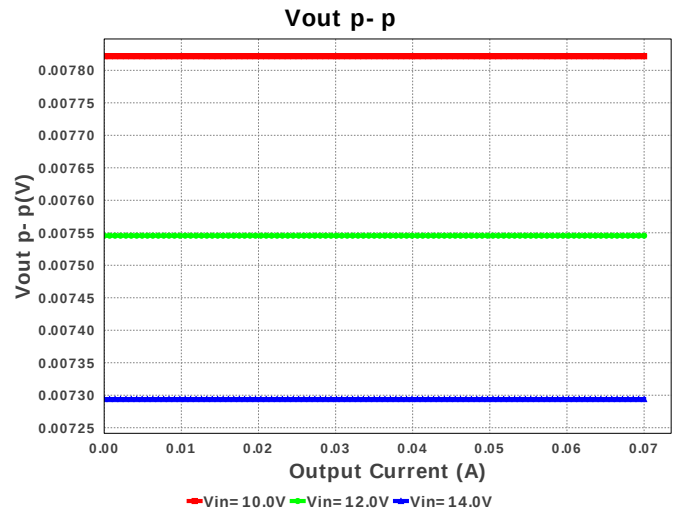
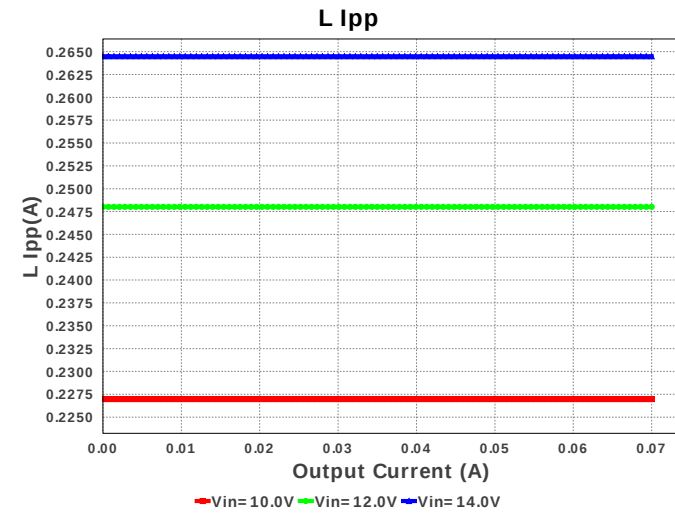
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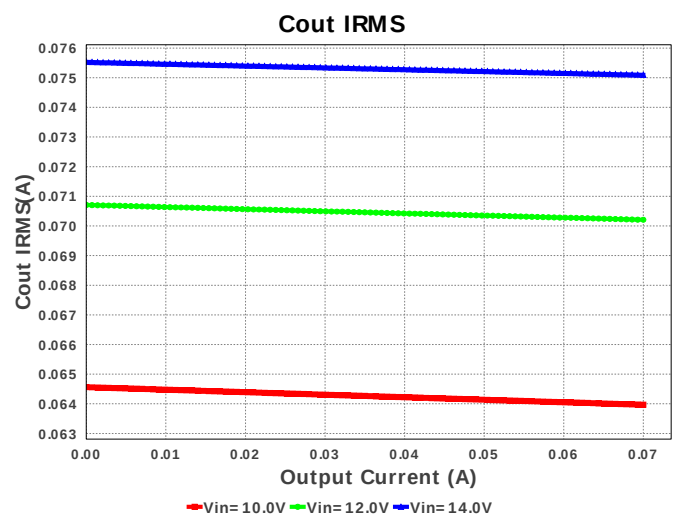
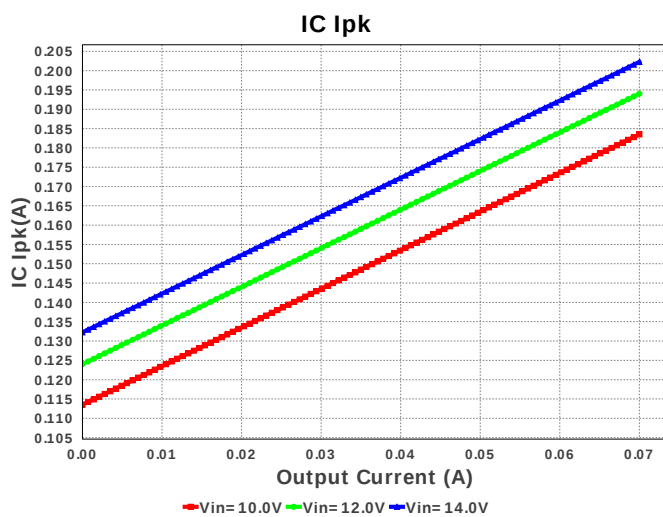
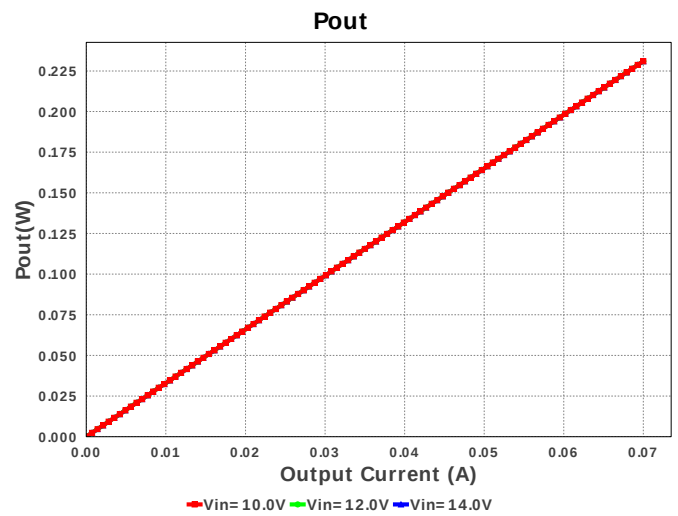
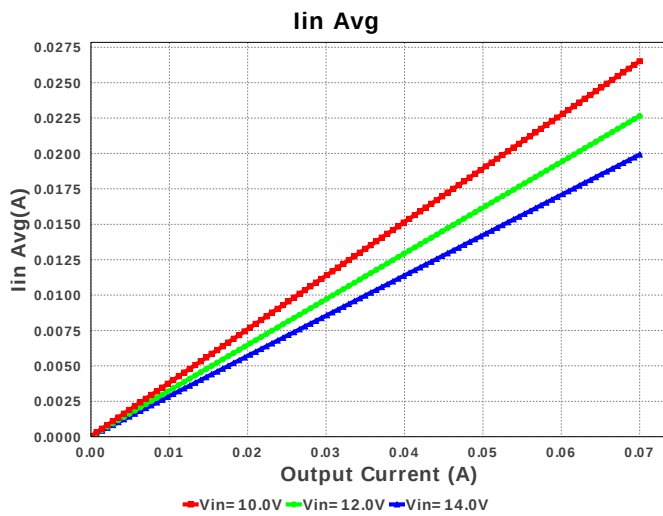
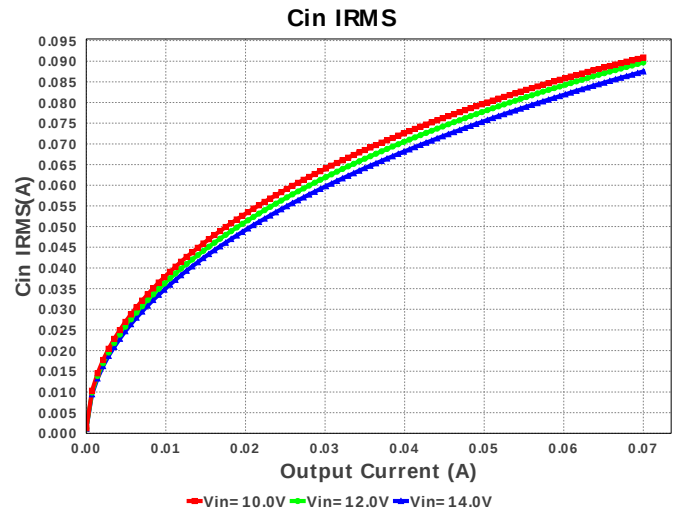
