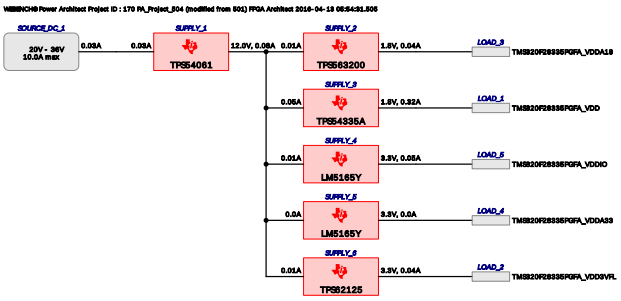
WEBENCH® Power Architect



Project Report

Project : 3473821/170 : PA_Project_504 (modified from 501)
Created : 2016-04-13 05:54:31.505
Optimize project optFactor=5

Project Summary

1.	Total System Efficiency	88.078 %
2.	Total System BOM Count	60.0
3.	Total System Footprint	2.52 kmm2
4.	Total System BOM Cost	$9.93
5.	Total System Power Dissipation	126.4 mW

--> Launch WEBENCH Power Architect.

Sequencer Flag Table

Supply	Sequencer Flag	Load	Load Name
SUPPLY_2	0	LOAD_3	TMS320F28335PGFA_VDDA18
SUPPLY_3	0	LOAD_1	TMS320F28335PGFA_VDD
SUPPLY_4	0	LOAD_5	TMS320F28335PGFA_VDDIO
SUPPLY_5	0	LOAD_4	TMS320F28335PGFA_VDDA33
SUPPLY_6	0	LOAD_2	TMS320F28335PGFA_VDD3VFL
SUPPLY_1	NA		

Power Supplies

#	Name	NSID	Description	Vout	Iout	Efficiency	Foot-print	Cost	Design	Page
1.	SUPPLY_1	TPS54061	Switcher : 4.7-60V Input, 200mA Synchronous Step-Down Converter	12.0 V	0.077 A	95.8%	295	$2.05	872	29
2.	SUPPLY_2	TPS563200	Switcher : 17V, 3A,6-pin, Low Iq Synchronous buck converter with Advanced Eco-mode	1.8 V	0.035 A	82.7%	72	$0.98	867	4
3.	SUPPLY_3	TPS54335A	Switcher : 28V, 3A, Low Iq, Synchronous, monolithic buck converter with Eco-mode	1.8 V	0.315 A	94.7%	1036	$2.96	868	9
4.	SUPPLY_4	LM5165Y	Switcher : Wide Vin with High Efficiency	3.3 V	0.05 A	87.8%	75	$1.03	869	14
5.	SUPPLY_5	LM5165Y	Switcher : Wide Vin with High Efficiency	3.3 V	0.002 A	96.9%	951	$2.06	870	19
6.	SUPPLY_6	TPS62125	Switcher : 3V-17V, 300mA Buck Converter With Adjustable Enable Threshold And Hysteresis	3.3 V	0.04 A	88%	91	$0.85	871	24

Power Loads

#	Name	VLoad	ILoad	Description
1.	TMS320F28335PGFA_VDDA18	1.8 V	0.035 A	SoftStart delay=50.0 µSec
2.	TMS320F28335PGFA_VDD	1.8 V	0.315 A	VoutRipple=10%, Requires a separate supply, SoftStart delay=50.0 µSec
3.	TMS320F28335PGFA_VDDIO	3.3 V	0.05 A	VoutRipple=10%, Requires a separate supply, SoftStart delay=50.0 µSec
4.	TMS320F28335PGFA_VDDA33	3.3 V	0.002 A	SoftStart delay=50.0 µSec
5.	TMS320F28335PGFA_VDD3VFL	3.3 V	0.04 A	VoutRipple=10%, Requires a separate supply, SoftStart delay=50.0 µSec

FPGAs, Processors

#	Manufacturer	Part Number	Name	Series	Description
1.	Texas Instruments	TMS320F28335PGFA	FPGA_1	TMS320C2000	FPGA Texas Instruments TMS320C2000 TMS320F28335PGFA

http://focus.ti.com/lit/ds/symlink/tms320f28335.pdf

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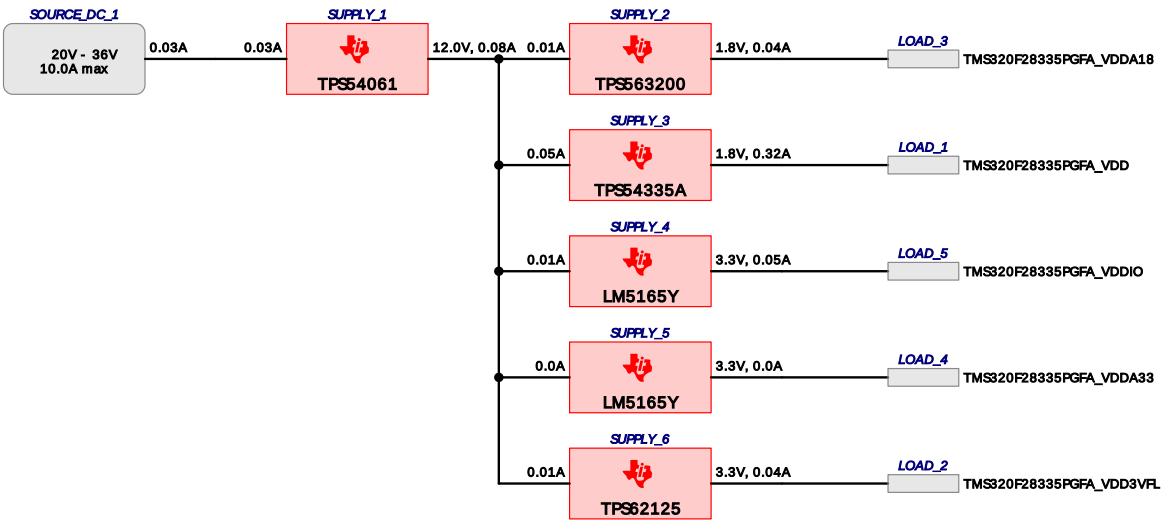
Project Diagram

WEBENCH® Power Architect Project ID : 170 PA_Project_504 (modified from 501) FPGA Architect 2016-04-13 05:54:31.505



Electrical Procurement BOM

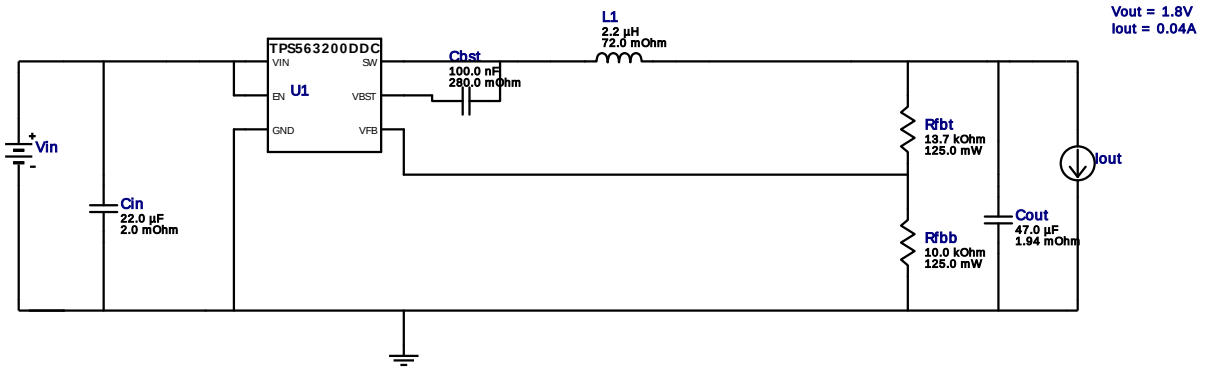
Manufacturer	Part Number	Description	Quantity	Budgetary Price	Footprint (mm^2)
AVX	08053C104KAT2A	0805	1	$0.01	7
Kemet	C0603C185K9PACTU	0603	1	$0.05	5
Kemet	C0805C104K5RACTU	0805	2	$0.01	14
Kemet	C1206C105K3RACTU	1206	2	$0.04	22
TDK	C3216X5R0J336M	1206	2	$0.27	22
TDK	C3216X6S0G476M	1206	1	$0.13	11
Yageo America	CC0805KRX7R9BB821	0805	1	$0.01	7
Vishay-Dale	CRCW080510M0FKEA	0805	2	$0.01	14
Vishay-Dale	CRCW08051M02FKEA	0805	1	$0.01	7
Vishay-Dale	CRCW08051M24FKEA	0805	1	$0.01	7
Vishay-Dale	CRCW08051M47FKEA	0805	1	$0.01	7
Vishay-Dale	CRCW0805316RFKEA	0805	1	$0.01	7
Vishay-Dale	CRCW08055M36FKEA	0805	2	$0.01	14
Panasonic	ERJ-6ENF1002V	0805	2	$0.01	14
Panasonic	ERJ-6ENF1003V	0805	3	$0.01	20
Panasonic	ERJ-6ENF1372V	0805	1	$0.01	7
Panasonic	ERJ-6ENF1403V	0805	1	$0.01	7
Panasonic	ERJ-6ENF1542V	0805	1	$0.01	7
Panasonic	ERJ-6ENF2003V	0805	1	$0.01	7
Panasonic	ERJ-6ENF3093V	0805	1	$0.01	7
Panasonic	ERJ-6ENF3572V	0805	1	$0.01	7
Panasonic	ERJ-6ENF4222V	0805	1	$0.01	7
Panasonic	ERJ-6ENF4873V	0805	2	$0.01	14
Panasonic	ERJ-6ENF6493V	0805	1	$0.01	7
Panasonic	ERJ-6ENF8062V	0805	1	$0.01	7
MuRata	GRM033R71E471KA01D	0201	2	$0.01	4
MuRata	GRM155R61A823KA01D	0402	1	$0.01	3
MuRata	GRM155R71E103KA01D	0402	1	$0.01	3
MuRata	GRM219R60J106KE19D	0805	1	$0.02	7
MuRata	GRM21BR61C106KE15L	0805	3	$0.04	20
MuRata	GRM31CR60G107ME39L	1206_190	3	$0.23	11
MuRata	GRM31CR71H475KA12L	1206	1	$0.07	11
MuRata	GRM32ER61E226KE15L	1210	1	$0.16	15
Texas Instruments	LM5165YDRCR	DRC0010J	2	$0.50	32
Coilcraft	MSS1210-565KEB	MSS1210	1	$0.81	204
Bourns	PM2110-102K-RC	PM2110	1	$1.21	890
Bourns	PM2110-331K-RC	PM2110	1	$1.21	890
Bourns	SDR0302-221KL	SDR0302	1	$0.18	15
Bourns	SDR0403-150ML	SDR0403	1	$0.18	28
Bourns	SRN3015-2R2M	SRN3015	1	$0.14	16
Taiyo Yuden	TMK212B7473KD-T	0805	1	$0.01	7
Texas Instruments	TPS54061DRBR	S-PVSON-N8	1	$1.04	16
Texas Instruments	TPS54335ADDAR	R-PDSO-G8	1	$0.90	57
Texas Instruments	TPS563200DDCR	DDC0006A	1	$0.52	10
Texas Instruments	TPS62125DSGR	S-PWSON-N8	1	$0.55	10
Total			60	$24.98	2498.3975000000005

WEBENCH ® Design Report

Vout = 1.8V
Iout = 0.04A

Device = TPS563200DDCR
Topology = Buck
Created = 4/13/16 5:54:28 AM
BOM Cost = $0.98
BOM Count = 7
Total Pd = 0.01W

Design : 3473821/867 TPS563200DDCR
TPS563200DDCR 10.8V-13.2V to 1.80V @ 0.035A



Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbst	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
2.	Cin	MuRata	GRM32ER61E226KE15L Series= X5R	Cap= 22.0 uF ESR= 2.0 mOhm VDC= 25.0 V IRMS= 3.67 A	1	$0.16	1210 15 mm²
3.	Cout	TDK	C3216X6S0G476M Series= X6S	Cap= 47.0 uF ESR= 1.94 mOhm VDC= 4.0 V IRMS= 0.0 A	1	$0.13	1206 11 mm²
4.	L1	Bourns	SRN3015-2R2M	L= 2.2 µH DCR= 72.0 mOhm	1	$0.14	SRN3015 16 mm²
5.	Rfbb	Panasonic	ERJ-6ENF1002V Series= ERJ-6E	Res= 10.0 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm²
6.	Rfbt	Panasonic	ERJ-6ENF1372V Series= ERJ-6E	Res= 13.7 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm²
7.	U1	Texas Instruments	TPS563200DDCR	Switcher	1	$0.52	DDC0006A 10 mm²

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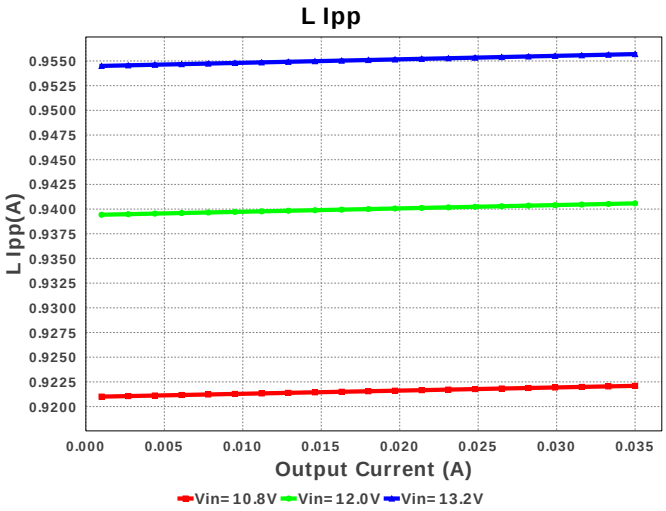

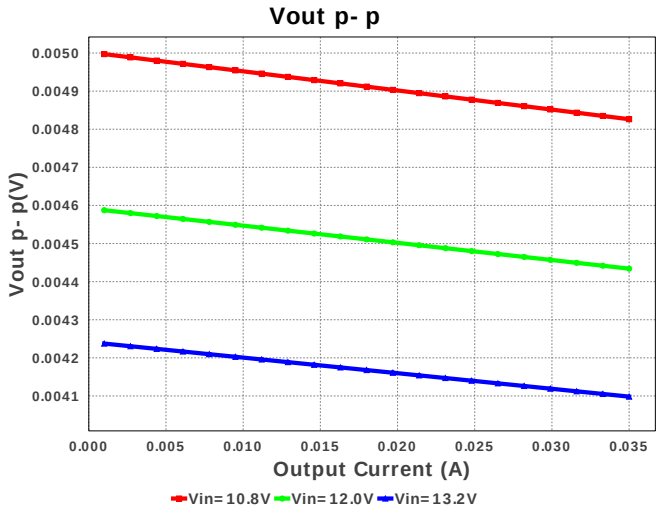

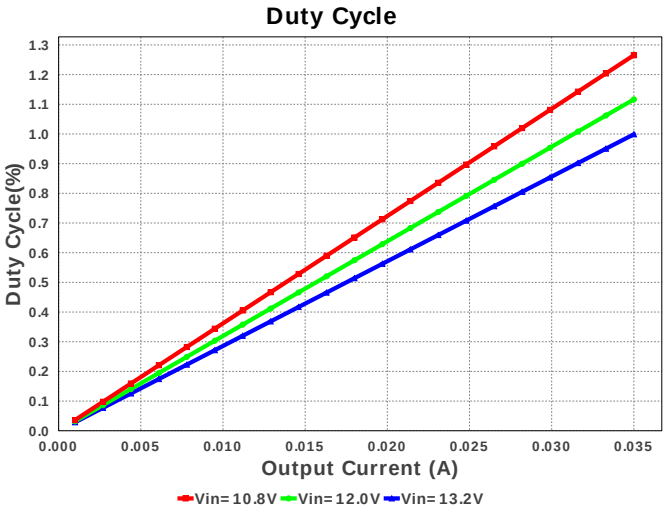

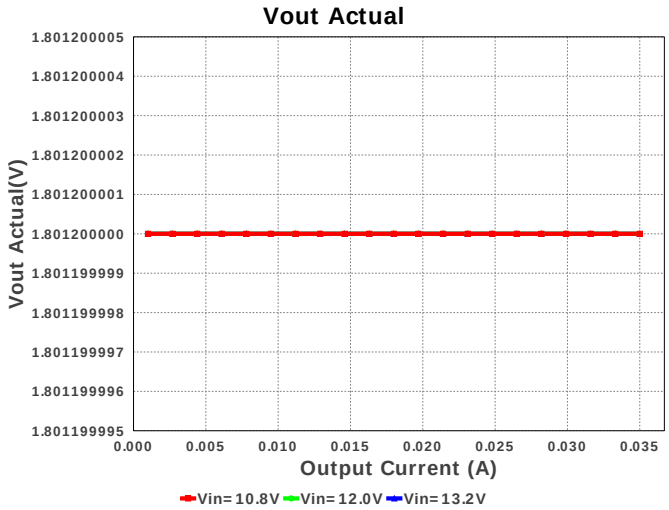

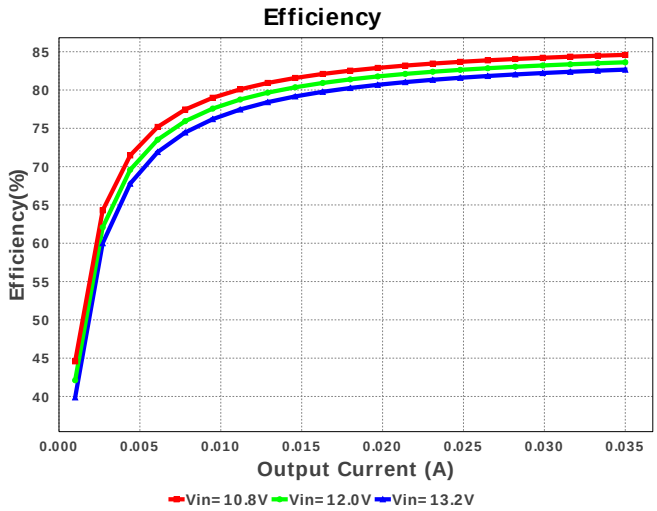

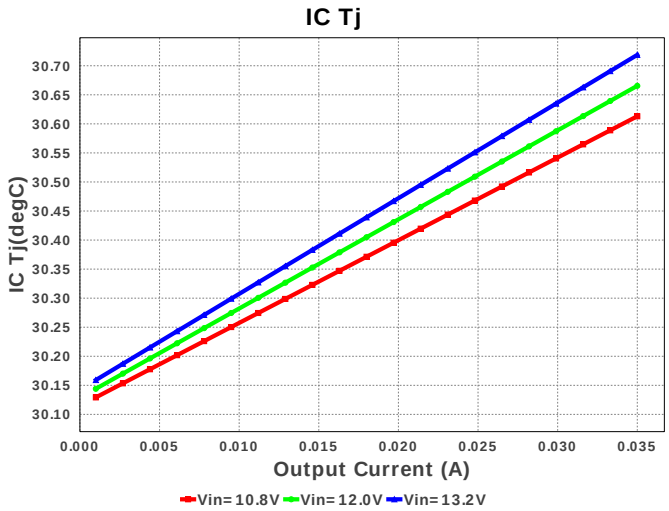

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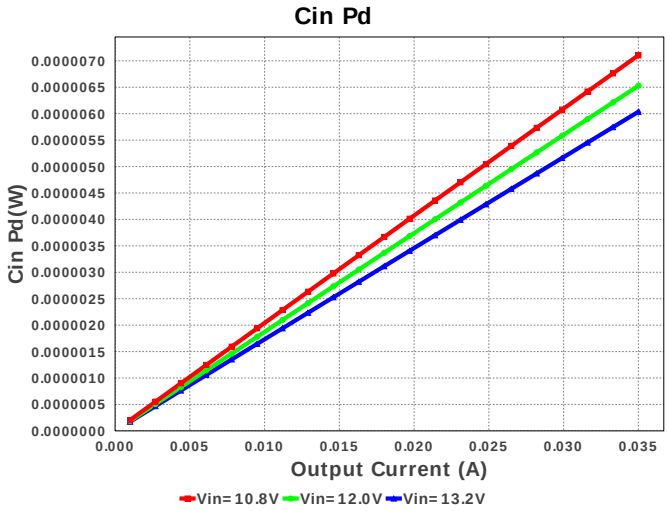

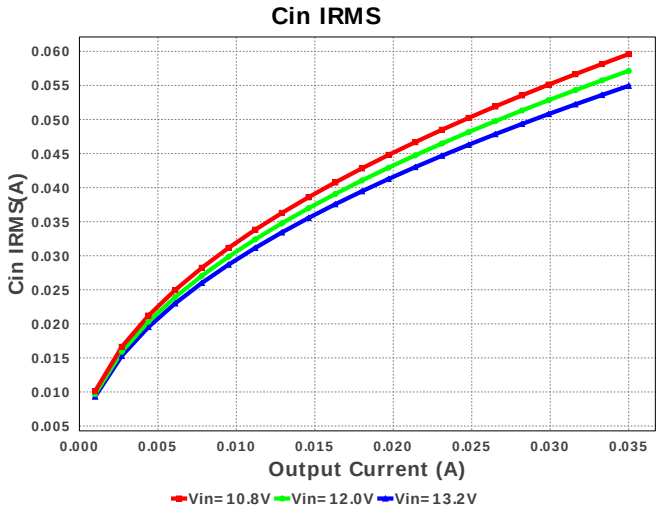

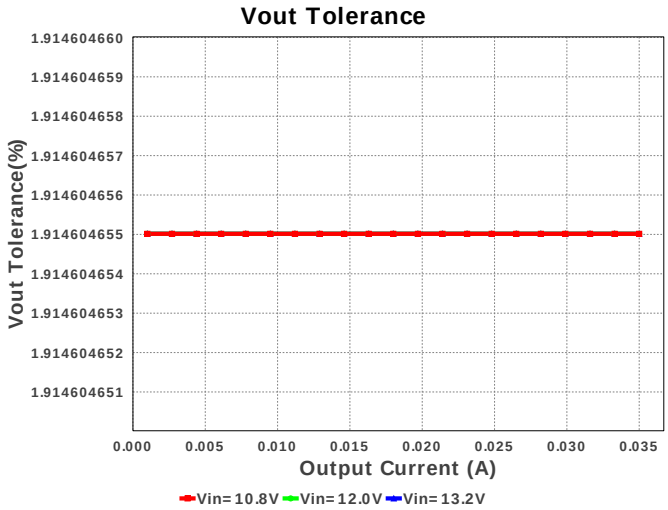

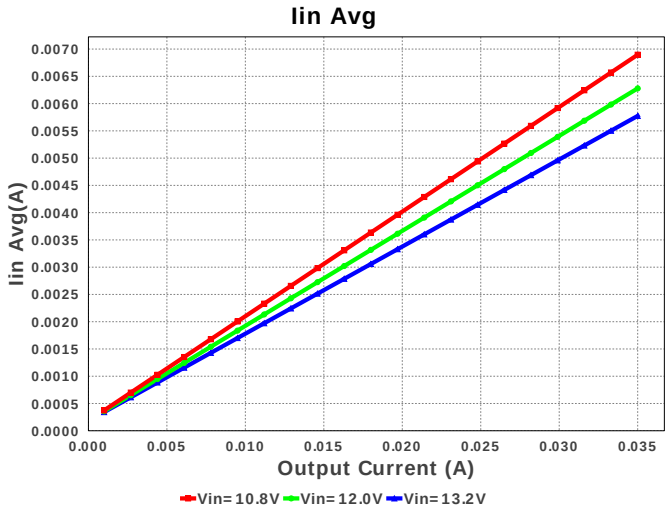

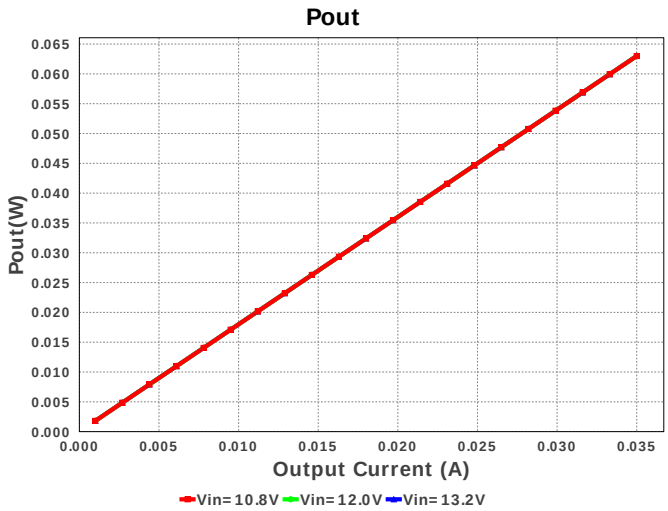

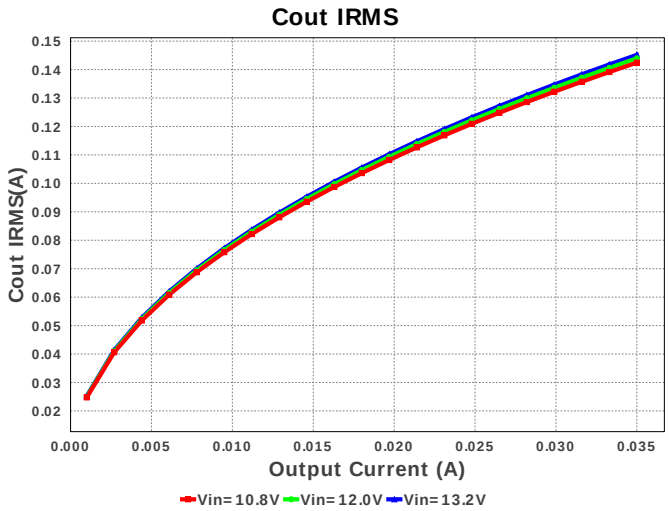

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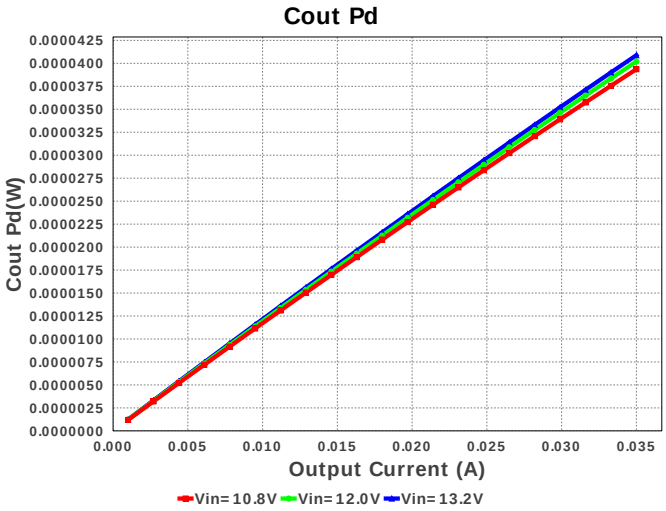

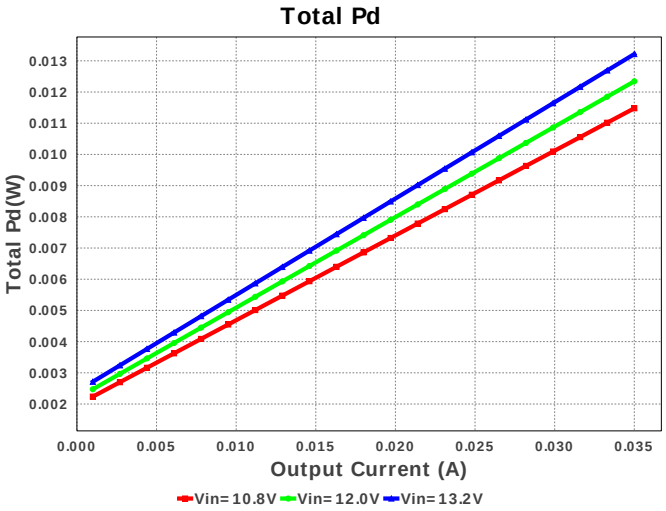

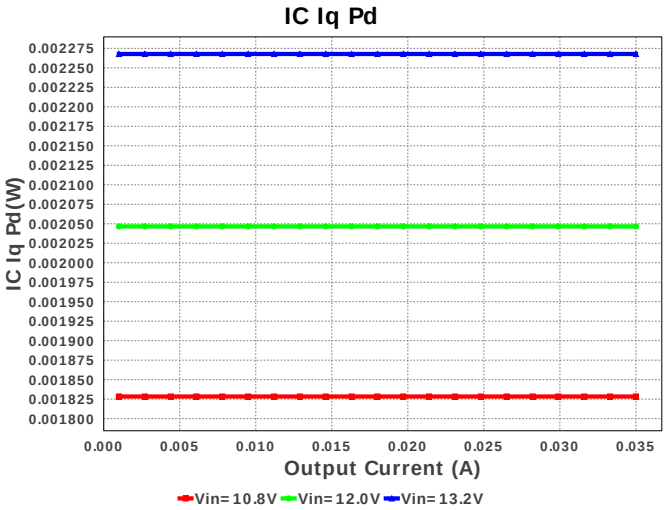

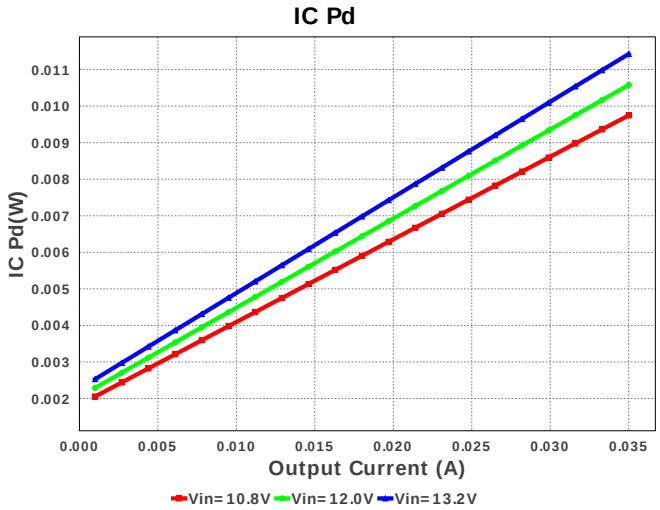

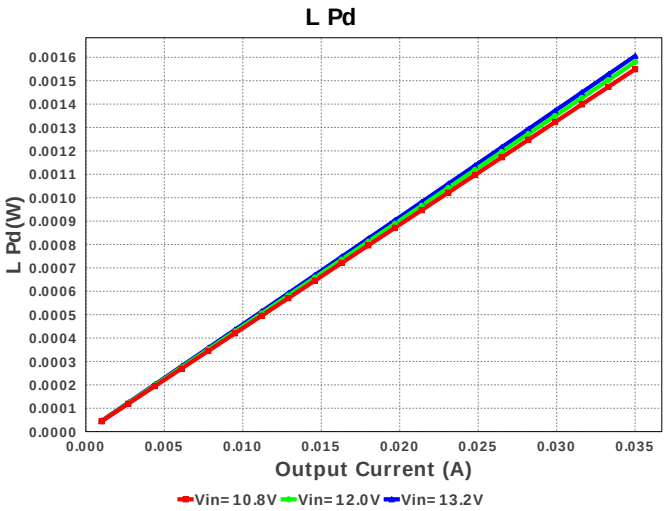

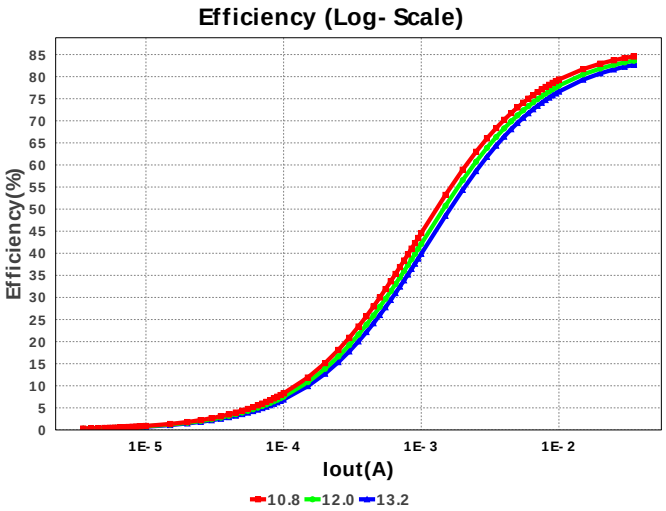

Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	54.938 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	145.171 mA	Current	Output capacitor RMS ripple current
3.	Iin Avg	5.774 mA	Current	Average input current
4.	L Ipp	955.7 mA	Current	Peak-to-peak inductor ripple current
5.	BOM Count	7	General	Total Design BOM count
6.	FootPrint	72.0 mm^2	General	Total Foot Print Area of BOM components
7.	Frequency	54.137 kHz	General	Switching frequency
8.	Pout	63.0 mW	General	Total output power
9.	Total BOM	$0.98	General	Total BOM Cost
10.	Vout Actual	1.801 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
11.	Vout OP	1.8 V	Op_Point	Operational Output Voltage

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#	Name	Value	Category	Description
12.	Duty Cycle	998.819 m%	Op_point	Duty cycle
13.	Efficiency	82.66 %	Op_point	Steady state efficiency
14.	IC Tj	30.719 degC	Op_point	IC junction temperature
15.	ICThetaJA	62.9 degC/W	Op_point	IC junction-to-ambient thermal resistance
16.	IOUT_OP	35.0 mA	Op_point	Iout operating point
17.	VIN_OP	13.2 V	Op_point	Vin operating point
18.	Vout p-p	4.254 mV	Op_point	Peak-to-peak output ripple voltage
19.	Cin Pd	6.036 µW	Power	Input capacitor power dissipation
20.	Cout Pd	40.885 µW	Power	Output capacitor power dissipation
21.	IC Iq Pd	2.268 mW	Power	IC Iq Pd
22.	IC Pd	11.426 mW	Power	IC power dissipation
23.	L Pd	1.606 mW	Power	Inductor power dissipation
24.	Total Pd	13.216 mW	Power	Total Power Dissipation
25.	Vout Tolerance	1.915 %		Vout Tolerance based on IC Tolerance and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	35.0 m	Maximum Output Current
2.	SoftStart	0.05 ms	Soft Start Time (ms)
3.	VinMax	13.2	Maximum input voltage
4.	VinMin	10.8	Minimum input voltage
5.	Vout	1.8	Output Voltage
6.	base_pn	TPS563200	Base Product Number
7.	source	DC	Input Source Type
8.	Ta	30.0	Ambient temperature

Design Assistance

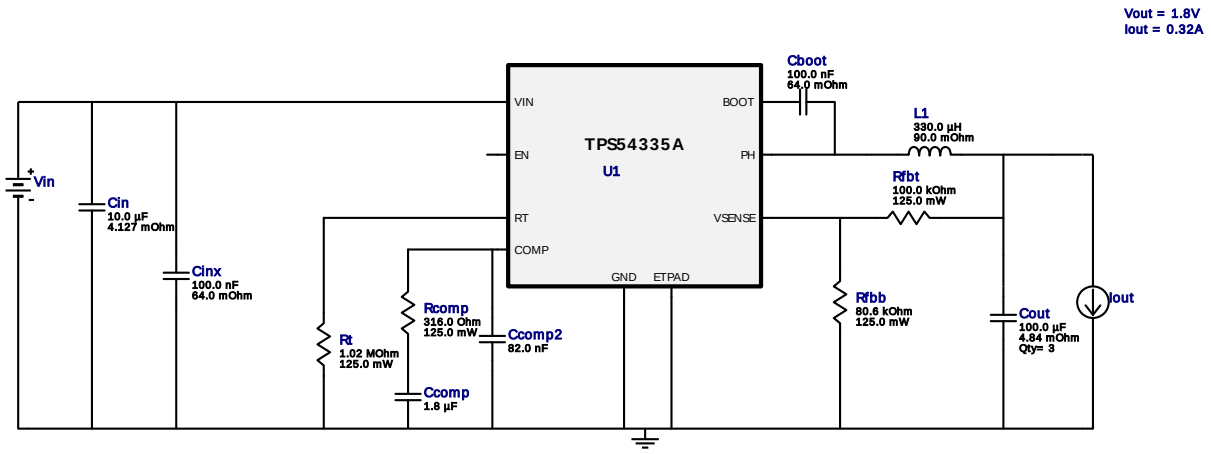
1. **TPS563200** Product Folder : http://www.ti.com/product/TPS563200 : contains the data sheet and other resources.

WEBENCH ® Design Report

Vout = 1.8V
Iout = 0.32A

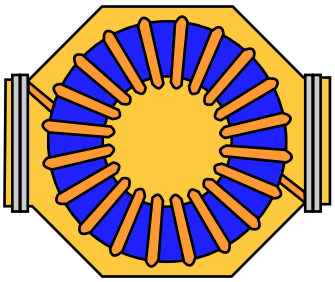
Device = TPS54335ADDAR
Topology = Buck
Created = 4/13/16 5:54:28 AM
BOM Cost = $2.96
BOM Count = 14
Total Pd = 0.03W

Design : 3473821/868 TPS54335ADDAR
TPS54335ADDAR 10.8V-13.2V to 1.80V @ 0.315A



Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot	Kemet	C0805C104K5RACTU Series= X7R	Cap= 100.0 nF ESR= 64.0 mOhm VDC= 50.0 V IRMS= 1.64 A	1	$0.01	0805 7 mm²
2.	Ccomp	Kemet	C0603C185K9PACTU Series= X5R	Cap= 1.8 uF VDC= 6.3 V IRMS= 0.0 A	1	$0.05	0603 5 mm²
3.	Ccomp2	MuRata	GRM155R61A823KA01D Series= X5R	Cap= 82.0 nF VDC= 10.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
4.	Cin	MuRata	GRM21BR61C106KE15L Series= X5R	Cap= 10.0 uF ESR= 4.127 mOhm VDC= 16.0 V IRMS= 2.46634 A	1	$0.04	0805 7 mm²
5.	Cinx	Kemet	C0805C104K5RACTU Series= X7R	Cap= 100.0 nF ESR= 64.0 mOhm VDC= 50.0 V IRMS= 1.64 A	1	$0.01	0805 7 mm²
6.	Cout	MuRata	GRM31CR60G107ME39L Series= X5R	Cap= 100.0 uF ESR= 4.84 mOhm VDC= 4.0 V IRMS= 4.3381 A	3	$0.23	1206_190 11 mm²
7.	L1	Bourns	PM2110-331K-RC	L= 330.0 µH DCR= 90.0 mOhm	1	$1.21	PM2110 890 mm²



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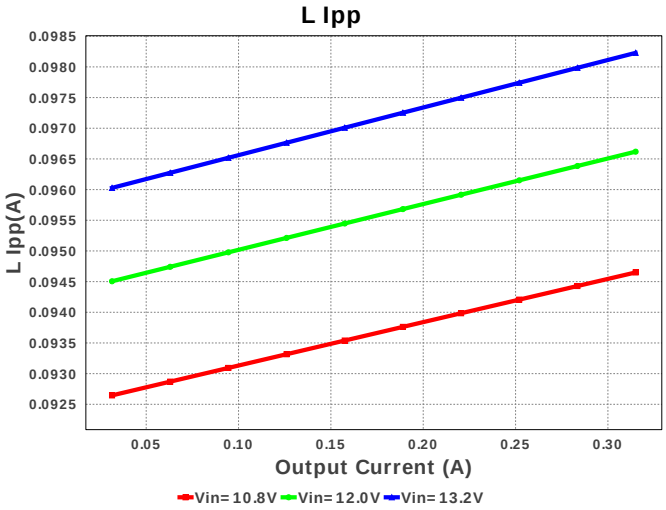
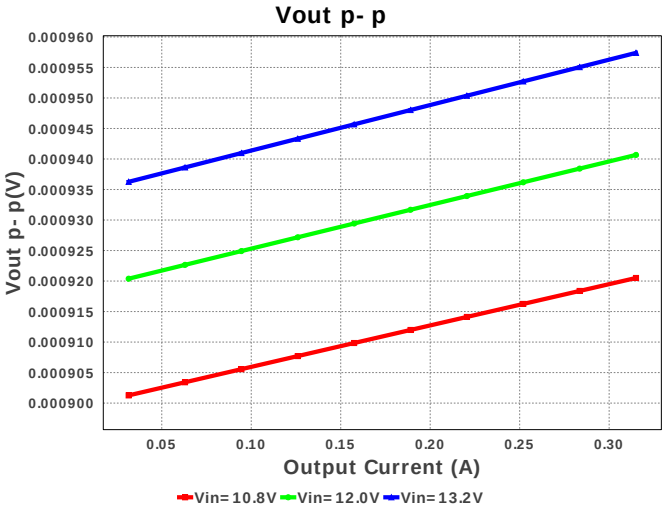
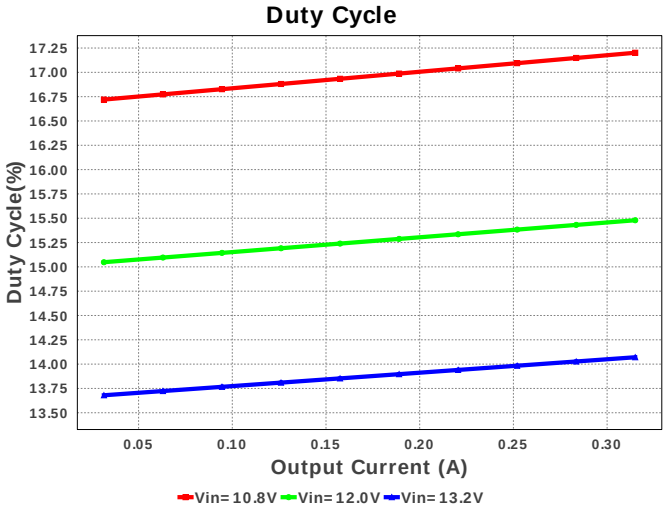
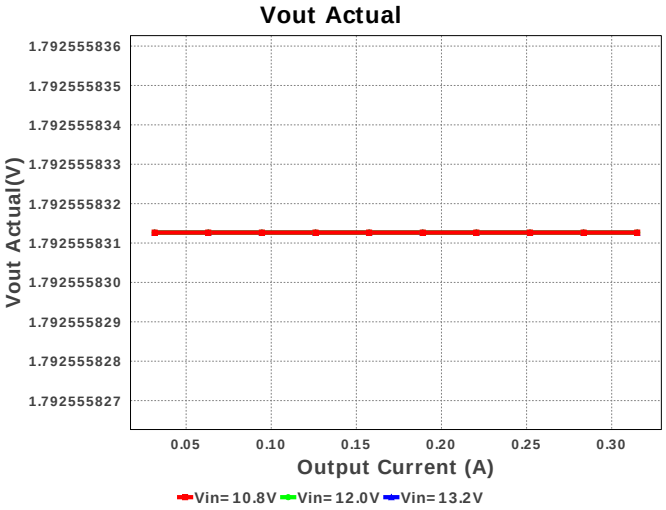
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
8.	Rcomp	Vishay-Dale	CRCW0805316RFKEA Series= CRCW..e3	Res= 316.0 Ohm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm²
9.	Rfbb	Panasonic	ERJ-6ENF8062V Series= ERJ-6E	Res= 80.6 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm²
10.	Rfbt	Panasonic	ERJ-6ENF1003V Series= ERJ-6E	Res= 100.0 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm²
11.	Rt	Vishay-Dale	CRCW08051M02FKEA Series= CRCW..e3	Res= 1.02 MOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm²
12.	U1	Texas Instruments	TPS54335ADDAR	Switcher	1	$0.90	