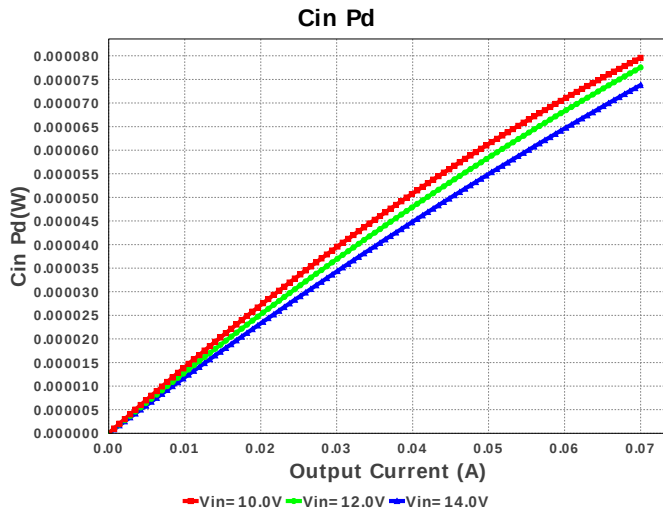
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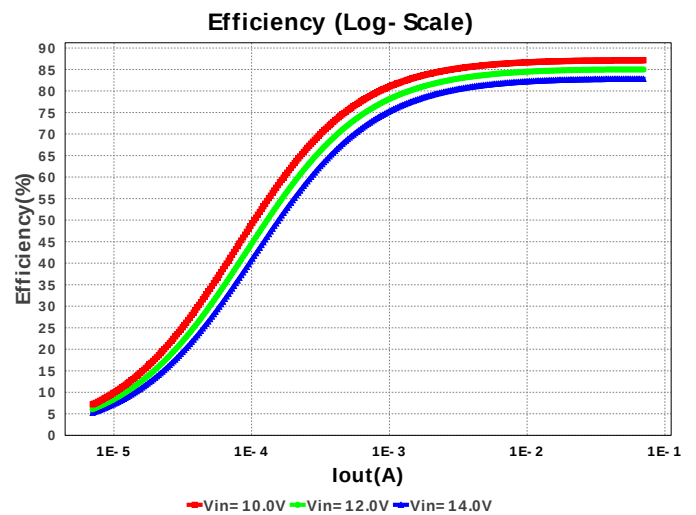
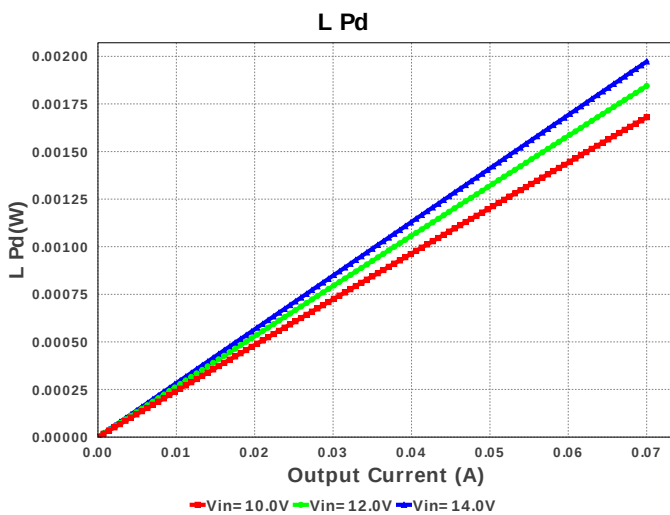
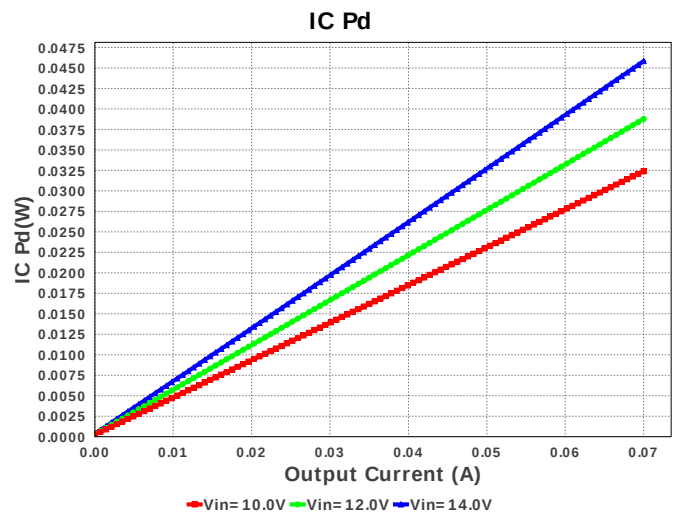
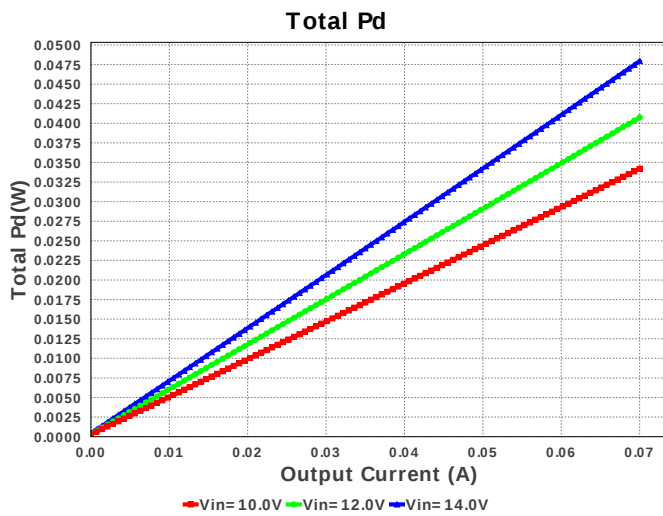
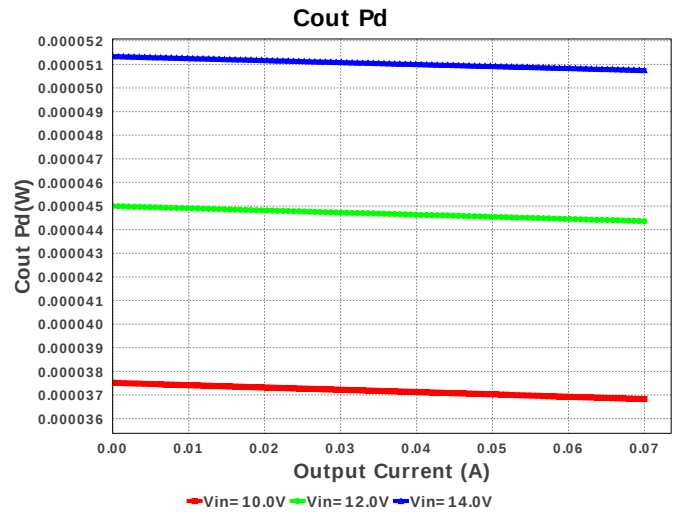
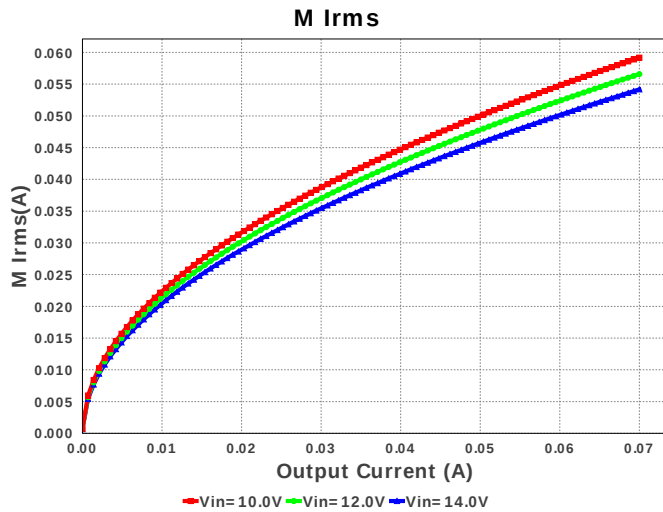


Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cin	MuRata	GRM188R61C225KE15D Series= X5R	Cap= 2.2 uF ESR= 9.637 mOhm VDC= 16.0 V IRMS= 1.20373 A	1	\$0.02	 0603 5 mm ²
2.	Cout	MuRata	GRM21BR60J226ME39L Series= X5R	Cap= 22.0 uF ESR= 9.0 mOhm VDC= 6.3 V IRMS= 3.5 A	1	\$0.04	 0805 7 mm ²
3.	L1	Bourns	SDR0503-100ML	L= 10.0 uH DCR= 130.0 mOhm	1	\$0.19	 SDR0503 48 mm ²
4.	Rpg	Vishay-Dale	CRCW0402100KFKED Series= CRCW..e3	Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
5.	U1	Texas Instruments	TPS62177DQCR	Switcher	1	\$0.60	 R-PWSON-N10 12 mm ²







Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	87.506 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	75.098 mA	Current	Output capacitor RMS ripple current
3.	IC IpK	202.25 mA	Current	Peak switch current in IC
4.	Iin Avg	19.924 mA	Current	Average input current
5.	L Ipp	264.5 mA	Current	Peak-to-peak inductor ripple current
6.	M1 Irms	54.167 mA	Current	Q lavg
7.	BOM Count	5	General	Total Design BOM count
8.	FootPrint	74.0 mm ²	General	Total Foot Print Area of BOM components
9.	Frequency	526.145 kHz	General	Switching frequency
10.	IC Tolerance	24.0 mV	General	IC Feedback Tolerance
11.	M Vds Act	198.775 mV	General	Voltage drop across the MosFET