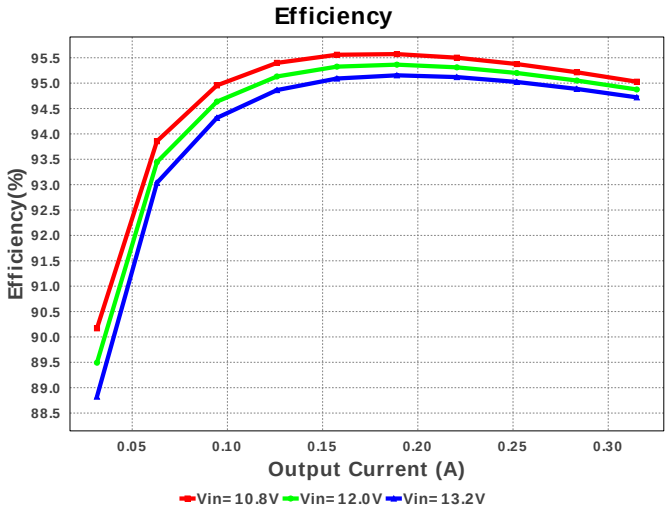
R-PDSO-G8 57 mm²

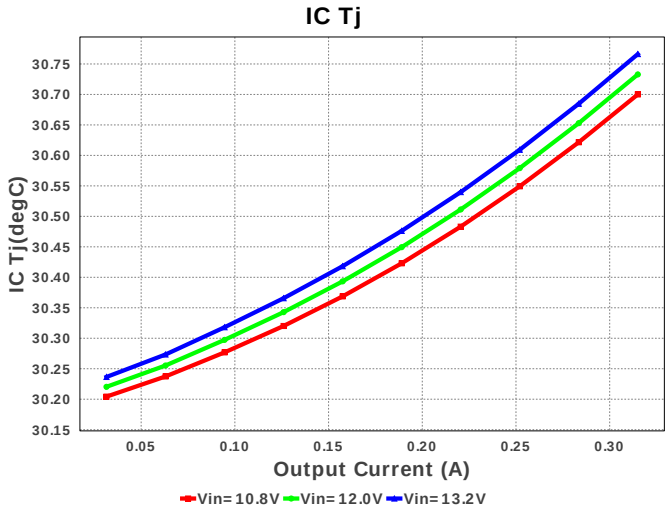


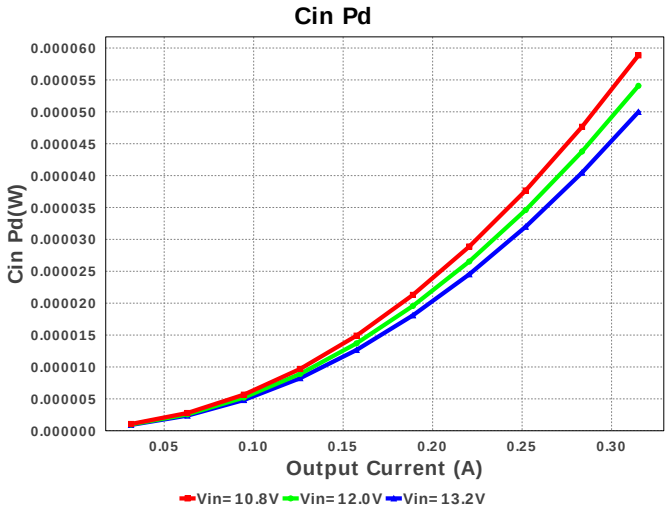


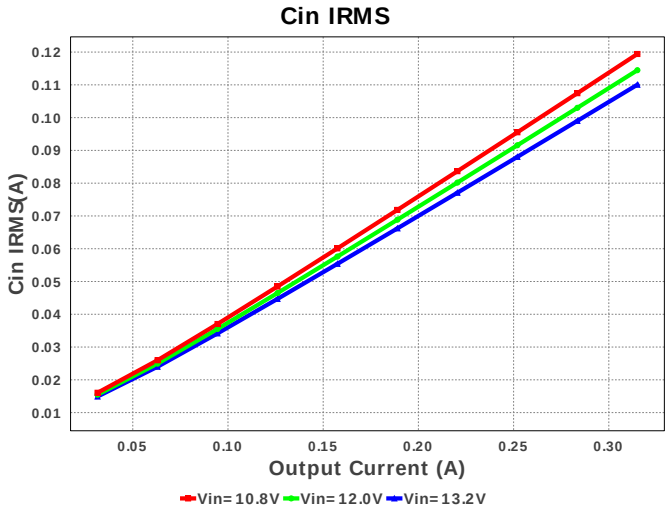


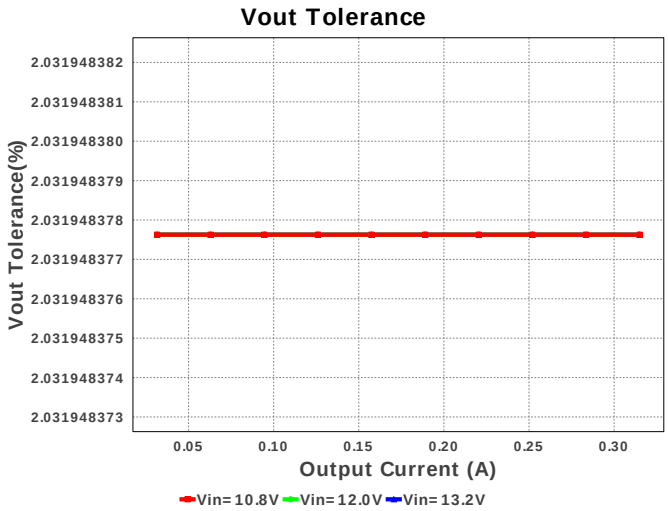


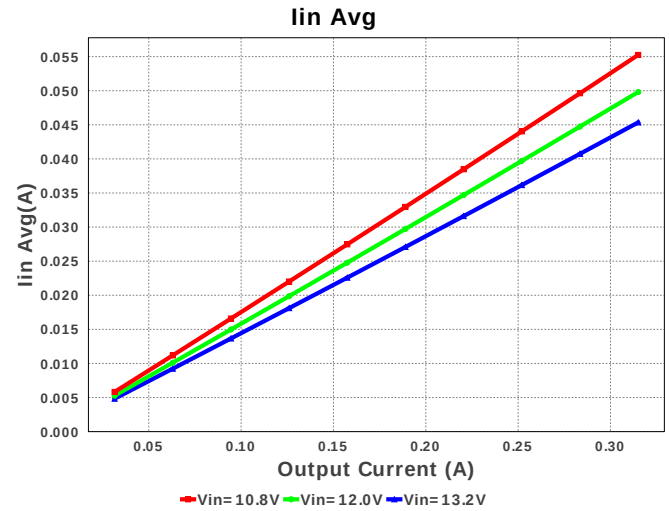

Efficiency
Efficiency(%)
95.5
95.0
94.5
94.0
93.5
93.0
92.5
92.0
91.5
91.0
90.5
90.0
89.5
89.0
88.5
0.05
0.10
0.15
0.20
0.25
0.30
Output Current (A)
Vin=10.8V
Vin=12.0V
Vin=13.2V

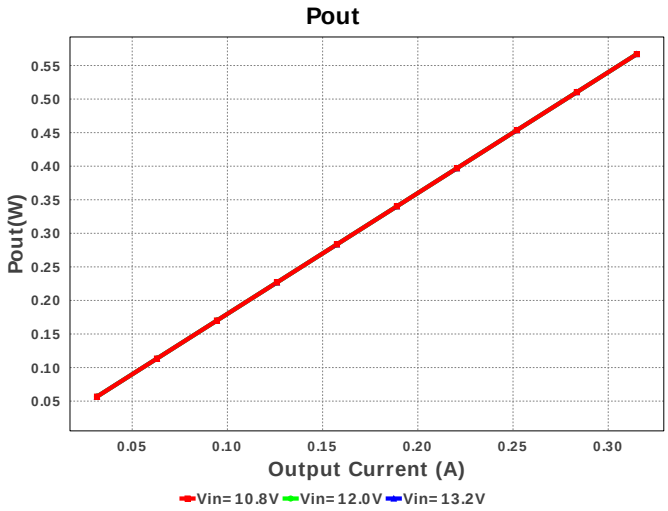

IC Tj
IC Tj(degC)
30.75
30.70
30.65
30.60
30.55
30.50
30.45
30.40
30.35
30.30
30.25
30.20
30.15
0.05
0.10
0.15
0.20
0.25
0.30
Output Current (A)
Vin=10.8V
Vin=12.0V
Vin=13.2V

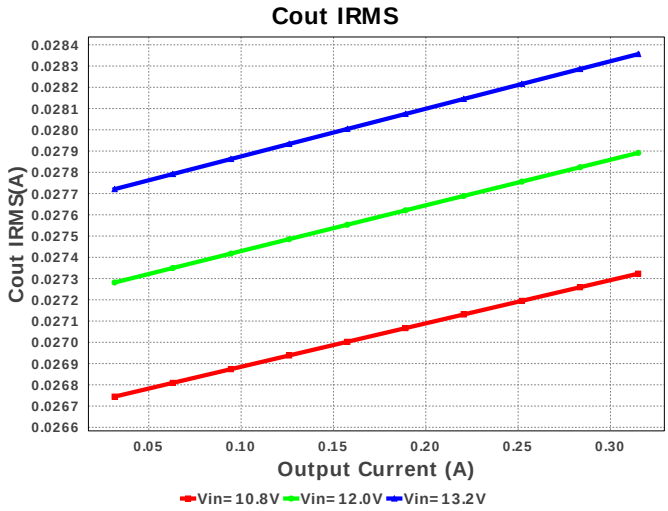

Cin Pd
Cin Pd(W)
0.000060
0.000055
0.000050
0.000045
0.000040
0.000035
0.000030
0.000025
0.000020
0.000015
0.000010
0.000005
0.000000
0.05
0.10
0.15
0.20
0.25
0.30
Output Current (A)
Vin=10.8V
Vin=12.0V
Vin=13.2V

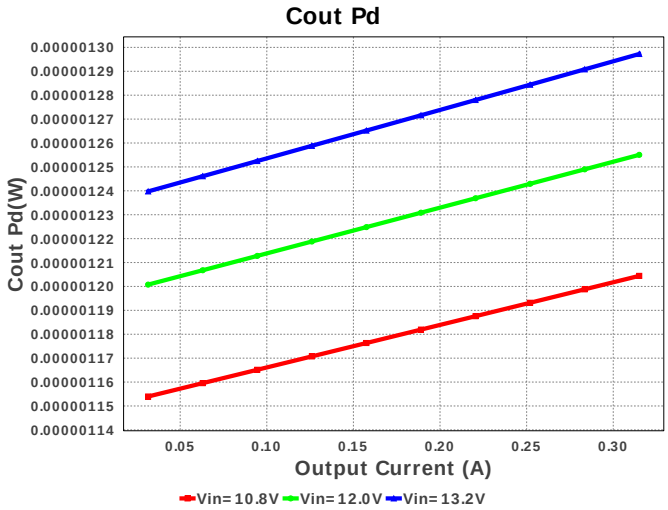

Cin IRMS
Cin IRMS(A)
0.12
0.11
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.05
0.10
0.15
0.20
0.25
0.30
Output Current (A)
Vin=10.8V
Vin=12.0V
Vin=13.2V

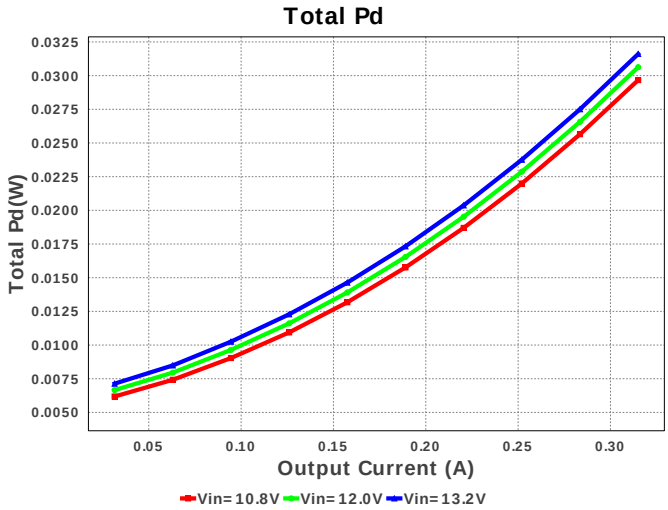

Vout Tolerance
Vout Tolerance(%)
2.031948382
2.031948381
2.031948380
2.031948379
2.031948378
2.031948377
2.031948376
2.031948375
2.031948374
2.031948373
0.05
0.10
0.15
0.20
0.25
0.30
Output Current (A)
Vin=10.8V
Vin=12.0V
Vin=13.2V

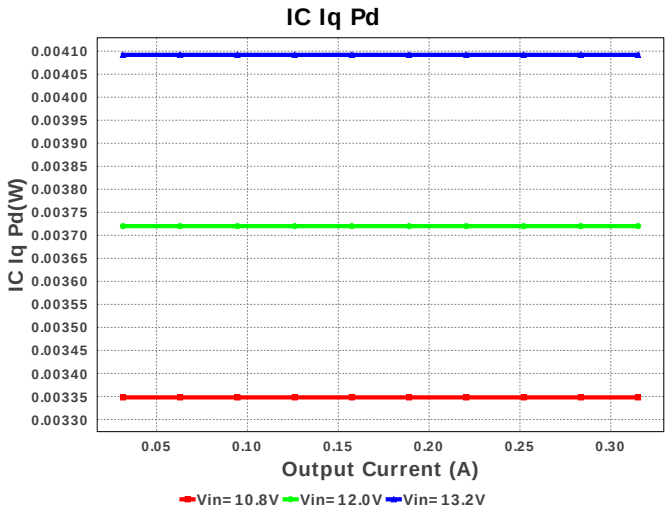

Iin Avg
Iin Avg(A)
0.055
0.050
0.045
0.040
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
0.05
0.10
0.15
0.20
0.25
0.30
Output Current (A)
Vin=10.8V
Vin=12.0V
Vin=13.2V

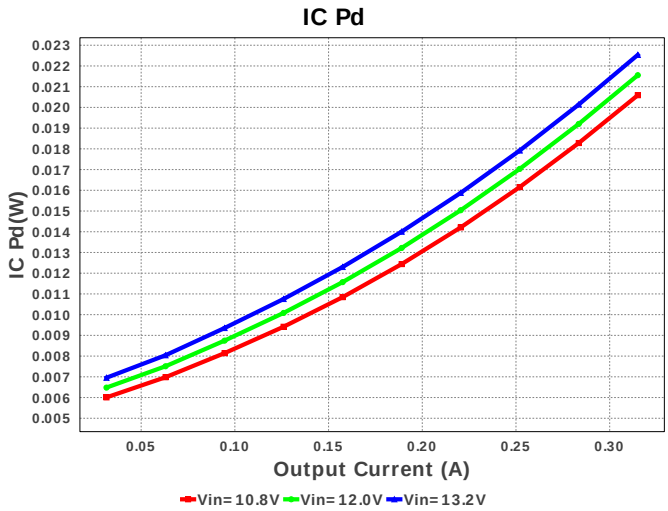












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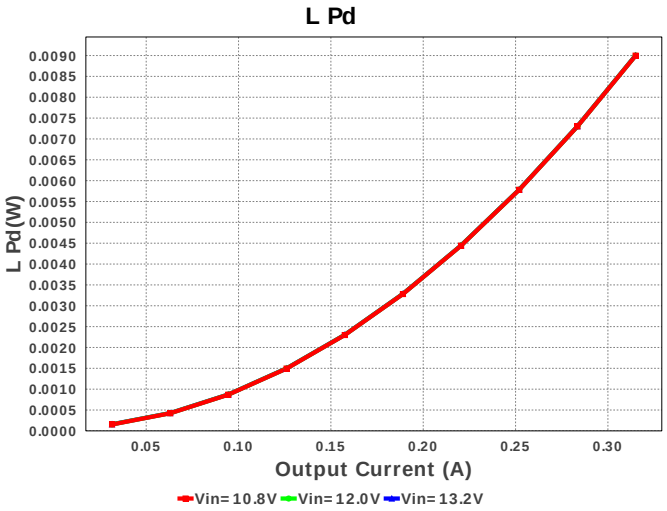
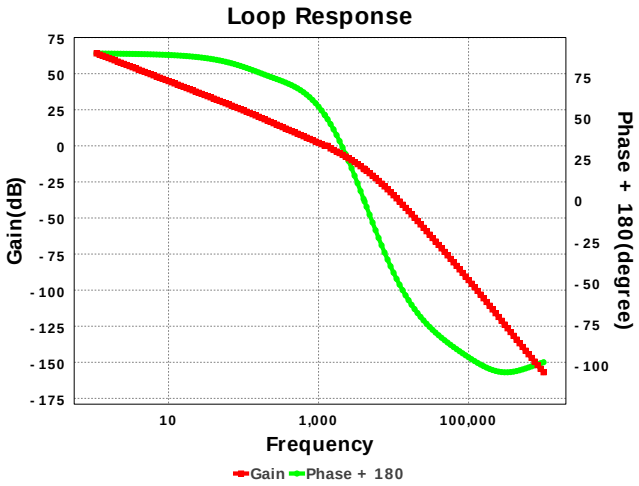




Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	110.046 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	28.356 mA	Current	Output capacitor RMS ripple current
3.	Iin Avg	45.349 mA	Current	Average input current
4.	L Ipp	98.229 mA	Current	Peak-to-peak inductor ripple current
5.	BOM Count	14	General	Total Design BOM count
6.	FootPrint	1.036 k mm^2	General	Total Foot Print Area of BOM components
7.	Frequency	49.182 kHz	General	Switching frequency
8.	IC Tolerance	12.0 mV	General	IC Feedback Tolerance
9.	Pout	567.0 mW	General	Total output power
10.	Total BOM	$2.96	General	Total BOM Cost
11.	ICThetaJA Effective	34.0 degC/W	Op_Point	Effective IC Junction-to-Ambient Thermal Resistance
12.	Low Freq Gain	64.02 dB	Op_Point	Gain at 10Hz
13.	Vout Actual	1.793 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
14.	Vout OP	1.8 V	Op_Point	Operational Output Voltage
15.	Cross Freq	1.221 kHz	Op_point	Bode plot crossover frequency
16.	Duty Cycle	14.071 %	Op_point	Duty cycle
17.	Efficiency	94.72 %	Op_point	Steady state efficiency
18.	Gain Marg	-16.246 dB	Op_point	Bode Plot Gain Margin
19.	IC Tj	30.766 degC	Op_point	IC junction temperature
20.	IOUT_OP	315.0 mA	Op_point	Iout operating point
21.	Phase Marg	52.356 deg	Op_point	Bode Plot Phase Margin
22.	VIN_OP	13.2 V	Op_point	Vin operating point
23.	Vout p-p	957.391 µV	Op_point	Peak-to-peak output ripple voltage
24.	Cin Pd	49.979 µW	Power	Input capacitor power dissipation
25.	Cout Pd	1.297 µW	Power	Output capacitor power dissipation
26.	IC Iq Pd	4.092 mW	Power	IC Iq Pd
27.	IC Pd	22.535 mW	Power	IC power dissipation
28.	L Pd	9.003 mW	Power	Inductor power dissipation
29.	Total Pd	31.606 mW	Power	Total Power Dissipation
30.	Vout Tolerance	2.032 %		Vout Tolerance based on IC Tolerance and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	315.0 m	Maximum Output Current
2.	SoftStart	0.05 ms	Soft Start Time (ms)
3.	VinMax	13.2	Maximum input voltage
4.	VinMin	10.8	Minimum input voltage
5.	Vout	1.8	Output Voltage
6.	base_pn	TPS54335A	Base Product Number
7.	source	DC	Input Source Type
8.	Ta	30.0	Ambient temperature

Design Assistance

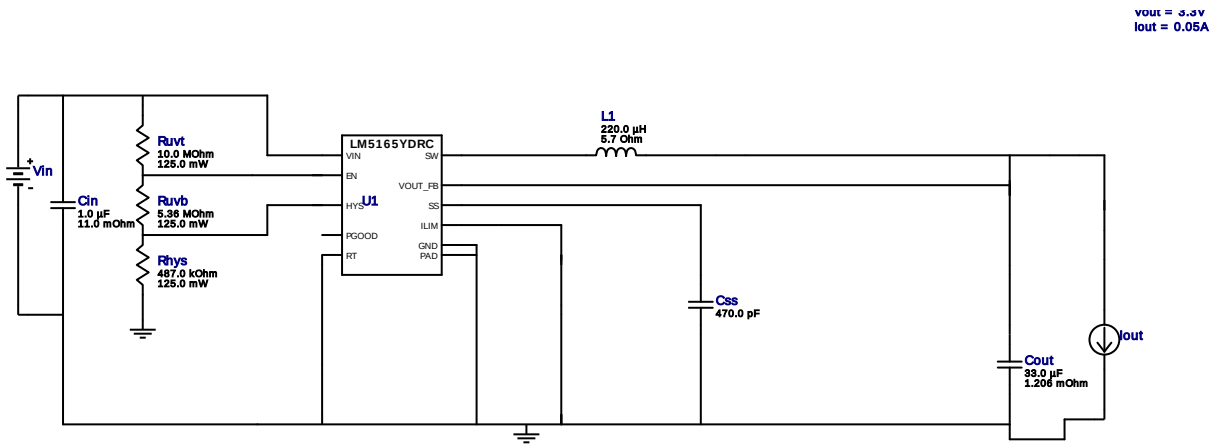
1. **TPS54335A** Product Folder : http://www.ti.com/product/TPS54335A : contains the data sheet and other resources.

Vout = 3.3V
Iout = 0.05A

Device = LM5165YDRCR
Topology = Buck
Created = 4/13/16 5:54:28 AM
BOM Cost = $1.03
BOM Count = 8
Total Pd = 0.02W

WEBENCH® Design Report

Design : 3473821/869 LM5165YDRCR
LM5165YDRCR 10.8V-13.2V to 3.30V @ 0.05A



1. This regulator device is qualified for Automotive applications. All passives and other components selected in this design may not be qualified for Automotive applications. The user is required to verify that all components in the design meet the qualification and safety requirements for their specific application.View WEBENCH(R) Disclaimer.

Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cin	Kemet	C1206C105K3RACTU Series= X7R	Cap= 1.0 uF ESR= 11.0 mOhm VDC= 25.0 V IRMS= 3.55 A	1	$0.04	1206 11 mm²
2.	Cout	TDK	C3216X5R0J336M Series= X5R	Cap= 33.0 uF ESR= 1.206 mOhm VDC= 6.3 V IRMS= 0.0 A	1	$0.27	1206 11 mm²
3.	Css	MuRata	GRM033R71E471KA01D Series= X7R	Cap= 470.0 pF VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0201 2 mm²
4.	L1	Bourns	SDR0302-221KL	L= 220.0 µH DCR= 5.7 Ohm	1	$0.18	SDR0302 15 mm²
5.	Rhys	Panasonic	ERJ-6ENF4873V Series= ERJ-6E	Res= 487.0 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm²
6.	Ruvb	Vishay-Dale	CRCW08055M36FKEA Series= CRCW..e3	Res= 5.36 MOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm²
7.	Ruvt	Vishay-Dale	CRCW080510M0FKEA Series= CRCW..e3	Res= 10.0 MOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm²
8.	U1	Texas Instruments	LM5165YDRCR	Switcher	1	$0.50	DRC0010J 16 mm²

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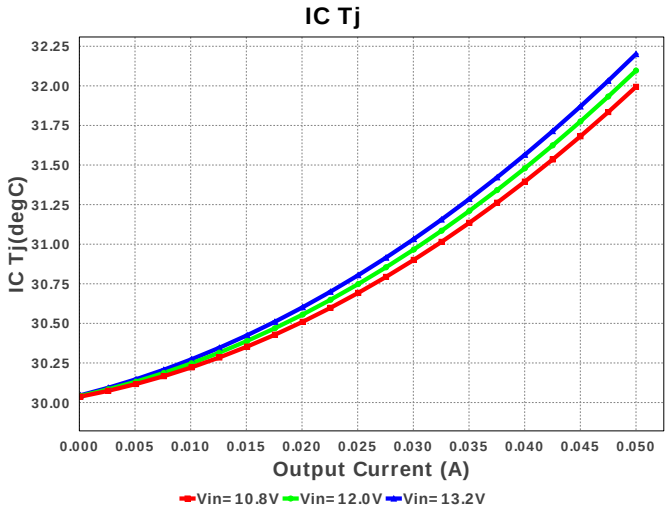
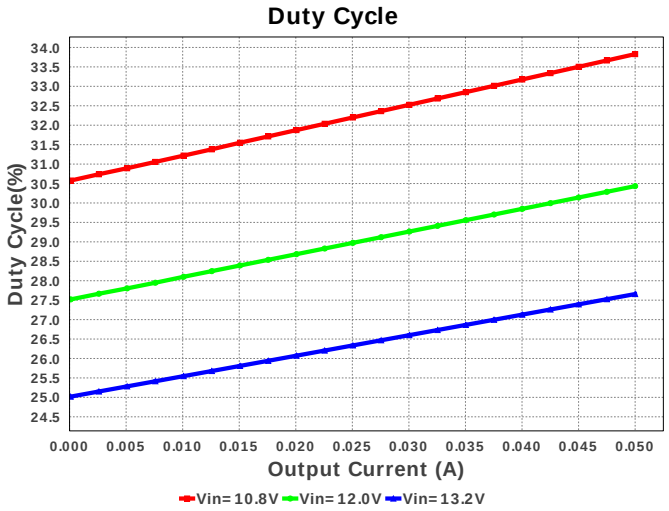
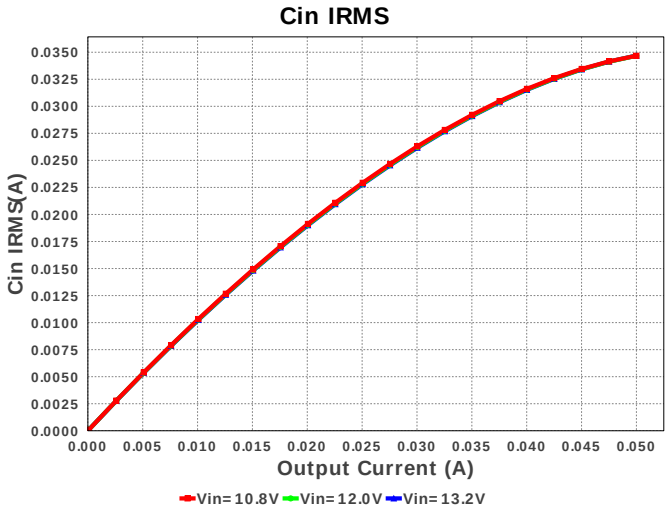
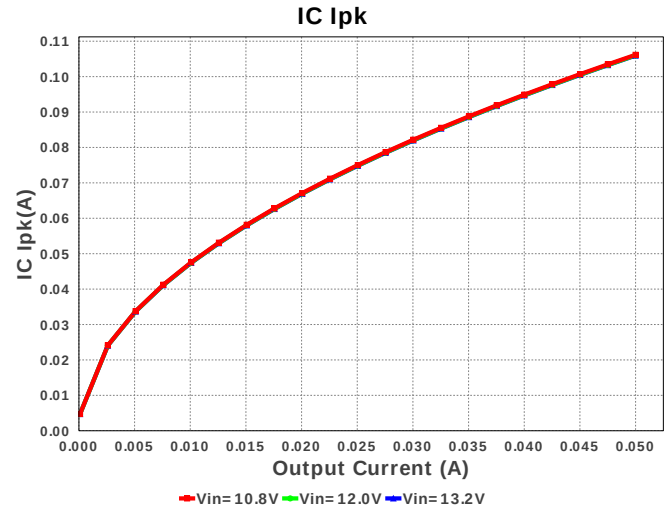
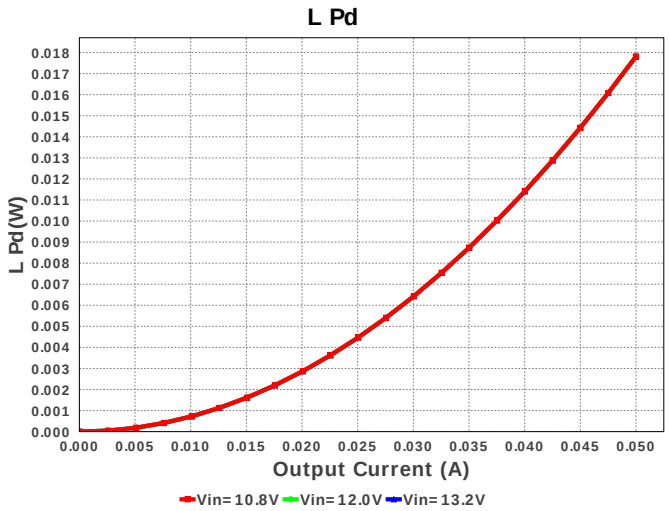
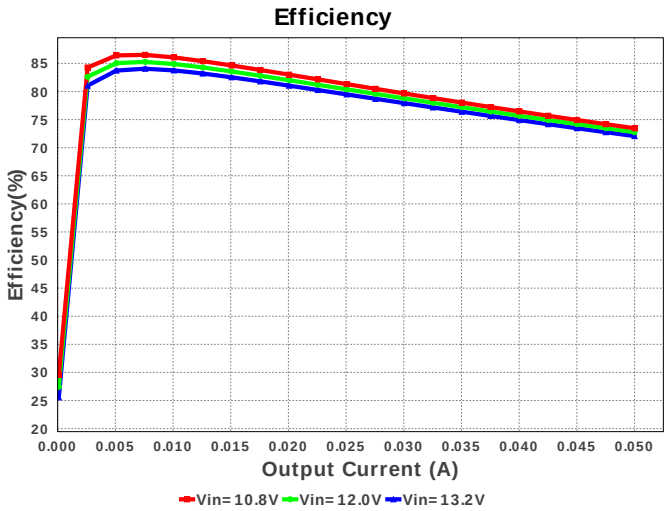

IC Tj
IC Tj(degC)
32.25
32.00
31.75
31.50
31.25
31.00
30.75
30.50
30.25
30.00
0.000 0.005 0.010 0.015 0.020 0.025 0.030 0.035 0.040 0.045 0.050
Output Current (A)
Vin=10.8V Vin=12.0V Vin=13.2V

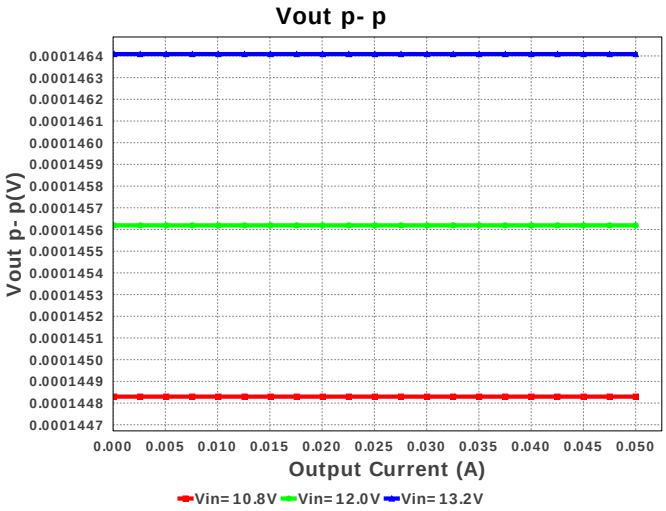

Duty Cycle
Duty Cycle(%)
34.0
33.5
33.0
32.5
32.0
31.5
31.0
30.5
30.0
29.5
29.0
28.5
28.0
27.5
27.0
26.5
26.0
25.5
25.0
24.5
0.000 0.005 0.010 0.015 0.020 0.025 0.030 0.035 0.040 0.045 0.050
Output Current (A)
Vin=10.8V Vin=12.0V Vin=13.2V

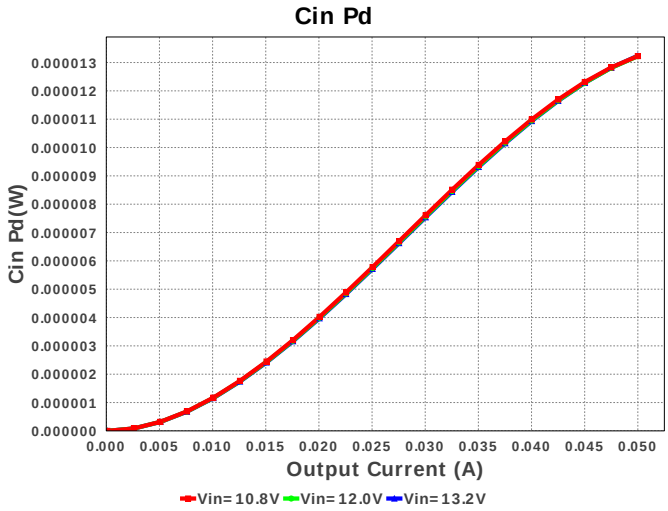

Cin IRMS
Cin IRMS(A)
0.0350
0.0325
0.0300
0.0275
0.0250
0.0225
0.0200
0.0175
0.0150
0.0125
0.0100
0.0075
0.0050
0.0025
0.0000
0.000 0.005 0.010 0.015 0.020 0.025 0.030 0.035 0.040 0.045 0.050
Output Current (A)
Vin=10.8V Vin=12.0V Vin=13.2V

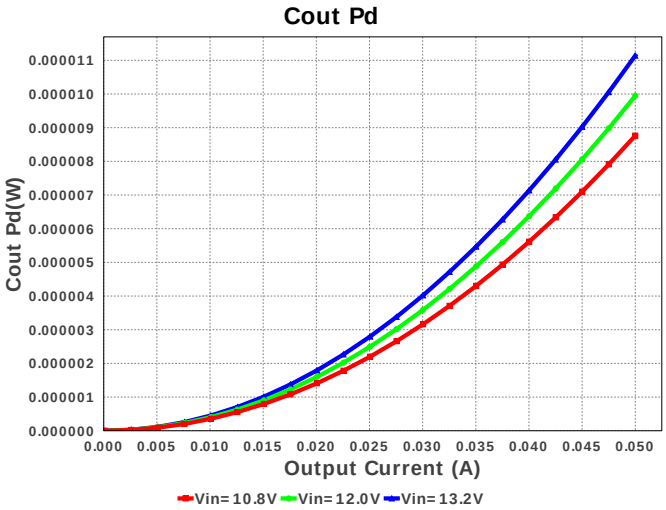

IC Ipk
IC Ipk(A)
0.11
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
0.000 0.005 0.010 0.015 0.020 0.025 0.030 0.035 0.040 0.045 0.050
Output Current (A)
Vin=10.8V Vin=12.0V Vin=13.2V

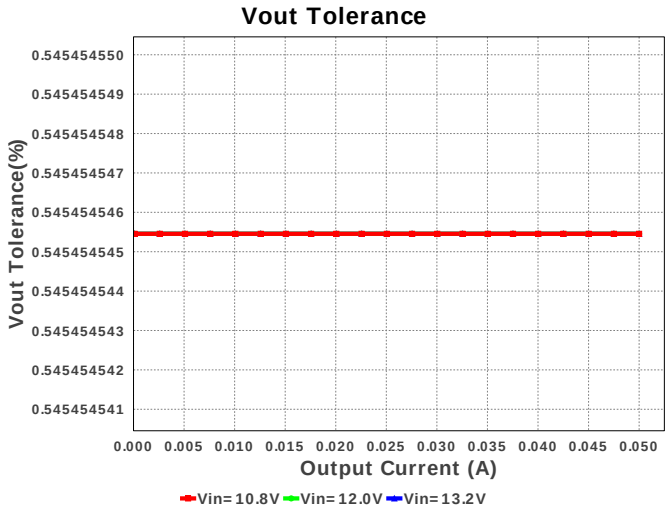

L Pd
L Pd(W)
0.018
0.017
0.016
0.015
0.014
0.013
0.012
0.011
0.010
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0.000
0.000 0.005 0.010 0.015 0.020 0.025 0.030 0.035 0.040 0.045 0.050
Output Current (A)
Vin=10.8V Vin=12.0V Vin=13.2V

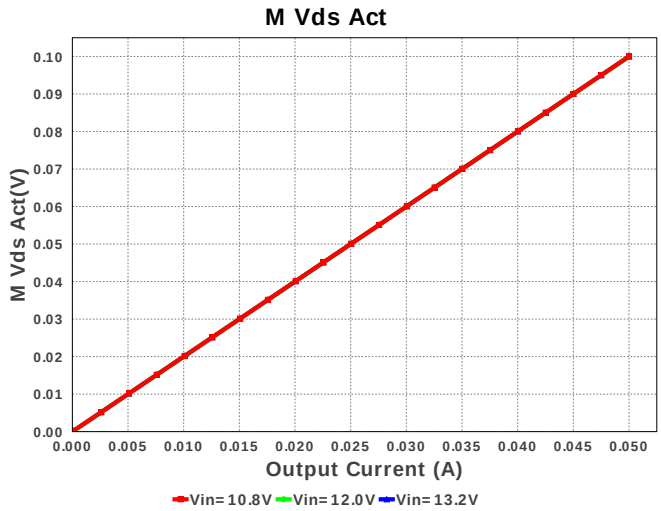

Efficiency
Efficiency(%)
85
80
75
70
65
60
55
50
45
40
35
30
25
20
0.000 0.005 0.010 0.015 0.020 0.025 0.030 0.035 0.040 0.045 0.050
Output Current (A)
Vin=10.8V Vin=12.0V Vin=13.2V

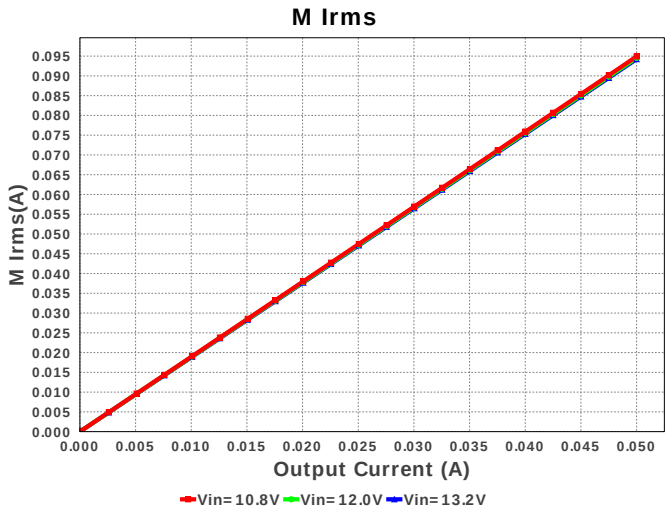

Vout p- p
Vout p- p(V)
0.0001464
0.0001463
0.0001462
0.0001461
0.0001460
0.0001459
0.0001458
0.0001457
0.0001456
0.0001455
0.0001454
0.0001453
0.0001452
0.0001451
0.0001450
0.0001449
0.0001448
0.0001447
0.000 0.005 0.010 0.015 0.020 0.025 0.030 0.035 0.040 0.045 0.050
Output Current (A)
Vin=10.8V Vin=12.0V Vin=13.2V

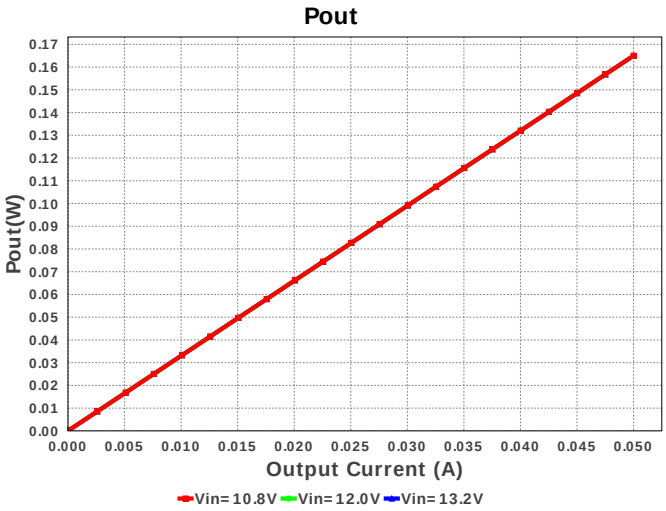

Cin Pd
Cin Pd(W)
0.000013
0.000012
0.000011
0.000010
0.000009
0.000008
0.000007
0.000006
0.000005
0.000004
0.000003
0.000002
0.000001
0.000000
0.000 0.005 0.010 0.015 0.020 0.025 0.030 0.035 0.040 0.045 0.050
Output Current (A)
Vin=10.8V Vin=12.0V Vin=13.2V

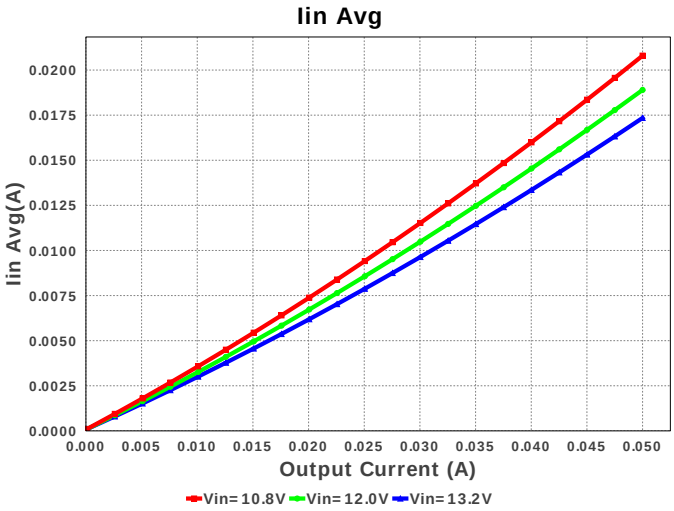

Cout Pd
Cout Pd(W)
0.000011
0.000010
0.000009
0.000008
0.000007
0.000006
0.000005
0.000004
0.000003
0.000002
0.000001
0.000000
0.000 0.005 0.010 0.015 0.020 0.025 0.030 0.035 0.040 0.045 0.050
Output Current (A)
Vin=10.8V Vin=12.0V Vin=13.2V

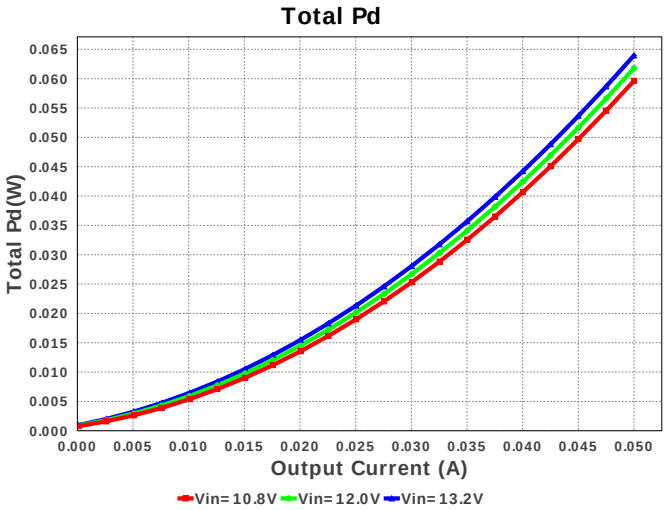

Vout Tolerance
Vout Tolerance(%)
0.545454550
0.545454549
0.545454548
0.545454547
0.545454546
0.545454545
0.545454544
0.545454543
0.545454542
0.545454541
0.000 0.005 0.010 0.015 0.020 0.025 0.030 0.035 0.040 0.045 0.050
Output Current (A)
Vin=10.8V Vin=12.0V Vin=13.2V

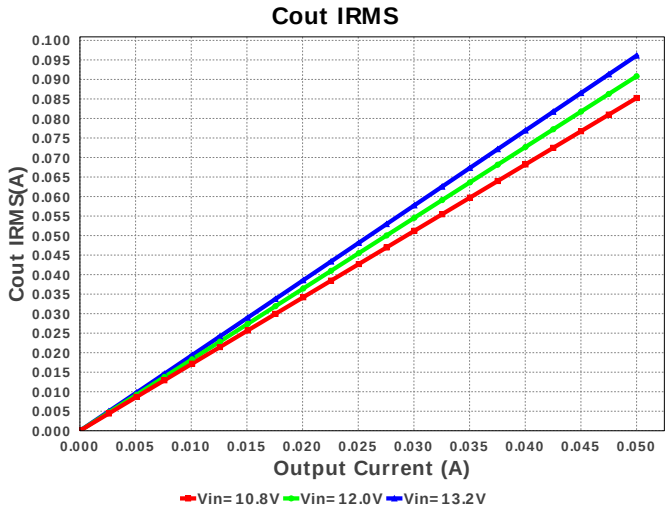

M Vds Act
M Vds Act(V)
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
0.000 0.005 0.010 0.015 0.020 0.025 0.030 0.035 0.040 0.045 0.050
Output Current (A)
Vin=10.8V Vin=12.0V Vin=13.2V

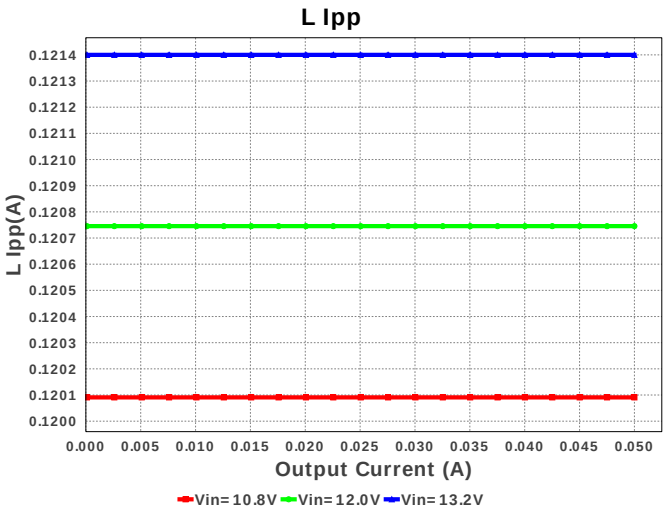

M Irms
M Irms(A)
0.095
0.090
0.085
0.080
0.075
0.070
0.065
0.060
0.055
0.050
0.045
0.040
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
0.000 0.005 0.010 0.015 0.020 0.025 0.030 0.035 0.040 0.045 0.050
Output Current (A)
Vin=10.8V Vin=12.0V Vin=13.2V