#	Name	Value	Category	Description
12.	Pout	231.0 mW	General	Total output power
13.	Total BOM	\$0.86	General	Total BOM Cost
14.	Vout OP	3.3 V	Op_Point	Operational Output Voltage
15.	Duty Cycle	13.006 %	Op_point	Duty cycle
16.	Efficiency	82.813 %	Op_point	Steady state efficiency
17.	IC Tj	32.824 degC	Op_point	IC junction temperature
18.	ICThetaJA	61.6 degC/W	Op_point	IC junction-to-ambient thermal resistance
19.	IOUT_OP	70.0 mA	Op_point	Iout operating point
20.	VIN_OP	14.0 V	Op_point	Vin operating point
21.	Vout p-p	7.294 mV	Op_point	Peak-to-peak output ripple voltage
22.	Cin Pd	73.794 μW	Power	Input capacitor power dissipation
23.	Cout Pd	50.758 μW	Power	Output capacitor power dissipation
24.	IC Pd	45.843 mW	Power	IC power dissipation
25.	L Pd	1.973 mW	Power	Inductor power dissipation
26.	Total Pd	47.941 mW	Power	Total Power Dissipation
27.	Vout Tolerance	727.273 m%		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	70.0 m	Maximum Output Current
2.	VinMax	14.0	Maximum input voltage
3.	VinMin	10.0	Minimum input voltage
4.	Vout	3.3	Output Voltage
5.	base_pn	TPS62177	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	30.0	Ambient temperature

Design Assistance

1. **TPS62177** Product Folder : <http://www.ti.com/product/TPS62177> : contains the data sheet and other resources.

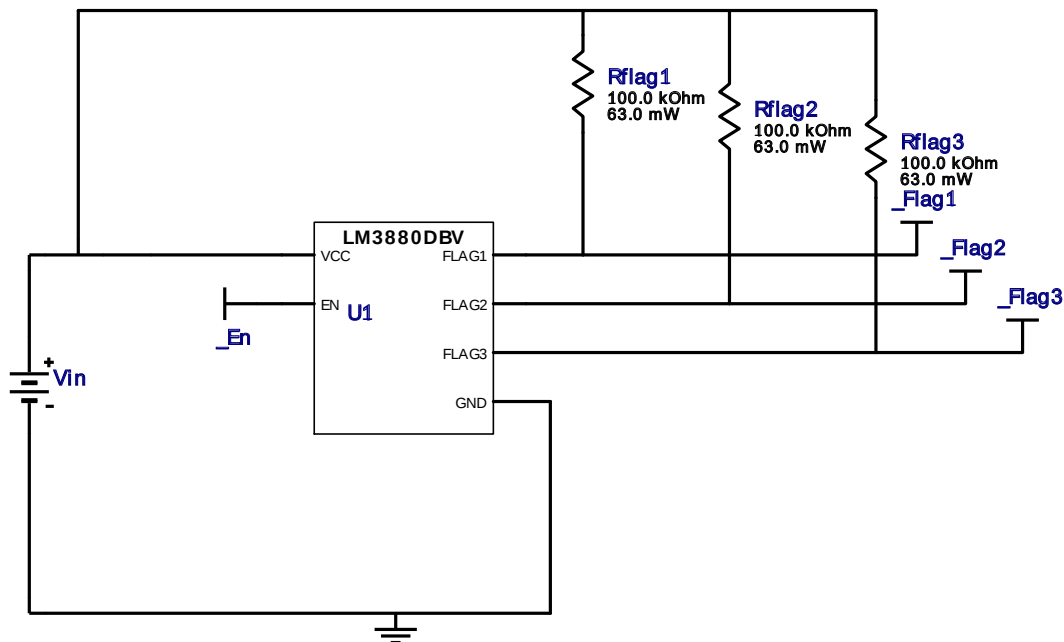


Vout = 3.3V
Iout = 0.0A

Device = LM3880MF-1AE/NOPB
Topology = SEQUENCER
Created = 7/12/16 5:34:52 PM
BOM Cost = \$0.48
BOM Count = 4
Total Pd = 0.0W

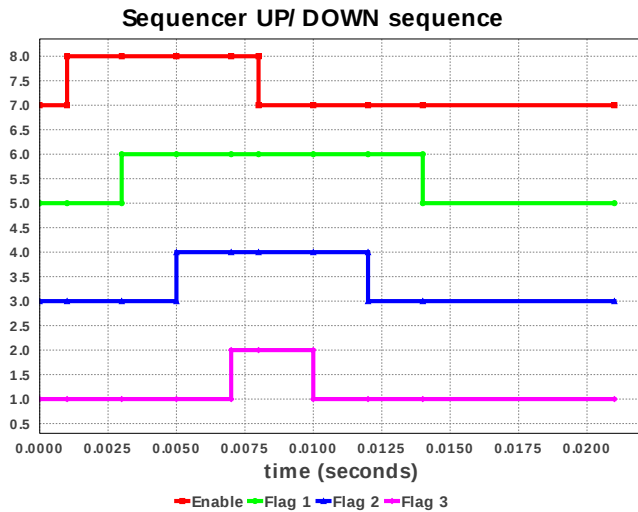
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Design : 4354344/32 LM3880MF-1AE/NOPB
Design 32 - LM3880MF-1AE/NOPB



Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Rflag1	Vishay-Dale	CRCW0402100KFKED Series= CRCW..e3	Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
2.	Rflag2	Vishay-Dale	CRCW0402100KFKED Series= CRCW..e3	Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
3.	Rflag3	Vishay-Dale	CRCW0402100KFKED Series= CRCW..e3	Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
4.	U1	Texas Instruments	LM3880MF-1AE/NOPB	Switcher	1	\$0.45	R-PDSO-G6 10 mm ²



Operating Values

#	Name	Value	Category	Description
1.	BOM Count	4	General	Total Design BOM count
2.	FootPrint	19.0 mm ²	General	Total Foot Print Area of BOM components
3.	Total BOM	\$0.48	General	Total BOM Cost
4.	Total Pd	82.5 μ W	Power	Total Power Dissipation
5.	Flag Voltage	3.3 V		Flag Voltage
6.	Flag1 Down delay (From EN high to low)	6.0 ms		Flag Delay
7.	Flag1 Up delay (From EN low to high)	2.0 ms		Flag Delay
8.	Flag2 Down delay (From EN high to low)	4.0 ms		Flag Delay
9.	Flag2 Up delay (From EN low to high)	4.0 ms		Flag Delay
10.	Flag3 Down delay (From EN high to low)	2.0 ms		Flag Delay
11.	Flag3 Up delay (From EN low to high)	6.0 ms		Flag Delay
12.	Flags Used	2.0		Flags Used
13.	Total Flags	3.0		Total Flags
14.	Vcc	3.3 V		Vcc

Design Inputs

#	Name	Value	Description
1.	Iout	1.0 μ	Maximum Output Current
2.	VinMax	3.3	Maximum input voltage
3.	VinMin	3.3	Minimum input voltage
4.	Vout	3.3	Output Voltage
5.	base_pn	LM3880	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	30.0	Ambient temperature

Design Assistance

1. **LM3880** Product Folder : <http://www.ti.com/product/LM3880> : contains the data sheet and other resources.

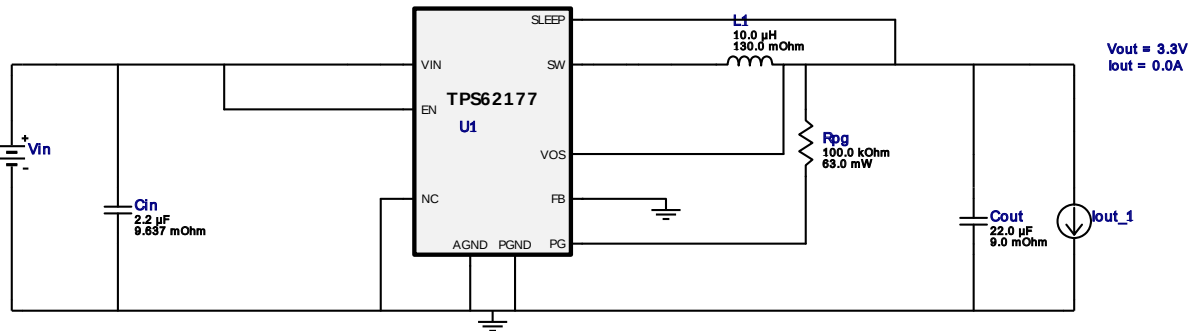


Vout = 3.3V
Iout = 0.0A

Device = TPS62177DQCR
Topology = Buck
Created = 7/12/16 5:34:52 PM
BOM Cost = \$0.86
BOM Count = 5
Total Pd = 0.0W