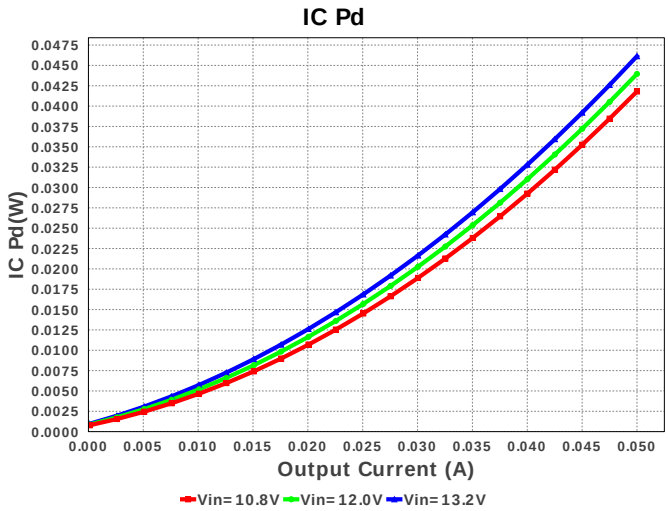

Pout
Pout(W)
Output Current (A)
Vin=10.8V Vin=12.0V Vin=13.2V

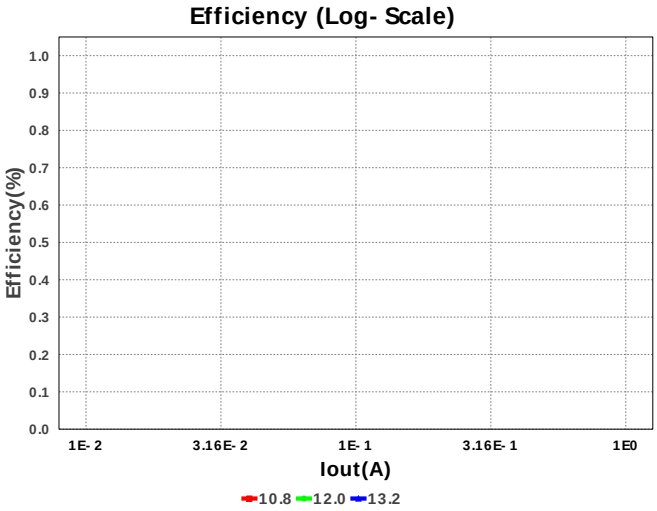

Iin Avg
Iin Avg(A)
Output Current (A)
Vin=10.8V Vin=12.0V Vin=13.2V


Total Pd
Total Pd(W)
Output Current (A)
Vin=10.8V Vin=12.0V Vin=13.2V


Cout IRMS
Cout IRMS(A)
Output Current (A)
Vin=10.8V Vin=12.0V Vin=13.2V


L Ipp
L Ipp(A)
Output Current (A)
Vin=10.8V Vin=12.0V Vin=13.2V


IC Pd
IC Pd(W)
Output Current (A)
Vin=10.8V Vin=12.0V Vin=13.2V



Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	24.642 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	28.387 mA	Current	Output capacitor RMS ripple current
3.	IC Ipk	168.27 mA	Current	Peak switch current in IC
4.	Iin Avg	14.235 mA	Current	Average input current
5.	L Ipp	236.54 mA	Current	Peak-to-peak inductor ripple current
6.	M1 Irms	35.821 mA	Current	Q Iavg
7.	BOM Count	8	General	Total Design BOM count
8.	FootPrint	75.0 mm^2	General	Total Foot Print Area of BOM components
9.	Frequency	53.463 kHz	General	Switching frequency
10.	IC Tolerance	18.0 mV	General	IC Feedback Tolerance
11.	M Vds Act	100.0 mV	General	Voltage drop across the MosFET
12.	Pout	165.0 mW	General	Total output power
13.	Total BOM	$1.03	General	Total BOM Cost
14.	Vout OP	3.3 V	Op_Point	Operational Output Voltage
15.	Duty Cycle	30.193 %	Op_point	Duty cycle
16.	Efficiency	87.809 %	Op_point	Steady state efficiency
17.	IC Tj	30.413 degC	Op_point	IC junction temperature
18.	ICThetaJA	47.7 degC/W	Op_point	IC junction-to-ambient thermal resistance
19.	IOUT_OP	50.0 mA	Op_point	Iout operating point
20.	VIN_OP	13.2 V	Op_point	Vin operating point
21.	Vout p-p	285.267 µV	Op_point	Peak-to-peak output ripple voltage
22.	Cin Pd	6.68 µW	Power	Input capacitor power dissipation
23.	Cout Pd	971.845 nW	Power	Output capacitor power dissipation
24.	IC Pd	8.65 mW	Power	IC power dissipation
25.	L Pd	14.25 mW	Power	Inductor power dissipation
26.	Total Pd	22.907 mW	Power	Total Power Dissipation
27.	Vout Tolerance	545.455 m%		Vout Tolerance based on IC Tolerance and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	50.0 m	Maximum Output Current
2.	SoftStart	0.05 ms	Soft Start Time (ms)
3.	VinMax	13.2	Maximum input voltage
4.	VinMin	10.8	Minimum input voltage
5.	Vout	3.3	Output Voltage
6.	base_pn	LM5165Y	Base Product Number
7.	source	DC	Input Source Type
8.	Ta	30.0	Ambient temperature

Design Assistance

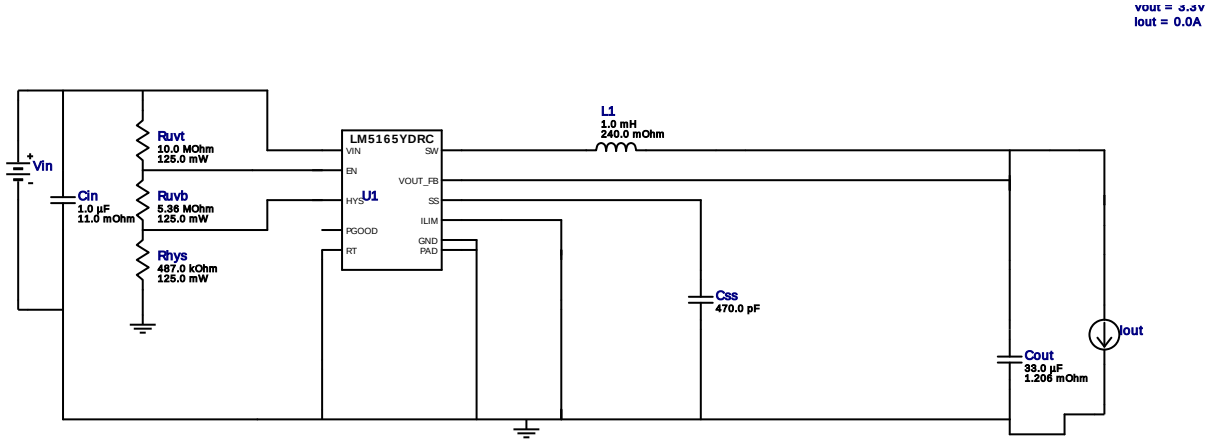
1. **LM5165Y** Product Folder : http://www.ti.com/product/LM5165Y : contains the data sheet and other resources.

WEBENCH ® Design Report

Vout = 3.3V
Iout = 0.0A

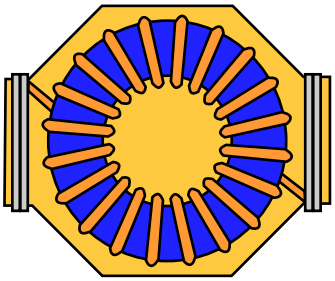
Device = LM5165YDRCR
Topology = Buck
Created = 4/13/16 5:54:29 AM
BOM Cost = $2.06
BOM Count = 8
Total Pd = 0.0W

Design : 3473821/870 LM5165YDRCR
LM5165YDRCR 10.8V-13.2V to 3.30V @ 0.002A



1. This regulator device is qualified for Automotive applications. All passives and other components selected in this design may not be qualified for Automotive applications. The user is required to verify that all components in the design meet the qualification and safety requirements for their specific application.View WEBENCH(R) Disclaimer.

Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cin	Kemet	C1206C105K3RACTU Series= X7R	Cap= 1.0 uF ESR= 11.0 mOhm VDC= 25.0 V IRMS= 3.55 A	1	$0.04	1206 11 mm²
2.	Cout	TDK	C3216X5R0J336M Series= X5R	Cap= 33.0 uF ESR= 1.206 mOhm VDC= 6.3 V IRMS= 0.0 A	1	$0.27	1206 11 mm²
3.	Css	MuRata	GRM033R71E471KA01D Series= X7R	Cap= 470.0 pF VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0201 2 mm²
4.	L1	Bourns	PM2110-102K-RC	L= 1.0 mH DCR= 240.0 mOhm	1	$1.21	 PM2110 890 mm²
5.	Rhys	Panasonic	ERJ-6ENF4873V Series= ERJ-6E	Res= 487.0 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm²
6.	Ruvb	Vishay-Dale	CRCW08055M36FKEA Series= CRCW..e3	Res= 5.36 MOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm²
7.	Ruvt	Vishay-Dale	CRCW080510M0FKEA Series= CRCW..e3	Res= 10.0 MOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm²

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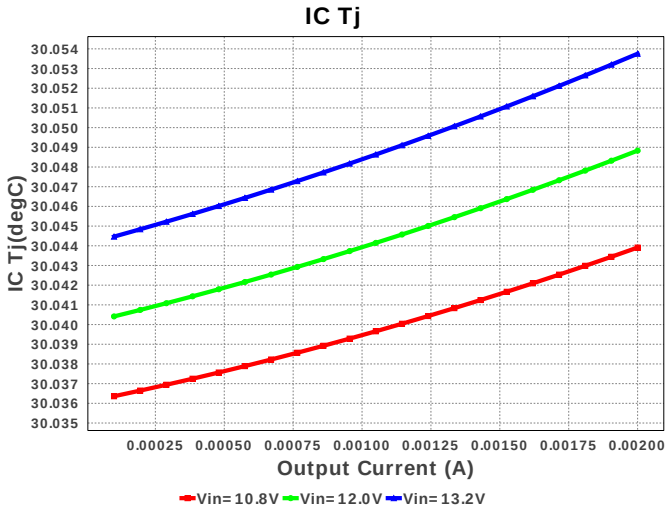
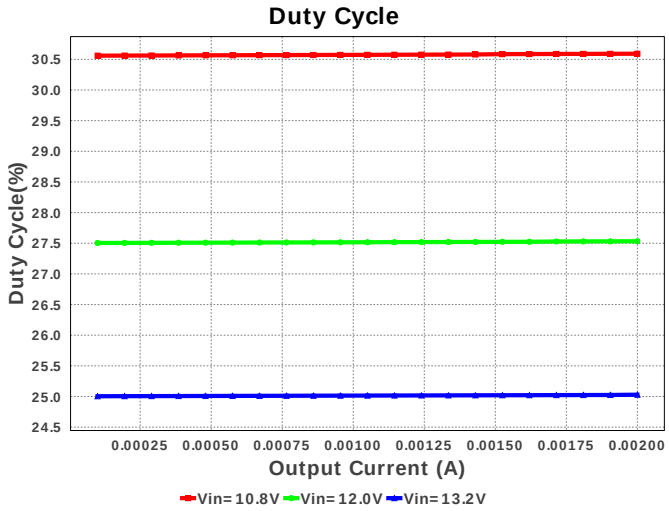
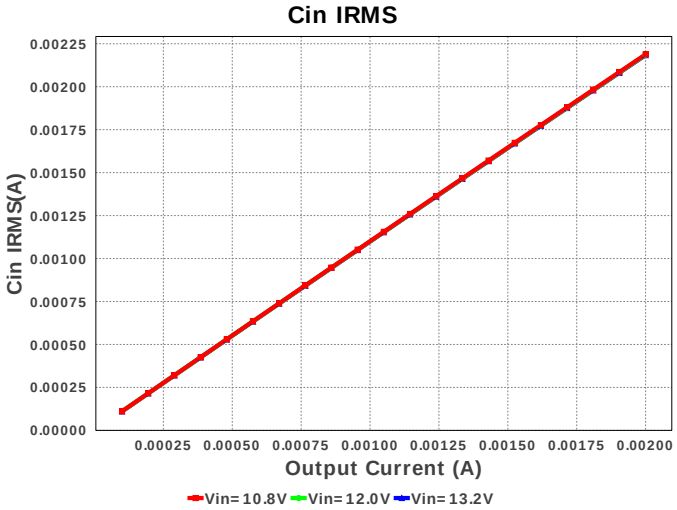
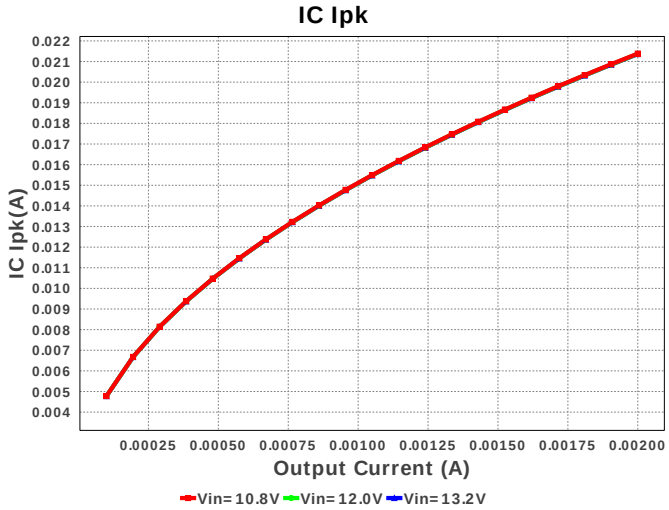
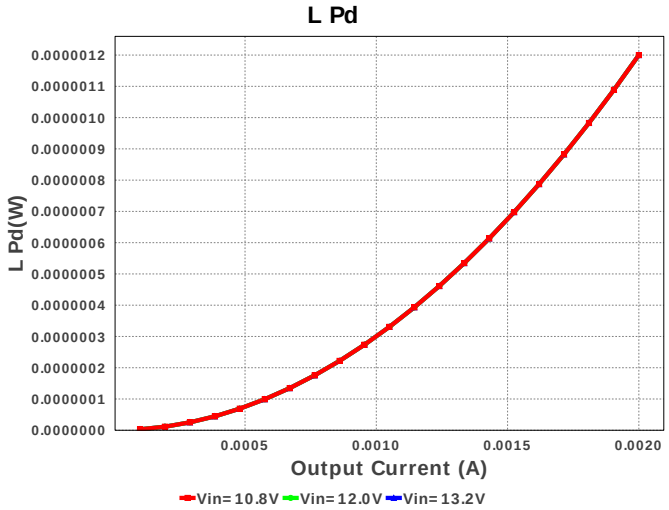
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
8.	U1	Texas Instruments	LM5165YDRCR	Switcher	1	$0.50	DRC0010J 16 mm²

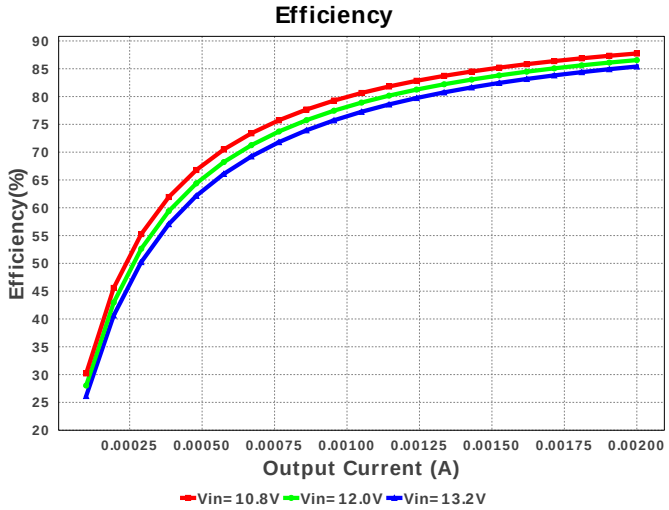












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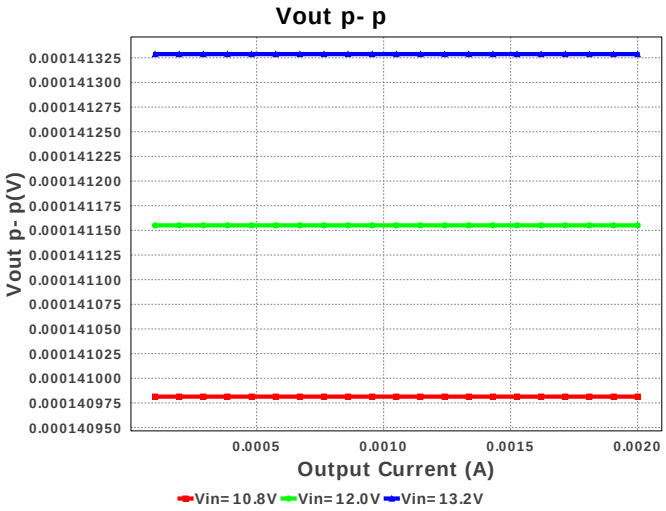
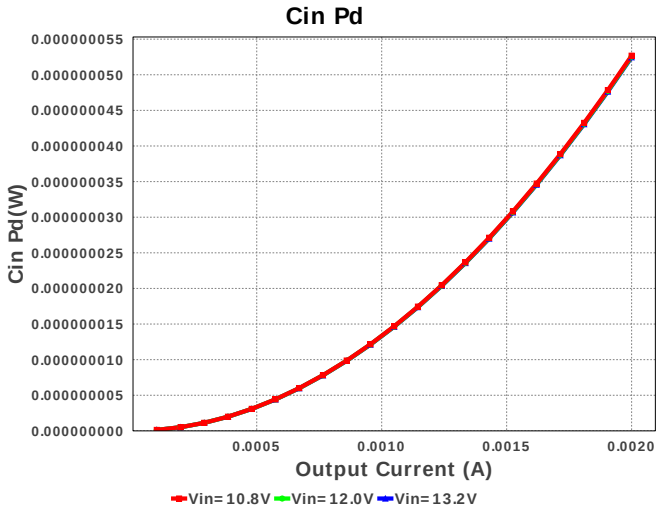
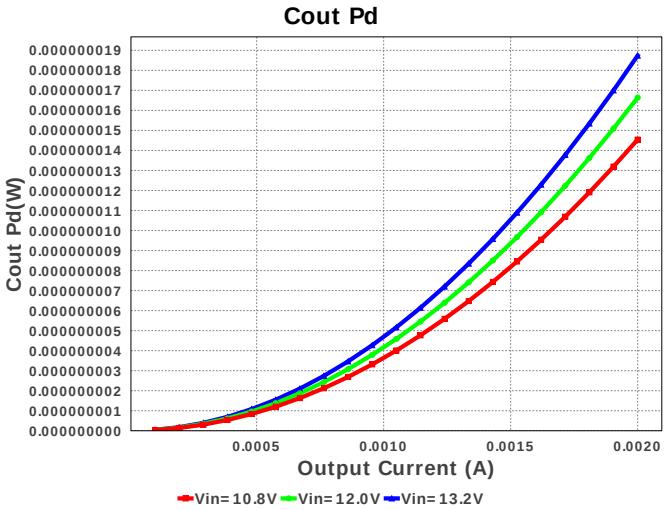
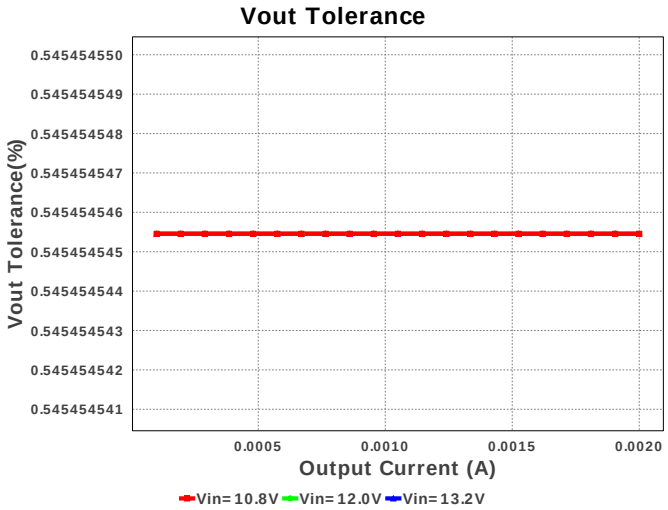
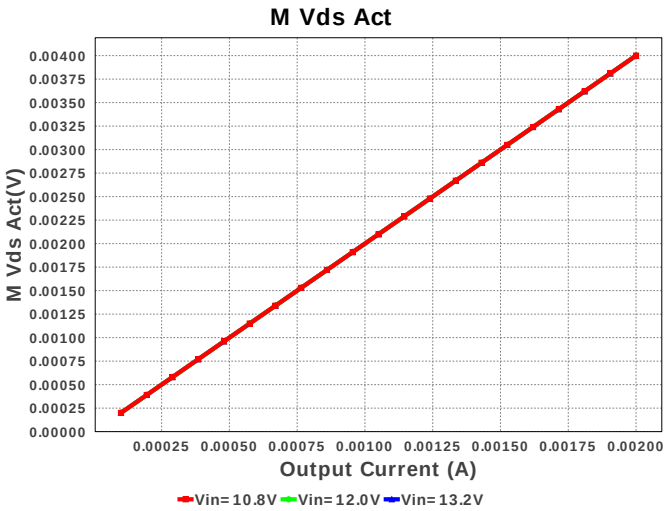
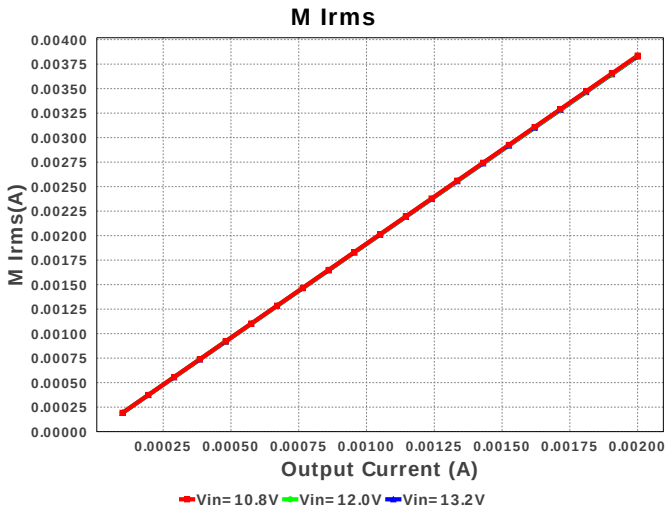

Vout p- p
Vout p- p(V)
0.000141325
0.000141300
0.000141275
0.000141250
0.000141225
0.000141200
0.000141175
0.000141150
0.000141125
0.000141100
0.000141075
0.000141050
0.000141025
0.000141000
0.000140975
0.000140950
0.0005
0.0010
0.0015
0.0020
Output Current (A)
Vin=10.8V Vin=12.0V Vin=13.2V

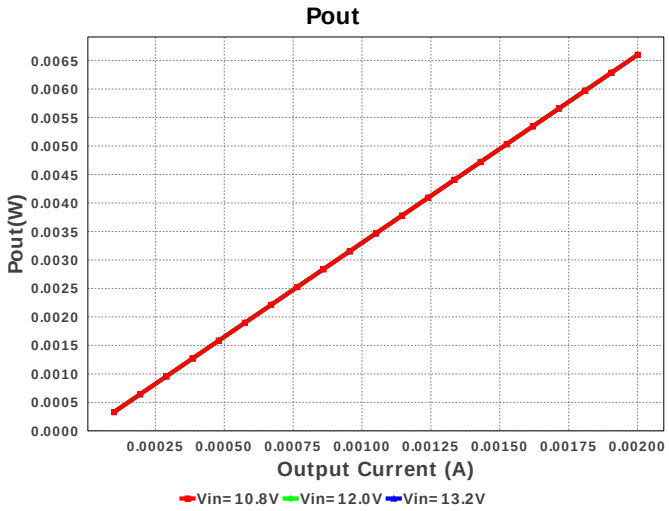

Cin Pd
Cin Pd(W)
0.000000055
0.000000050
0.000000045
0.000000040
0.000000035
0.000000030
0.000000025
0.000000020
0.000000015
0.000000010
0.000000005
0.000000000
0.0005
0.0010
0.0015
0.0020
Output Current (A)
Vin=10.8V Vin=12.0V Vin=13.2V