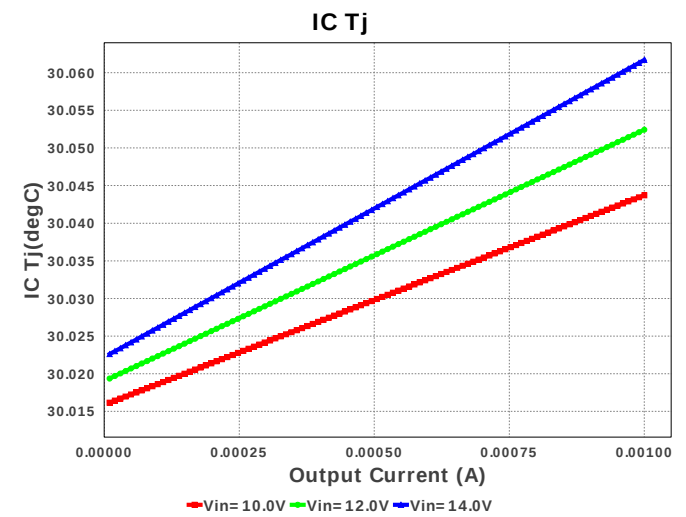
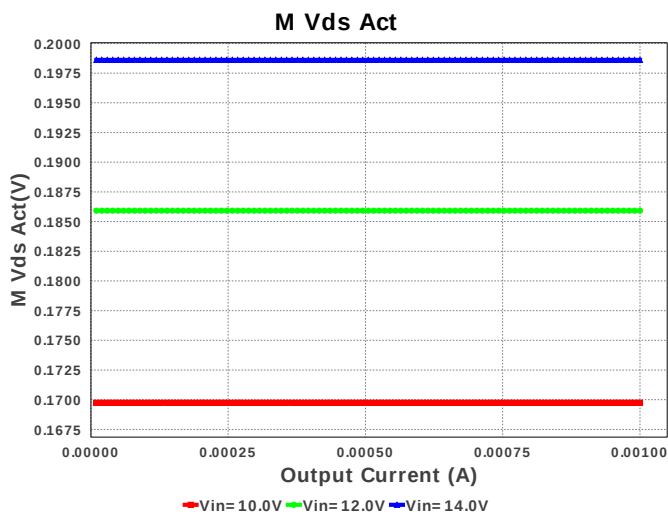
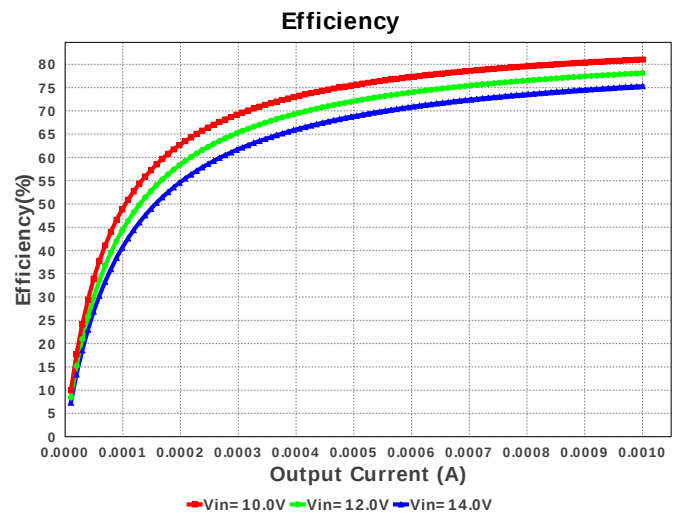
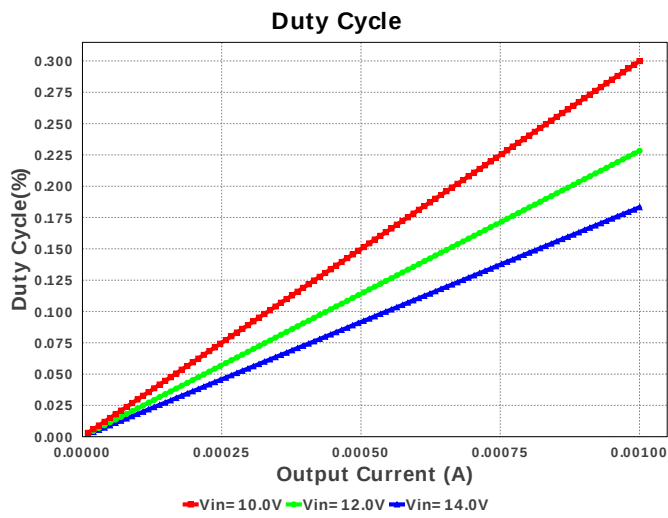
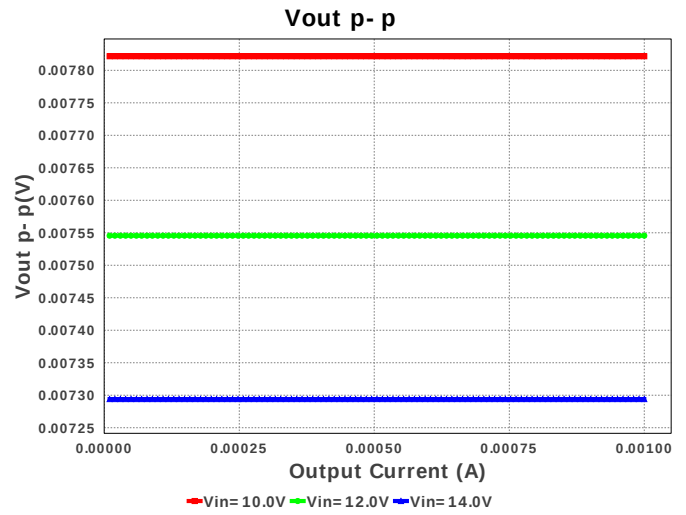
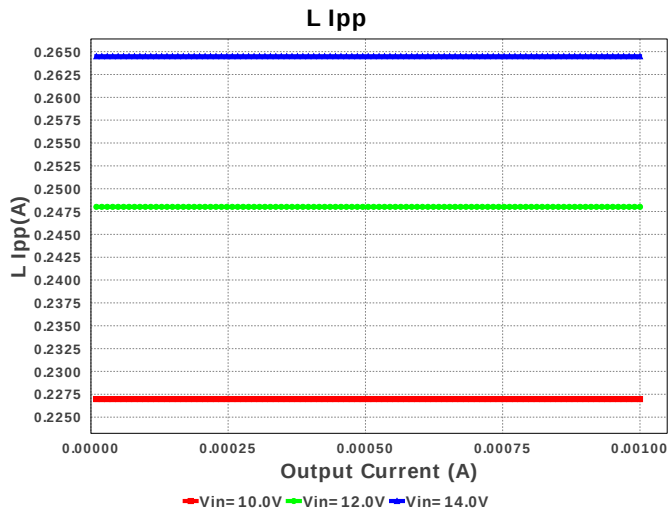
WEBENCH® Design Report

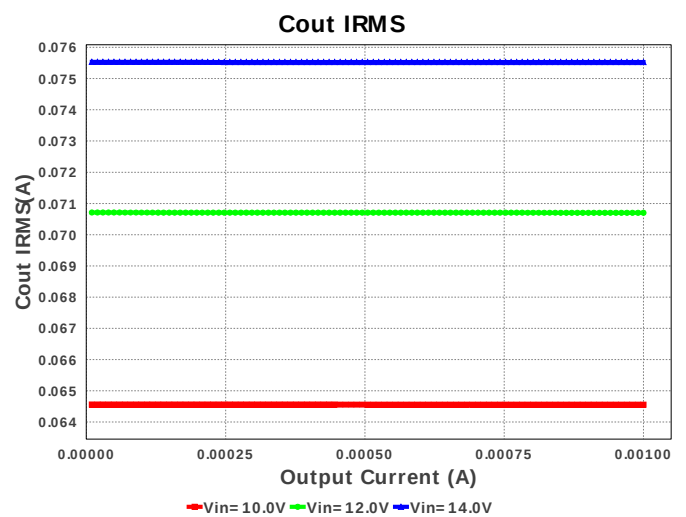
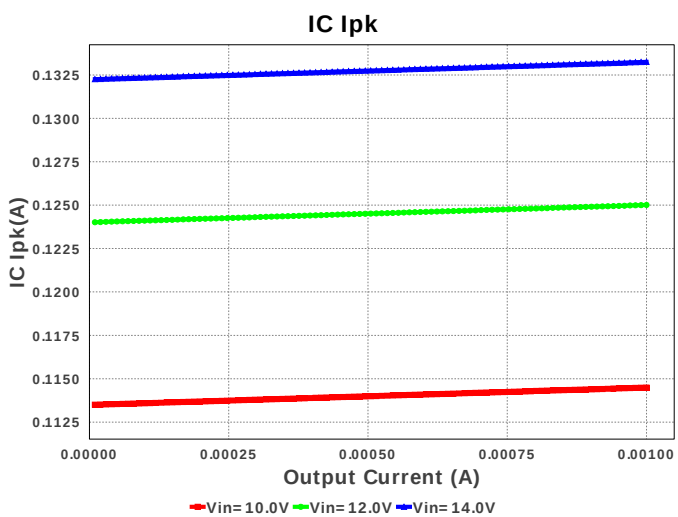
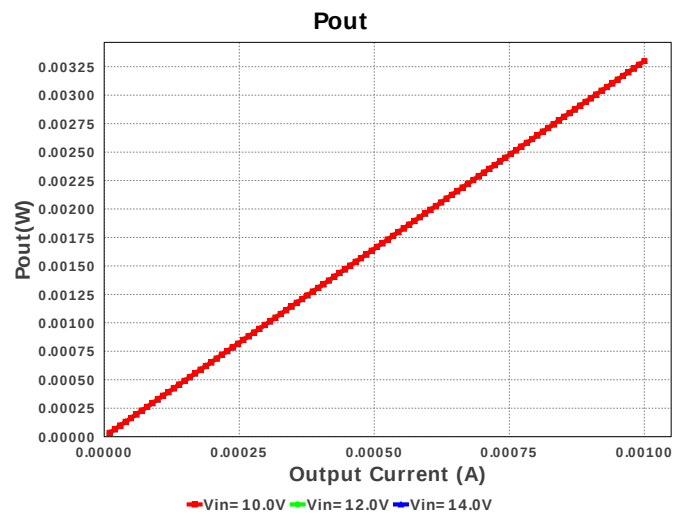
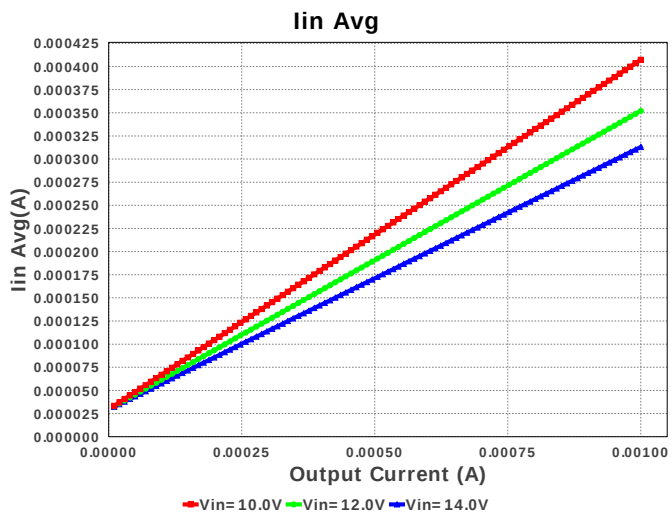
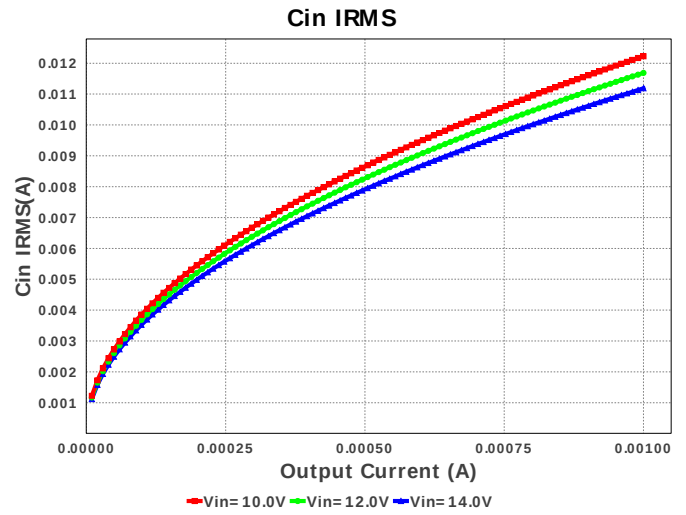
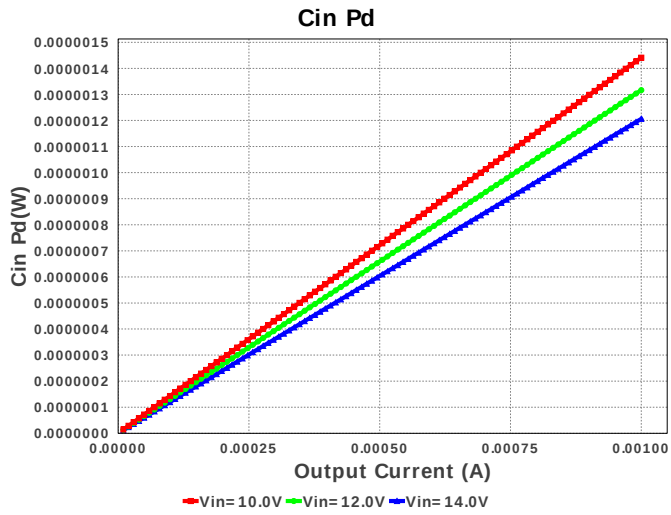
Design : 4354344/33 TPS62177DQCR
TPS62177DQCR 10.0V-14.0V to 3.30V @ 0.001A