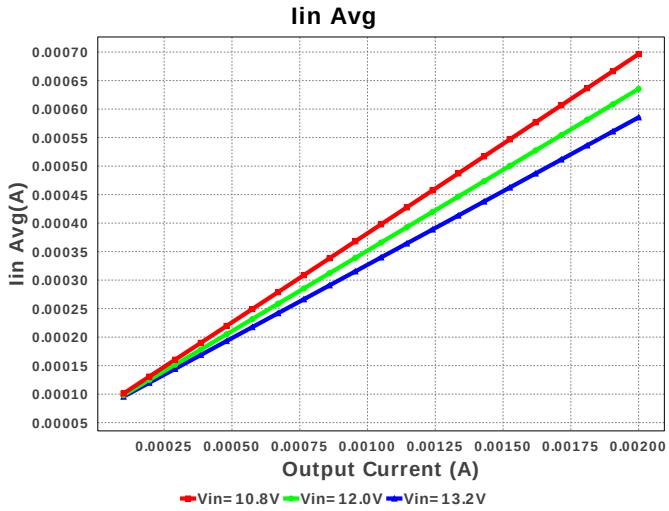

Cout Pd
Cout Pd(W)
0.000000019
0.000000018
0.000000017
0.000000016
0.000000015
0.000000014
0.000000013
0.000000012
0.000000011
0.000000010
0.000000009
0.000000008
0.000000007
0.000000006
0.000000005
0.000000004
0.000000003
0.000000002
0.000000001
0.000000000
0.0005
0.0010
0.0015
0.0020
Output Current (A)
Vin=10.8V Vin=12.0V Vin=13.2V

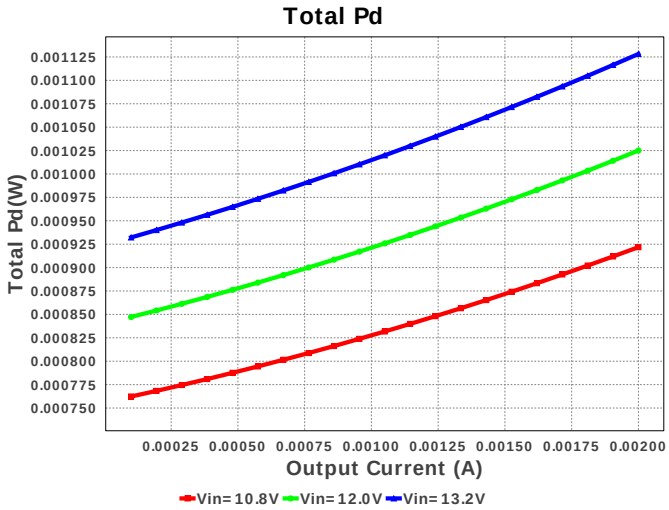

Vout Tolerance
Vout Tolerance(%)
0.545454550
0.545454549
0.545454548
0.545454547
0.545454546
0.545454545
0.545454544
0.545454543
0.545454542
0.545454541
0.0005
0.0010
0.0015
0.0020
Output Current (A)
Vin=10.8V Vin=12.0V Vin=13.2V

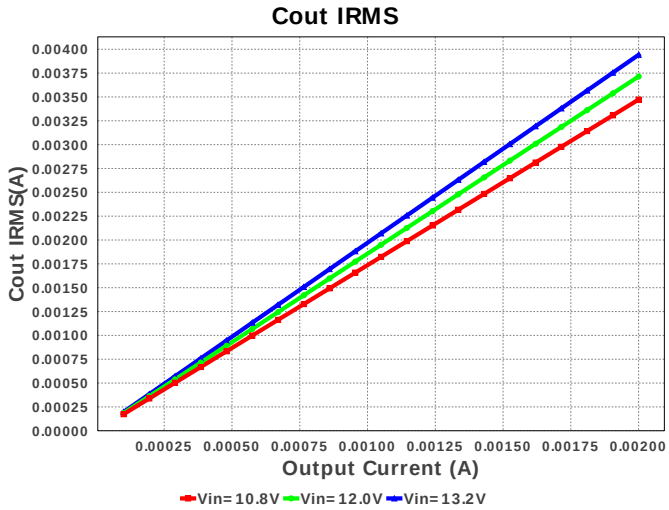

M Vds Act
M Vds Act(V)
0.00400
0.00375
0.00350
0.00325
0.00300
0.00275
0.00250
0.00225
0.00200
0.00175
0.00150
0.00125
0.00100
0.00075
0.00050
0.00025
0.00000
0.00025 0.00050 0.00075 0.00100 0.00125 0.00150 0.00175 0.00200
Output Current (A)
Vin=10.8V Vin=12.0V Vin=13.2V

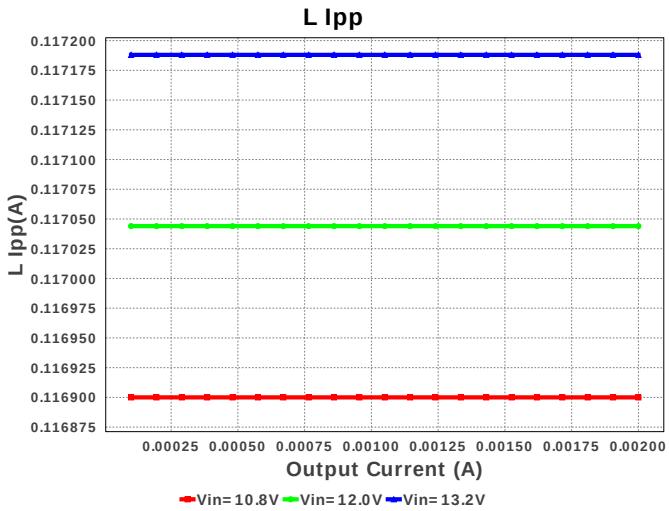

M Irms
M Irms(A)
0.00400
0.00375
0.00350
0.00325
0.00300
0.00275
0.00250
0.00225
0.00200
0.00175
0.00150
0.00125
0.00100
0.00075
0.00050
0.00025
0.00000
0.00025 0.00050 0.00075 0.00100 0.00125 0.00150 0.00175 0.00200
Output Current (A)
Vin=10.8V Vin=12.0V Vin=13.2V

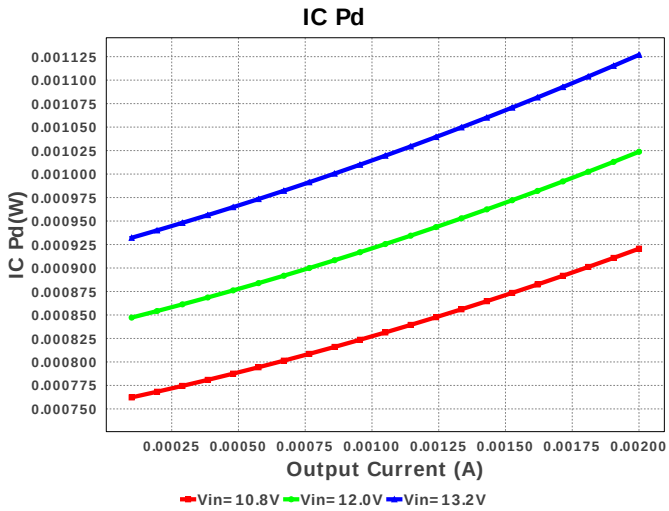

Pout
Pout(W)
0.0065
0.0060
0.0055
0.0050
0.0045
0.0040
0.0035
0.0030
0.0025
0.0020
0.0015
0.0010
0.0005
0.0000
0.00025 0.00050 0.00075 0.00100 0.00125 0.00150 0.00175 0.00200
Output Current (A)
Vin=10.8V Vin=12.0V Vin=13.2V

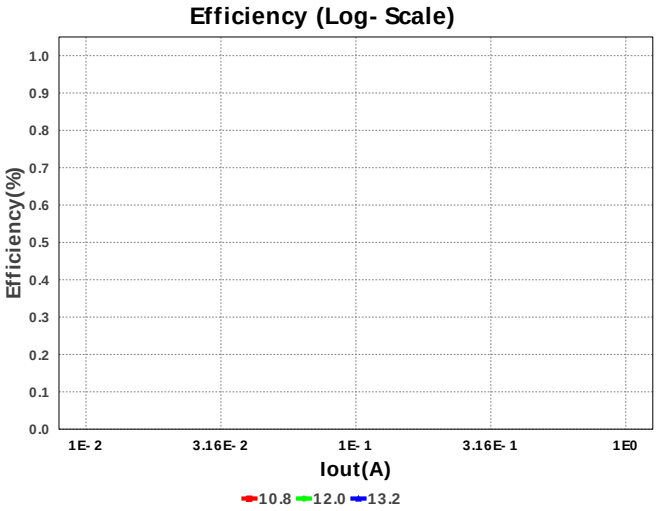

Iin Avg
Iin Avg(A)
0.00070
0.00065
0.00060
0.00055
0.00050
0.00045
0.00040
0.00035
0.00030
0.00025
0.00020
0.00015
0.00010
0.00005
0.00025 0.00050 0.00075 0.00100 0.00125 0.00150 0.00175 0.00200
Output Current (A)
Vin=10.8V Vin=12.0V Vin=13.2V


Total Pd
Total Pd(W)
0.001125
0.001100
0.001075
0.001050
0.001025
0.001000
0.000975
0.000950
0.000925
0.000900
0.000875
0.000850
0.000825
0.000800
0.000775
0.000750
0.00025 0.00050 0.00075 0.00100 0.00125 0.00150 0.00175 0.00200
Output Current (A)
Vin=10.8V Vin=12.0V Vin=13.2V


Cout IRMS
Cout IRMS(A)
0.00400
0.00375
0.00350
0.00325
0.00300
0.00275
0.00250
0.00225
0.00200
0.00175
0.00150
0.00125
0.00100
0.00075
0.00050
0.00025
0.00000
0.00025 0.00050 0.00075 0.00100 0.00125 0.00150 0.00175 0.00200
Output Current (A)
Vin=10.8V Vin=12.0V Vin=13.2V


L Ipp
L Ipp(A)
0.117200
0.117175
0.117150
0.117125
0.117100
0.117075
0.117050
0.117025
0.117000
0.116975
0.116950
0.116925
0.116900
0.116875
0.00025 0.00050 0.00075 0.00100 0.00125 0.00150 0.00175 0.00200
Output Current (A)
Vin=10.8V Vin=12.0V Vin=13.2V


IC Pd
IC Pd(W)
0.001125
0.001100
0.001075
0.001050
0.001025
0.001000
0.000975
0.000950
0.000925
0.000900
0.000875
0.000850
0.000825
0.000800
0.000775
0.000750
0.00025 0.00050 0.00075 0.00100 0.00125 0.00150 0.00175 0.00200
Output Current (A)
Vin=10.8V Vin=12.0V Vin=13.2V



Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	255.61 µA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	1.132 mA	Current	Output capacitor RMS ripple current
3.	IC Ipk	120.059 mA	Current	Peak switch current in IC
4.	Iin Avg	516.23 µA	Current	Average input current
5.	L Ipp	236.12 mA	Current	Peak-to-peak inductor ripple current
6.	M1 Irms	266.155 µA	Current	Q Iavg
7.	BOM Count	8	General	Total Design BOM count
8.	FootPrint	951.0 mm^2	General	Total Foot Print Area of BOM components
9.	Frequency	10.543 kHz	General	Switching frequency
10.	IC Tolerance	18.0 mV	General	IC Feedback Tolerance
11.	M Vds Act	4.0 mV	General	Voltage drop across the MosFET
12.	Pout	6.6 mW	General	Total output power
13.	Total BOM	$2.06	General	Total BOM Cost
14.	Vout OP	3.3 V	Op_Point	Operational Output Voltage
15.	Duty Cycle	25.219 %	Op_point	Duty cycle
16.	Efficiency	96.855 %	Op_point	Steady state efficiency
17.	IC Tj	30.01 degC	Op_point	IC junction temperature
18.	ICThetaJA	47.7 degC/W	Op_point	IC junction-to-ambient thermal resistance
19.	IOUT_OP	2.0 mA	Op_point	Iout operating point
20.	VIN_OP	13.2 V	Op_point	Vin operating point
21.	Vout p-p	284.759 µV	Op_point	Peak-to-peak output ripple voltage
22.	Cin Pd	718.701 pW	Power	Input capacitor power dissipation
23.	Cout Pd	1.546 nW	Power	Output capacitor power dissipation
24.	IC Pd	213.316 µW	Power	IC power dissipation
25.	L Pd	960.0 nW	Power	Inductor power dissipation
26.	Total Pd	214.308 µW	Power	Total Power Dissipation
27.	Vout Tolerance	545.455 m%		Vout Tolerance based on IC Tolerance and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	2.0 m	Maximum Output Current
2.	SoftStart	0.05 ms	Soft Start Time (ms)
3.	VinMax	13.2	Maximum input voltage
4.	VinMin	10.8	Minimum input voltage
5.	Vout	3.3	Output Voltage
6.	base_pn	LM5165Y	Base Product Number
7.	source	DC	Input Source Type
8.	Ta	30.0	Ambient temperature

Design Assistance

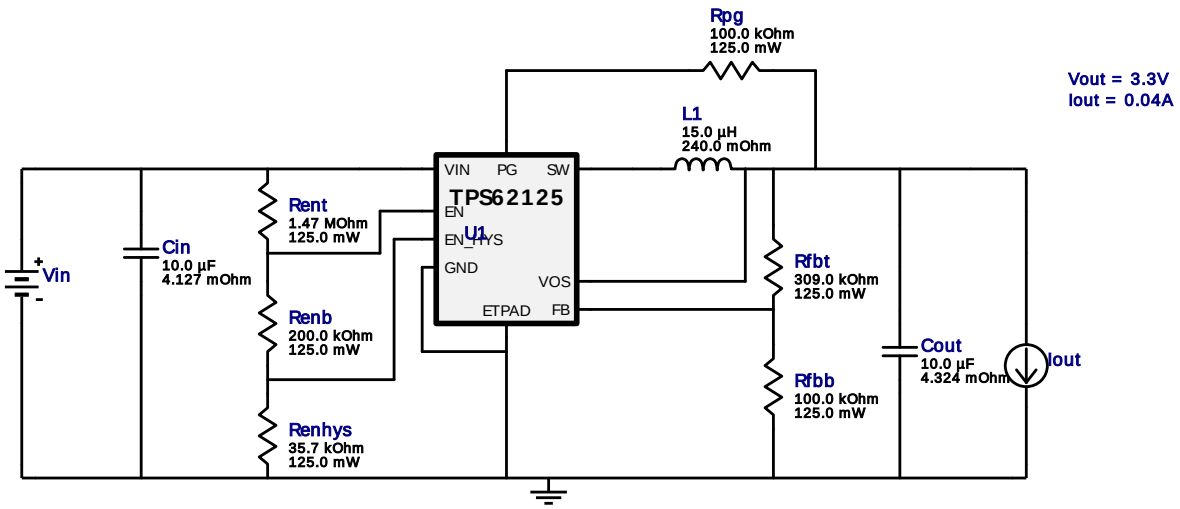
1. **LM5165Y** Product Folder : http://www.ti.com/product/LM5165Y : contains the data sheet and other resources.

WEBENCH ® Design Report

Vout = 3.3V
Iout = 0.04A

Device = TPS62125DSGR
Topology = Buck
Created = 4/13/16 5:54:29 AM
BOM Cost = $0.85
BOM Count = 10
Total Pd = 0.02W

Design : 3473821/871 TPS62125DSGR
TPS62125DSGR 10.8V-13.2V to 3.30V @ 0.04A



Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cin	MuRata	GRM21BR61C106KE15L Series= X5R	Cap= 10.0 uF ESR= 4.127 mOhm VDC= 16.0 V IRMS= 2.46634 A	1	$0.04	0805 7 mm²
2.	Cout	MuRata	GRM219R60J106KE19D Series= X5R	Cap= 10.0 uF ESR= 4.324 mOhm VDC= 6.3 V IRMS= 2.8728 A	1	$0.02	0805 7 mm²
3.	L1	Bourns	SDR0403-150ML	L= 15.0 µH DCR= 240.0 mOhm	1	$0.18	SDR0403 28 mm²
4.	Renb	Panasonic	ERJ-6ENF2003V Series= ERJ-6E	Res= 200.0 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm²
5.	Renhys	Panasonic	ERJ-6ENF3572V Series= ERJ-6E	Res= 35.7 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm²
6.	Rent	Vishay-Dale	CRCW08051M47FKEA Series= CRCW..e3	Res= 1.47 MOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm²
7.	Rfbb	Panasonic	ERJ-6ENF1003V Series= ERJ-6E	Res= 100.0 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm²
8.	Rfbt	Panasonic	ERJ-6ENF3093V Series= ERJ-6E	Res= 309.0 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm²
9.	Rpg	Panasonic	ERJ-6ENF1003V Series= ERJ-6E	Res= 100.0 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm²

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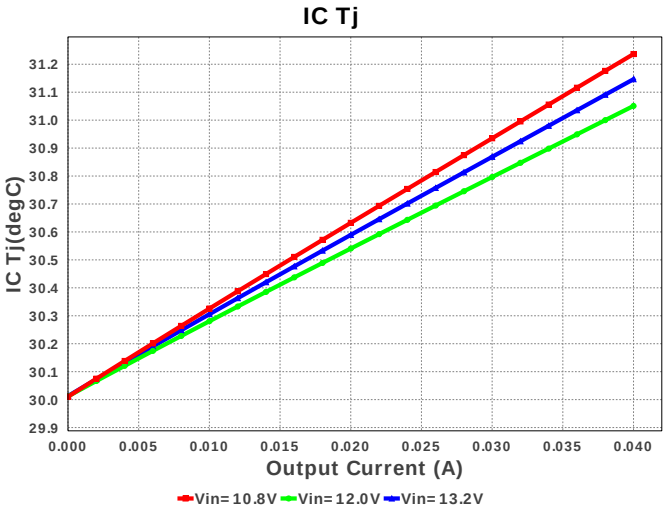
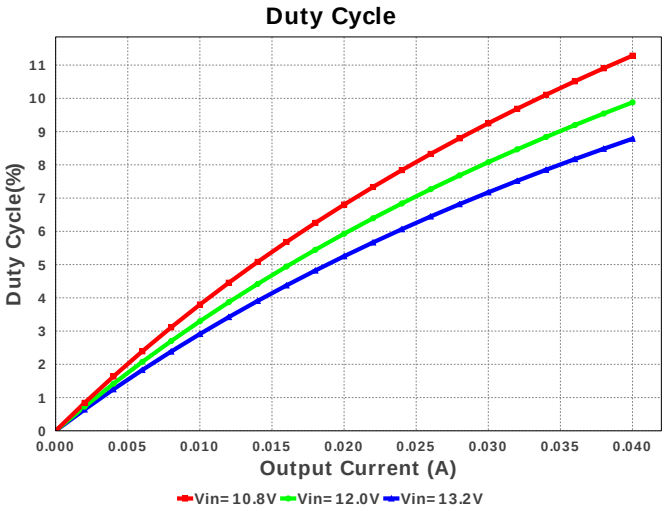
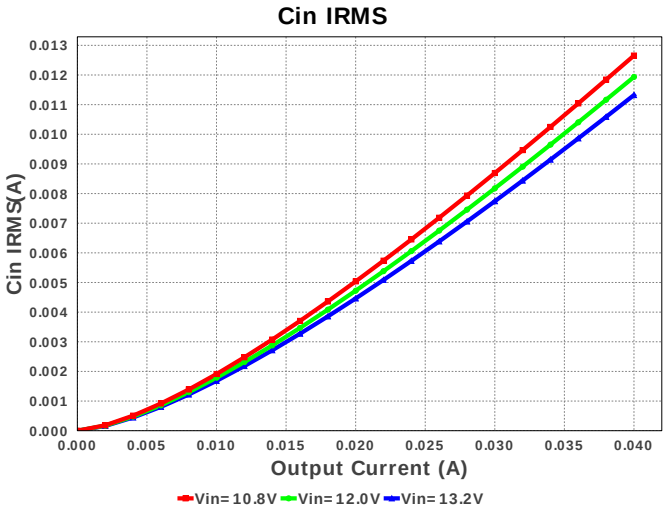
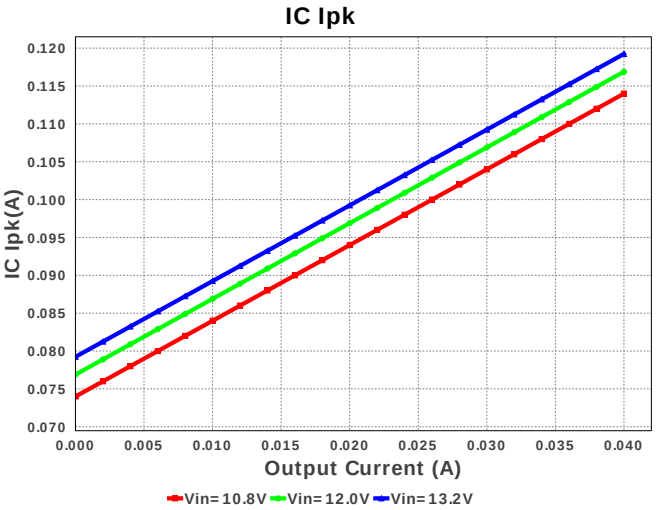
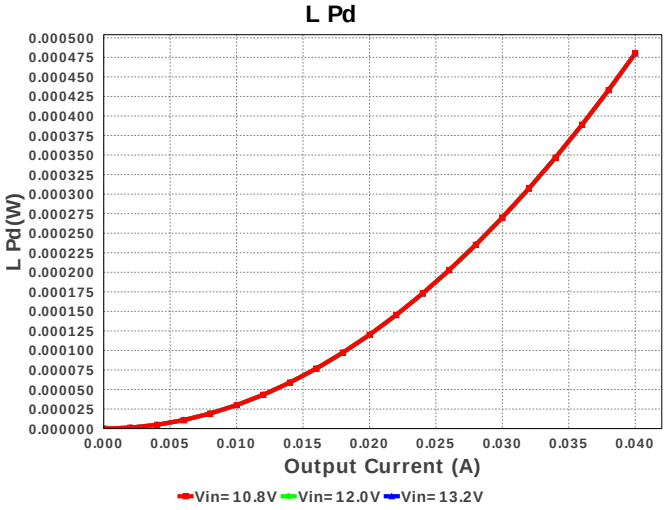
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	U1	Texas Instruments	TPS62125DSGR	Switcher	1	$0.55	S-PWSON-N8 10 mm²

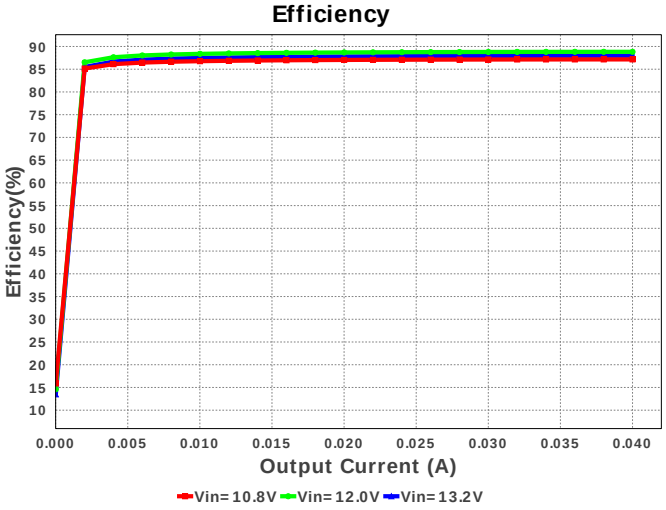












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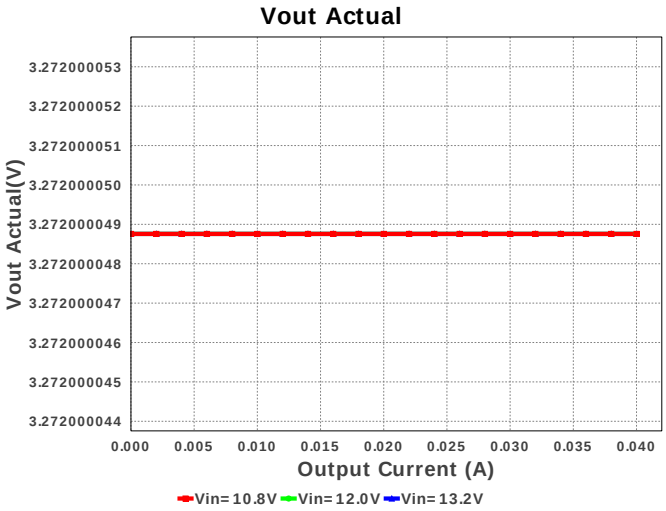
Vout Actual
Vout Actual(V)
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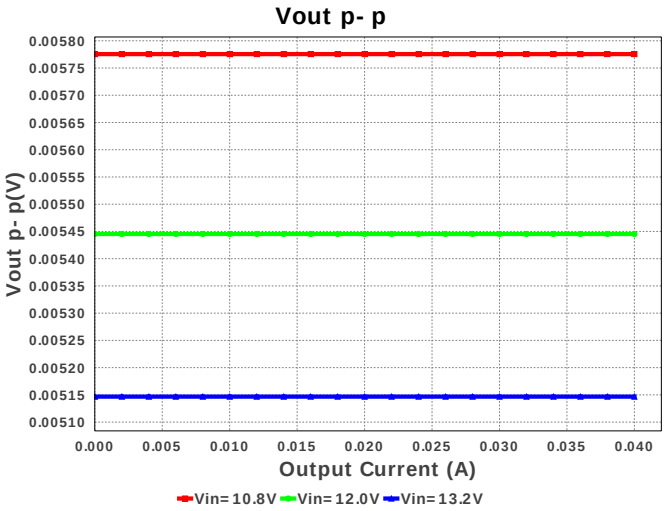
3.272000052
3.272000051
3.272000050
3.272000049
3.272000048
3.272000047
3.272000046
3.272000045
3.272000044
0.000 0.005 0.010 0.015 0.020 0.025 0.030 0.035 0.040
Output Current (A)
Vin=10.8V Vin=12.0V Vin=13.2V


Vout p-p
Vout p-p(V)
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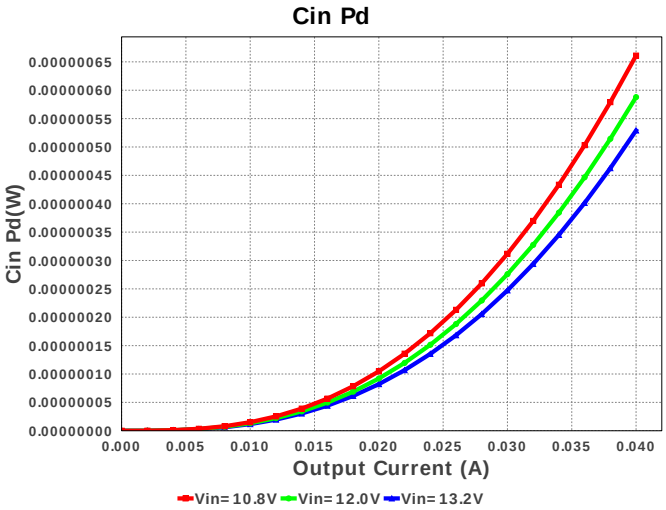
0.00575
0.00570
0.00565
0.00560
0.00555
0.00550
0.00545
0.00540
0.00535
0.00530
0.00525
0.00520
0.00515
0.00510
0.000 0.005 0.010 0.015 0.020 0.025 0.030 0.035 0.040
Output Current (A)
Vin=10.8V Vin=12.0V Vin=13.2V


Cin Pd
Cin Pd(W)
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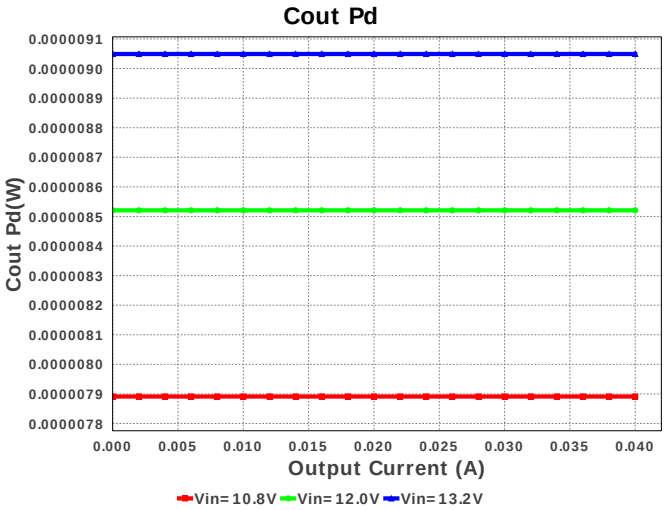
0.00000060
0.00000055
0.00000050
0.00000045
0.00000040
0.00000035
0.00000030
0.00000025
0.00000020
0.00000015
0.00000010
0.00000005
0.00000000
0.000 0.005 0.010 0.015 0.020 0.025 0.030 0.035 0.040
Output Current (A)
Vin=10.8V Vin=12.0V Vin=13.2V


Cout Pd
Cout Pd(W)
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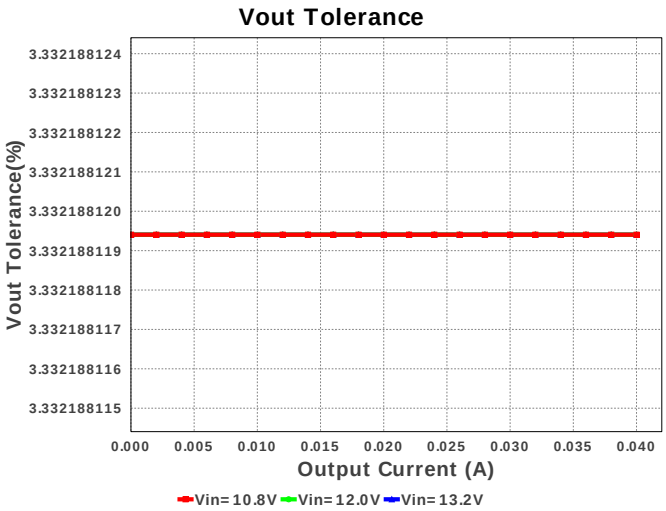
0.0000090
0.0000089
0.0000088
0.0000087
0.0000086
0.0000085
0.0000084
0.0000083
0.0000082
0.0000081
0.0000080
0.0000079
0.0000078
0.000 0.005 0.010 0.015 0.020 0.025 0.030 0.035 0.040
Output Current (A)
Vin=10.8V Vin=12.0V Vin=13.2V


Vout Tolerance
Vout Tolerance(%)
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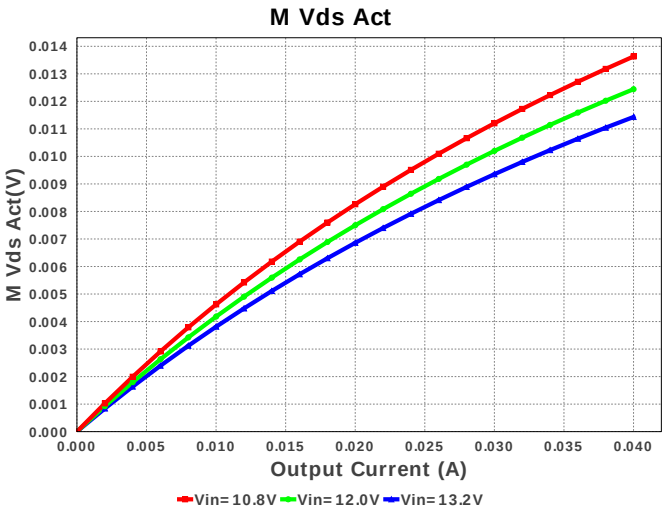
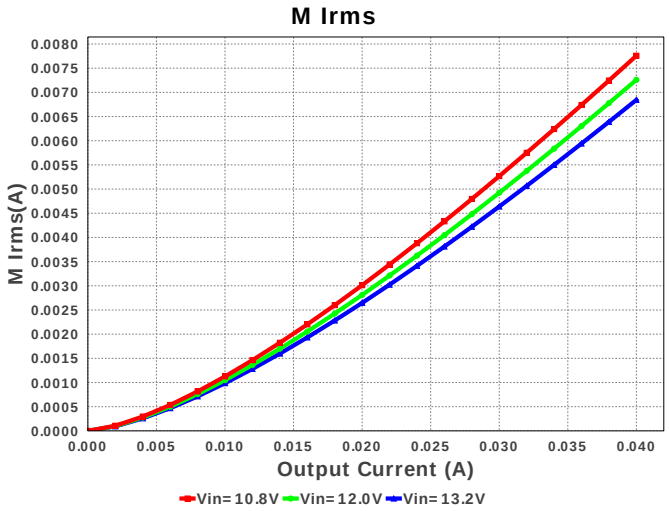
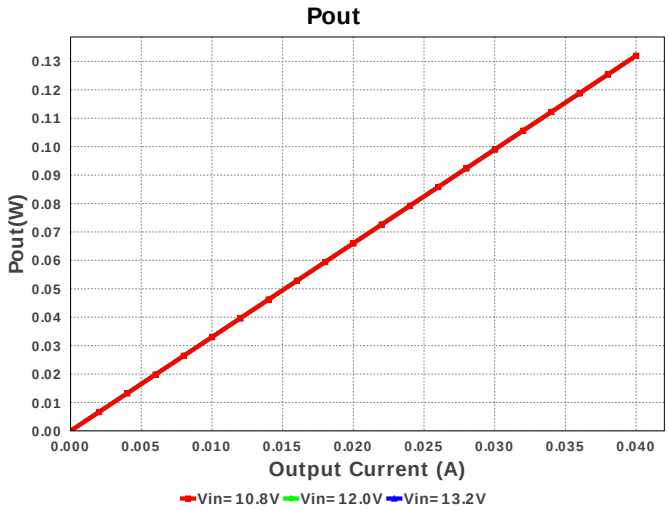
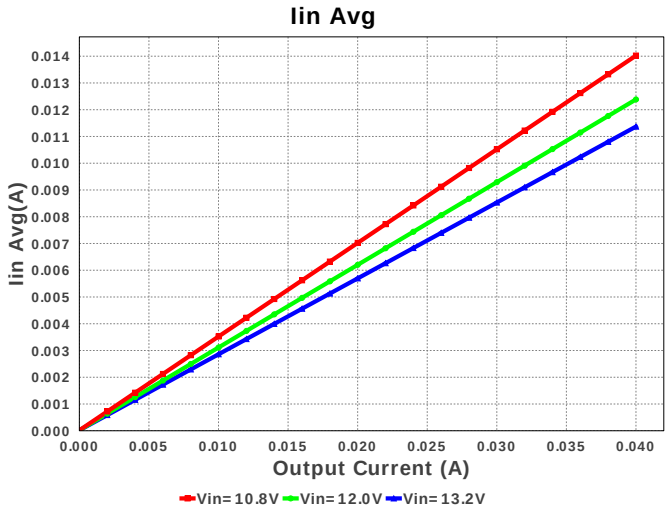
3.332188123
3.332188122
3.332188121
3.332188120
3.332188119
3.332188118
3.332188117
3.332188116
3.332188115
0.000 0.005 0.010 0.015 0.020 0.025 0.030 0.035 0.040
Output Current (A)
Vin=10.8V Vin=12.0V Vin=13.2V


M Vds Act
M Vds Act(V)
0.014
0.013
0.012
0.011
0.010
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0.000
0.000 0.005 0.010 0.015 0.020 0.025 0.030 0.035 0.040
Output Current (A)
Vin=10.8V Vin=12.0V Vin=13.2V


M Irms
M Irms(A)
Output Current (A)
Vin=10.8V Vin=12.0V Vin=13.2V


Pout
Pout(W)
Output Current (A)
Vin=10.8V Vin=12.0V Vin=13.2V


Iin Avg
Iin Avg(A)
Output Current (A)
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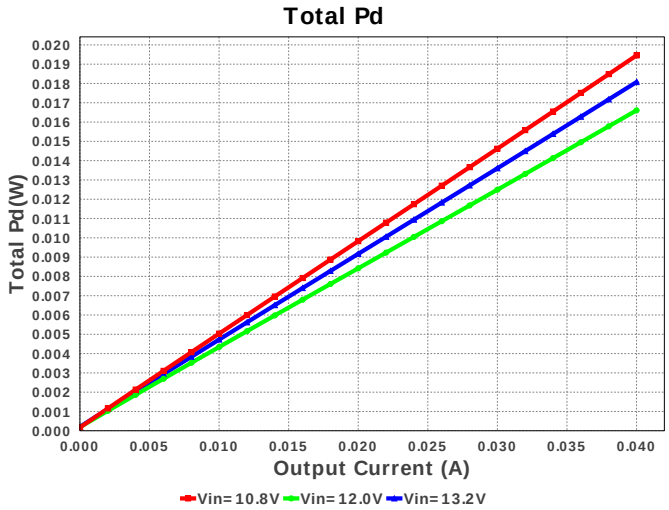
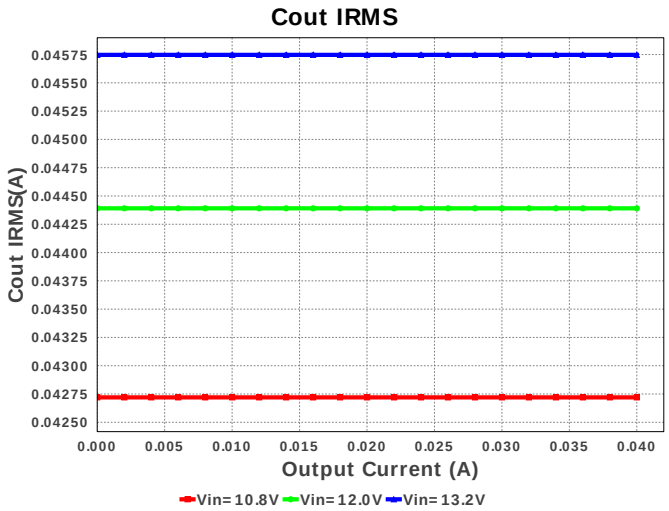
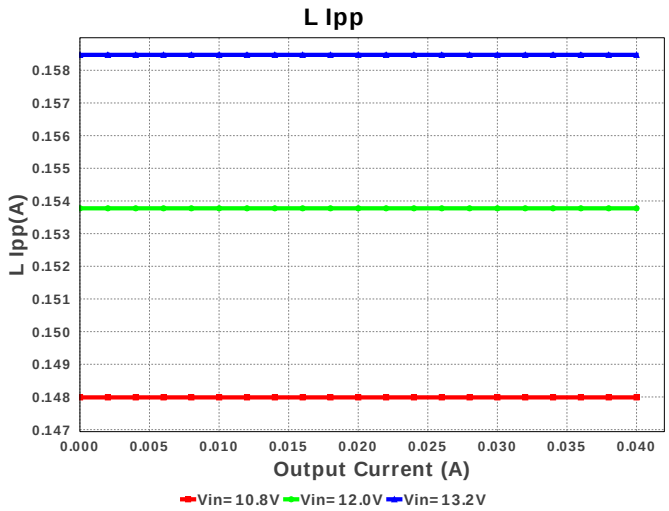
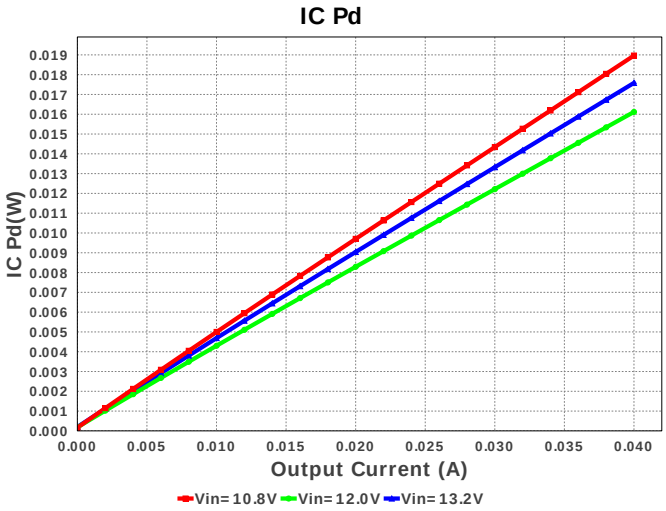
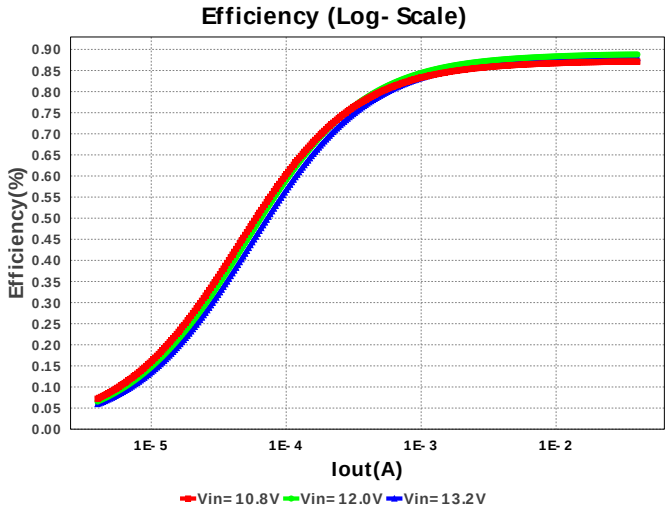

Total Pd
Total Pd(W)
Output Current (A)
Vin=10.8V Vin=12.0V Vin=13.2V


Cout IRMS
Cout IRMS(A)
Output Current (A)
Vin=10.8V Vin=12.0V Vin=13.2V


L Ipp
L Ipp(A)
Output Current (A)
Vin=10.8V Vin=12.0V Vin=13.2V





Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	11.323 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	45.747 mA	Current	Output capacitor RMS ripple current
3.	IC Ipk	119.236 mA	Current	Peak switch current in IC
4.	Iin Avg	11.369 mA	Current	Average input current
5.	L Ipp	158.47 mA	Current	Peak-to-peak inductor ripple current
6.	M1 Irms	6.845 mA	Current	Q Iavg
7.	BOM Count	10	General	Total Design BOM count
8.	FootPrint	91.0 mm^2	General	Total Foot Print Area of BOM components
9.	Frequency	365.844 kHz	General	Switching frequency
10.	IC Tolerance	20.2 mV	General	IC Feedback Tolerance
11.	M Vds Act	11.432 mV	General	Voltage drop across the MosFET
12.	Pout	132.0 mW	General	Total output power
13.	Total BOM	$0.85	General	Total BOM Cost
14.	Vout Actual	3.272 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
15.	Vout OP	3.3 V	Op_Point	Operational Output Voltage
16.	Duty Cycle	8.784 %	Op_point	Duty cycle
17.	Efficiency	87.957 %	Op_point	Steady state efficiency
18.	IC Tj	31.146 degC	Op_point	IC junction temperature
19.	ICThetaJA	65.2 degC/W	Op_point	IC junction-to-ambient thermal resistance
20.	IOUT_OP	40.0 mA	Op_point	Iout operating point
21.	VIN_OP	13.2 V	Op_point	Vin operating point
22.	Vout p-p	5.147 mV	Op_point	Peak-to-peak output ripple voltage
23.	Cin Pd	529.091 nW	Power	Input capacitor power dissipation
24.	Cout Pd	9.049 µW	Power	Output capacitor power dissipation
25.	IC Pd	17.583 mW	Power	IC power dissipation
26.	L Pd	480.0 µW	Power	Inductor power dissipation
27.	Total Pd	18.073 mW	Power	Total Power Dissipation
28.	Vout Tolerance	3.332 %		Vout Tolerance based on IC Tolerance and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	40.0 m	Maximum Output Current
2.	SoftStart	0.05 ms	Soft Start Time (ms)
3.	VinMax	13.2	Maximum input voltage
4.	VinMin	10.8	Minimum input voltage
5.	Vout	3.3	Output Voltage
6.	base_pn	TPS62125	Base Product Number
7.	source	DC	Input Source Type
8.	Ta	30.0	Ambient temperature

Design Assistance

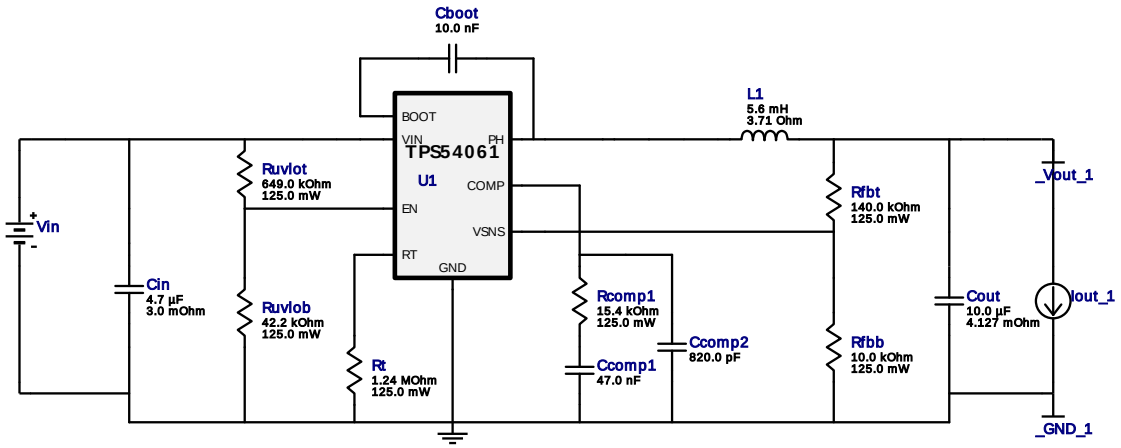
1. **TPS62125** Product Folder : http://www.ti.com/product/TPS62125 : contains the data sheet and other resources.