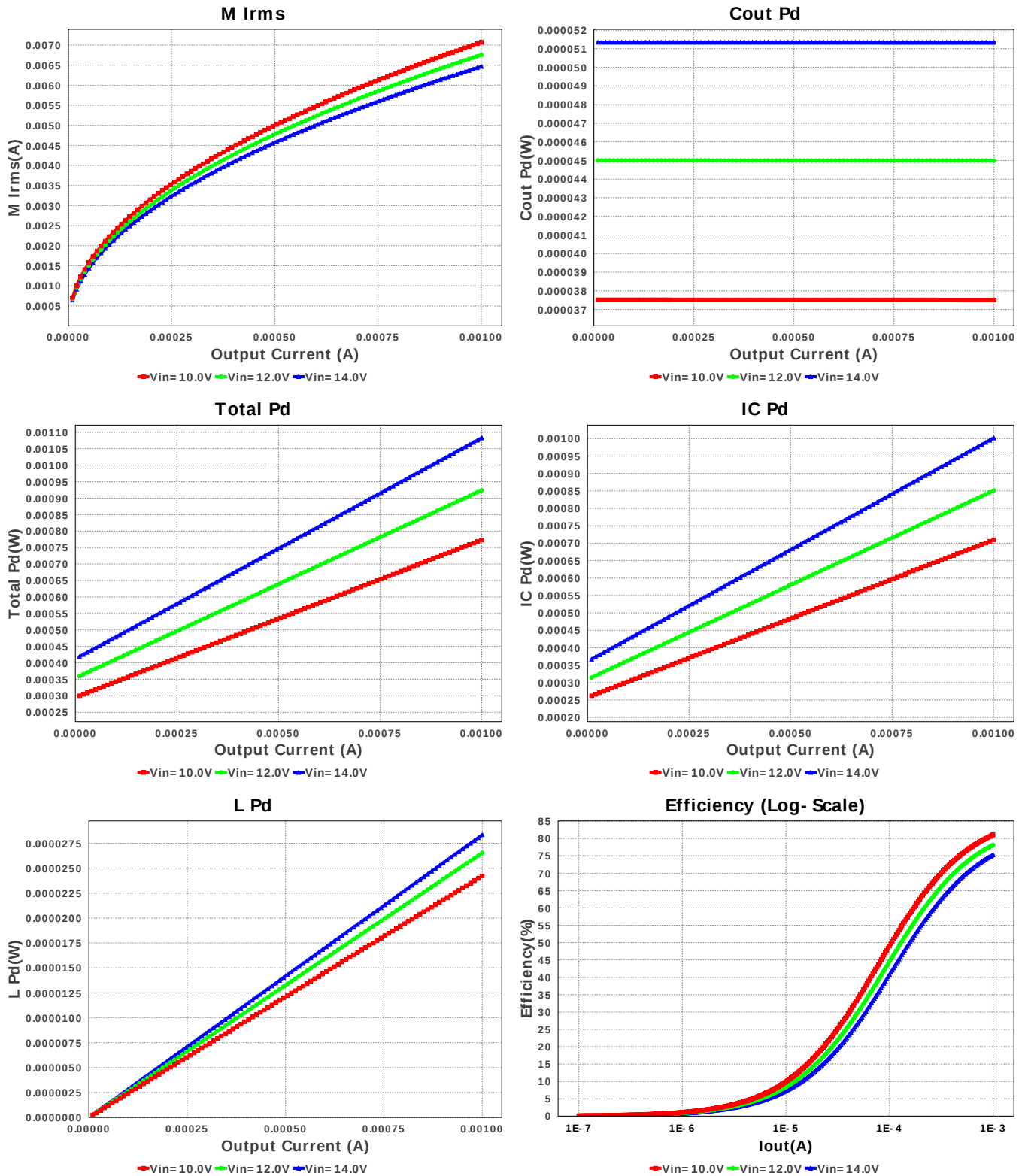


Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cin	MuRata	GRM188R61C225KE15D Series= X5R	Cap= 2.2 uF ESR= 9.637 mOhm VDC= 16.0 V IRMS= 1.20373 A	1	\$0.02	0603 5 mm ²
2.	Cout	MuRata	GRM21BR60J226ME39L Series= X5R	Cap= 22.0 uF ESR= 9.0 mOhm VDC= 6.3 V IRMS= 3.5 A	1	\$0.04	0805 7 mm ²
3.	L1	Bourns	SDR0503-100ML	L= 10.0 uH DCR= 130.0 mOhm	1	\$0.19	SDR0503 48 mm ²
4.	Rpg	Vishay-Dale	CRCW0402100KFKED Series= CRCW..e3	Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
5.	U1	Texas Instruments	TPS62177DQCR	Switcher	1	\$0.60	R-PWSON-N10 12 mm ²







Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	11.188 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	75.527 mA	Current	Output capacitor RMS ripple current
3.	IC Ipk	133.25 mA	Current	Peak switch current in IC
4.	Iin Avg	313.03 μ A	Current	Average input current
5.	L Ipp	264.5 mA	Current	Peak-to-peak inductor ripple current
6.	M1 Irms	6.465 mA	Current	Q lavg
7.	BOM Count	5	General	Total Design BOM count
8.	FootPrint	74.0 mm ²	General	Total Foot Print Area of BOM components
9.	Frequency	7.41 kHz	General	Switching frequency
10.	IC Tolerance	24.0 mV	General	IC Feedback Tolerance
11.	M Vds Act	198.608 mV	General	Voltage drop across the MosFET

#	Name	Value	Category	Description
12.	Pout	3.3 mW	General	Total output power
13.	Total BOM	\$0.86	General	Total BOM Cost
14.	Vout OP	3.3 V	Op_Point	Operational Output Voltage
15.	Duty Cycle	183.182 m%	Op_point	Duty cycle
16.	Efficiency	75.3 %	Op_point	Steady state efficiency
17.	IC Tj	30.062 degC	Op_point	IC junction temperature
18.	ICThetaJA	61.6 degC/W	Op_point	IC junction-to-ambient thermal resistance
19.	IOUT_OP	1.0 mA	Op_point	Iout operating point
20.	VIN_OP	14.0 V	Op_point	Vin operating point
21.	Vout p-p	7.294 mV	Op_point	Peak-to-peak output ripple voltage
22.	Cin Pd	1.206 μ W	Power	Input capacitor power dissipation
23.	Cout Pd	51.339 μ W	Power	Output capacitor power dissipation
24.	IC Pd	1.002 mW	Power	IC power dissipation
25.	L Pd	28.344 μ W	Power	Inductor power dissipation
26.	Total Pd	1.082 mW	Power	Total Power Dissipation
27.	Vout Tolerance	727.273 m%		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	1.0 m	Maximum Output Current
2.	VinMax	14.0	Maximum input voltage
3.	VinMin	10.0	Minimum input voltage
4.	Vout	3.3	Output Voltage
5.	base_pn	TPS62177	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	30.0	Ambient temperature

Design Assistance

1. [TPS62177 Product Folder](http://www.ti.com/product/TPS62177) : <http://www.ti.com/product/TPS62177> : contains the data sheet and other resources.

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