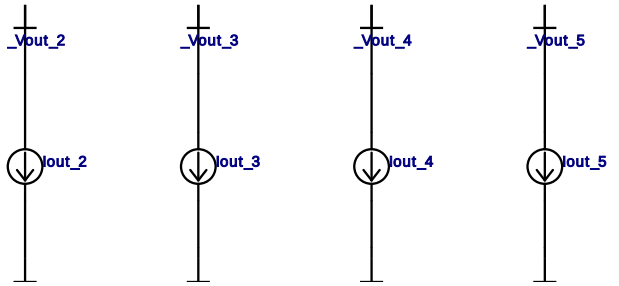
WEBENCH ® Design Report

Vout = 12.0V
Iout = 0.08A

Device = TPS54061DRBR
Topology = Buck
Created = 4/13/16 5:54:30 AM
BOM Cost = $2.05
BOM Count = 13
Total Pd = 0.04W

Design : 3473821/872 TPS54061DRBR
TPS54061DRBR 20.0V-36.0V to 12.00V @ 0.07724A





Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot	MuRata	GRM155R71E103KA01D Series= X7R	Cap= 10.0 nF VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
2.	Ccomp1	Taiyo Yuden	TMK212B7473KD-T Series= X7R	Cap= 47.0 nF VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
3.	Ccomp2	Yageo America	CC0805KRX7R9BB821 Series= X7R	Cap= 820.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
4.	Cin	MuRata	GRM31CR71H475KA12L Series= X7R	Cap= 4.7 uF ESR= 3.0 mOhm VDC= 50.0 V IRMS= 4.98 A	1	$0.07	1206 11 mm²
5.	Cout	MuRata	GRM21BR61C106KE15L Series= X5R	Cap= 10.0 uF ESR= 4.127 mOhm VDC= 16.0 V IRMS= 2.46634 A	1	$0.04	0805 7 mm²

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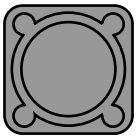
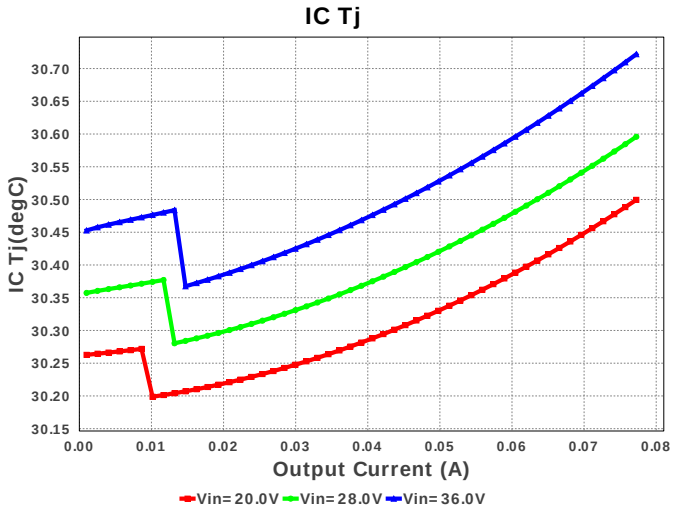
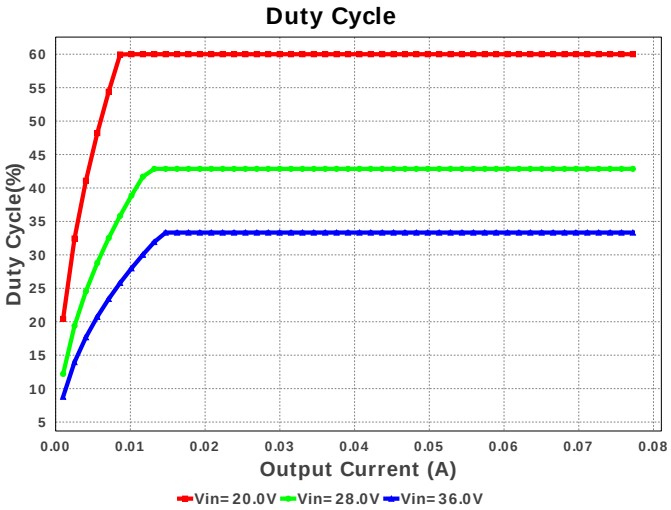
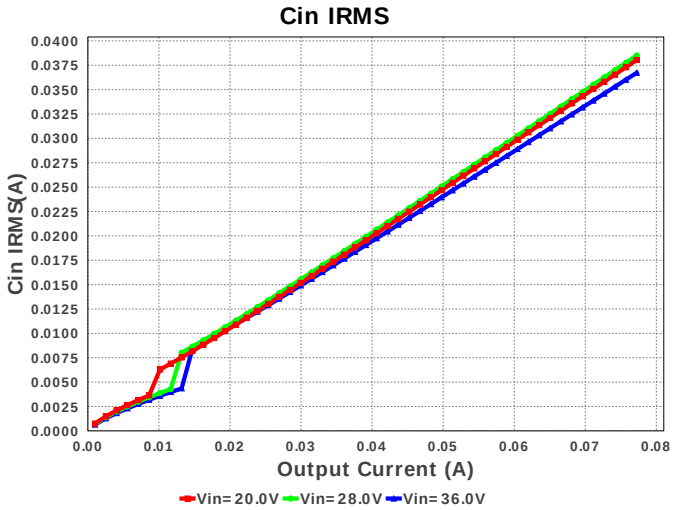
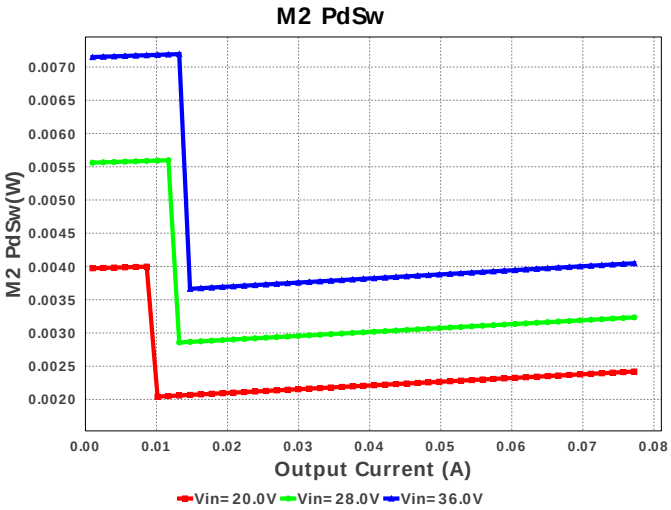
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
6.	L1	Coilcraft	MSS1210-565KEB	L= 5.6 mH DCR= 3.71 Ohm	1	$0.81	 MSS1210 204 mm²
7.	Rcomp1	Panasonic	ERJ-6ENF1542V Series= ERJ-6E	Res= 15.4 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm²
8.	Rfbb	Panasonic	ERJ-6ENF1002V Series= ERJ-6E	Res= 10.0 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm²
9.	Rfbt	Panasonic	ERJ-6ENF1403V Series= ERJ-6E	Res= 140.0 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm²
10.	Rt	Vishay-Dale	CRCW08051M24FKEA Series= CRCW..e3	Res= 1.24 MOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm²
11.	Ruvlob	Panasonic	ERJ-6ENF4222V Series= ERJ-6E	Res= 42.2 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm²
12.	Ruvlot	Panasonic	ERJ-6ENF6493V Series= ERJ-6E	Res= 649.0 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm²
13.	U1	Texas Instruments	TPS54061DRBR	Switcher	1	$1.04	 S-PVSON-N8 16 mm²









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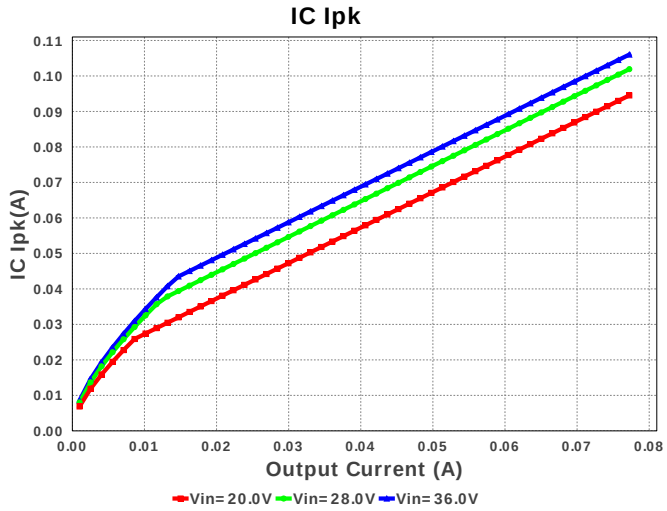
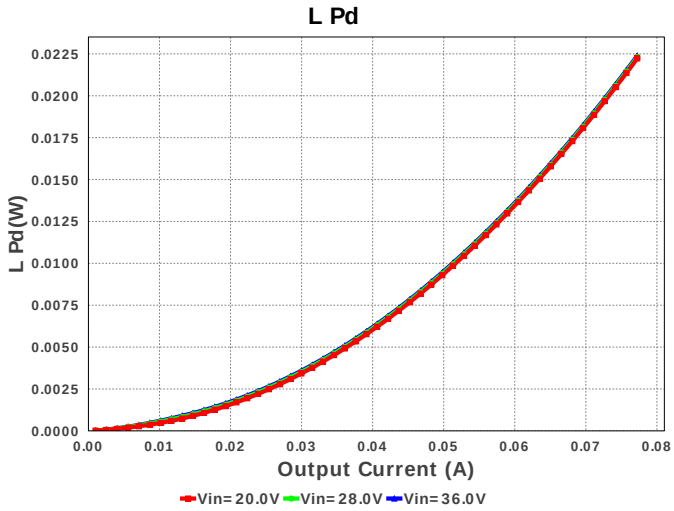
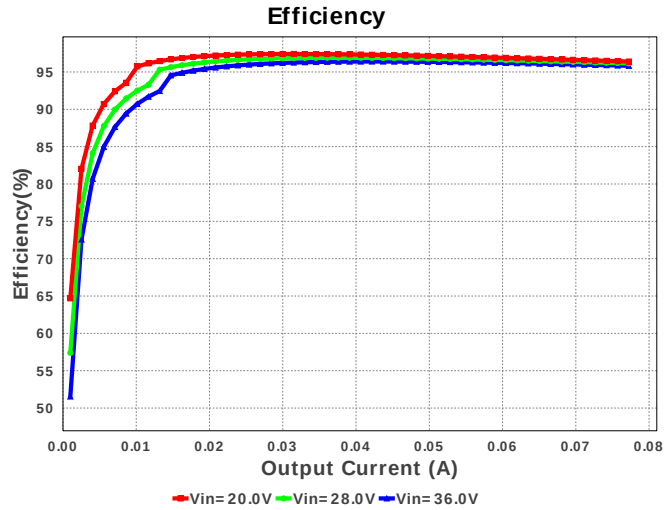
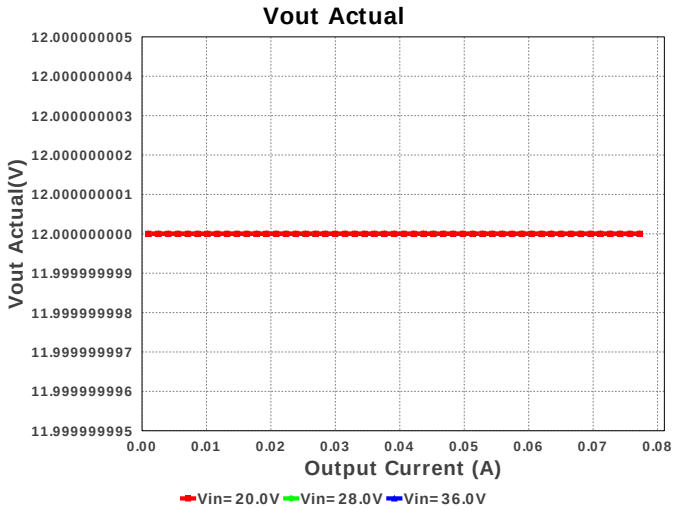
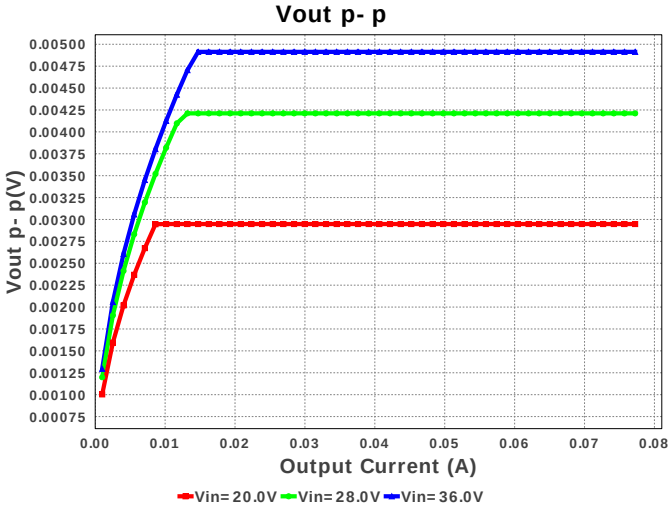
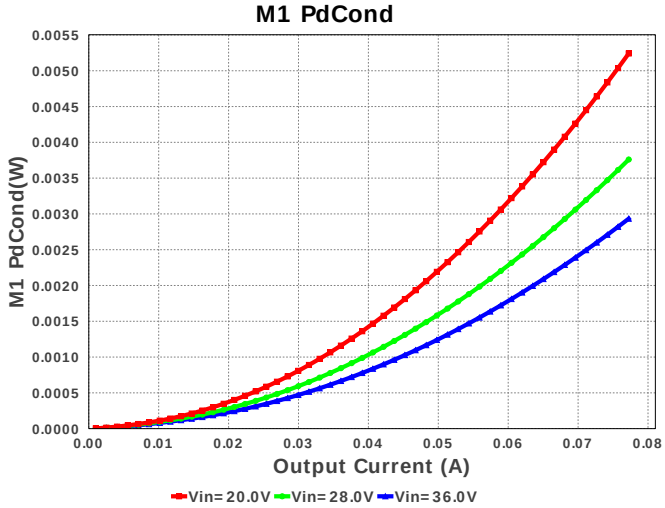

IC Ipk
IC Ipk(A)
Output Current (A)
Vin=20.0V Vin=28.0V Vin=36.0V

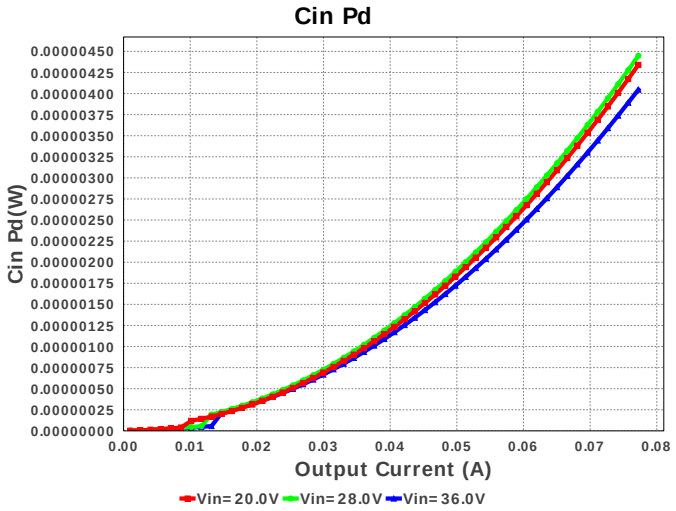

L Pd
L Pd(W)
Output Current (A)
Vin=20.0V Vin=28.0V Vin=36.0V

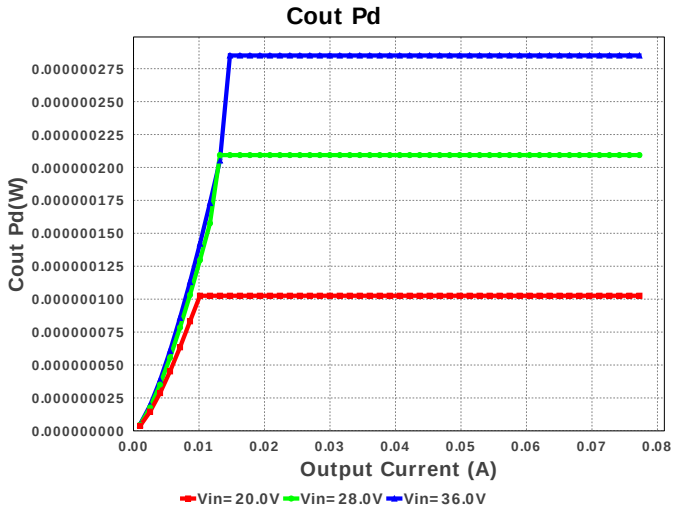

Efficiency
Efficiency(%)
Output Current (A)
Vin=20.0V Vin=28.0V Vin=36.0V

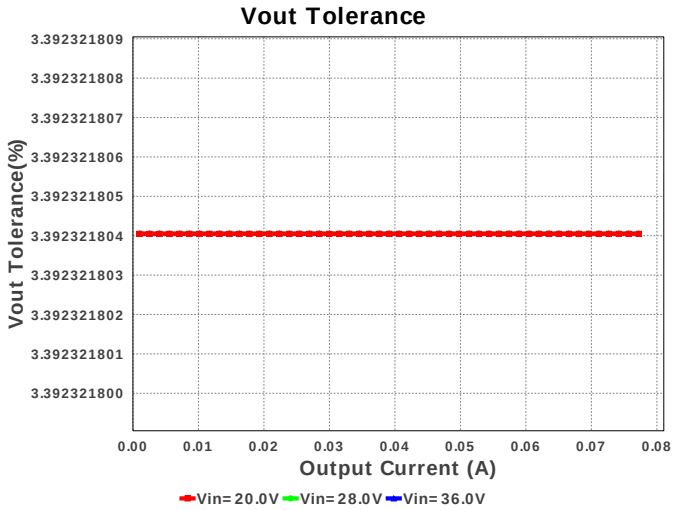

Vout Actual
Vout Actual(V)
Output Current (A)
Vin=20.0V Vin=28.0V Vin=36.0V

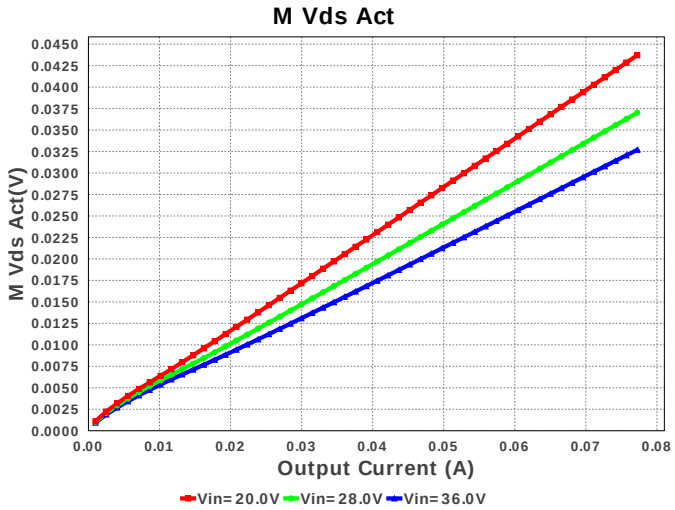

Vout p-p
Vout p-p(V)
Output Current (A)
Vin=20.0V Vin=28.0V Vin=36.0V

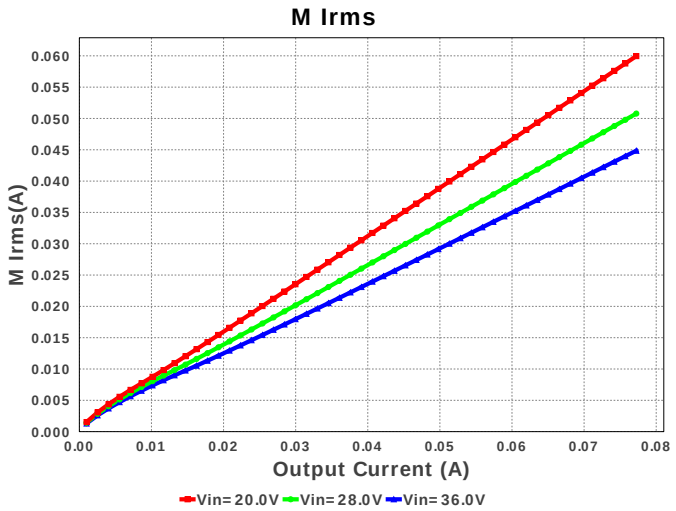

M1 PdCond
M1 PdCond(W)
Output Current (A)
Vin=20.0V Vin=28.0V Vin=36.0V

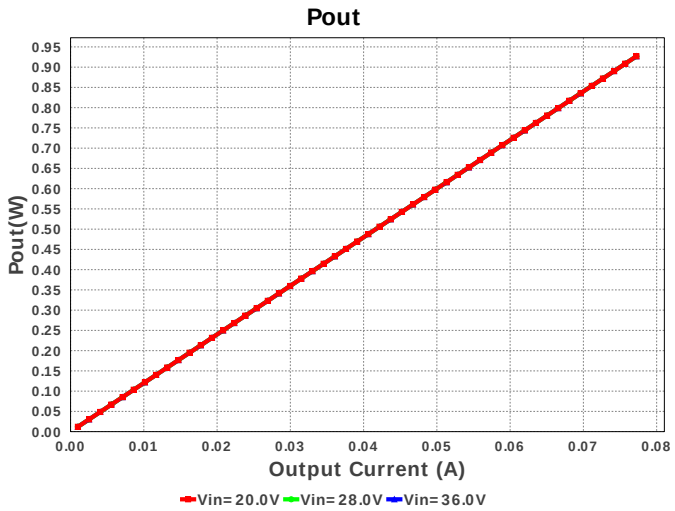












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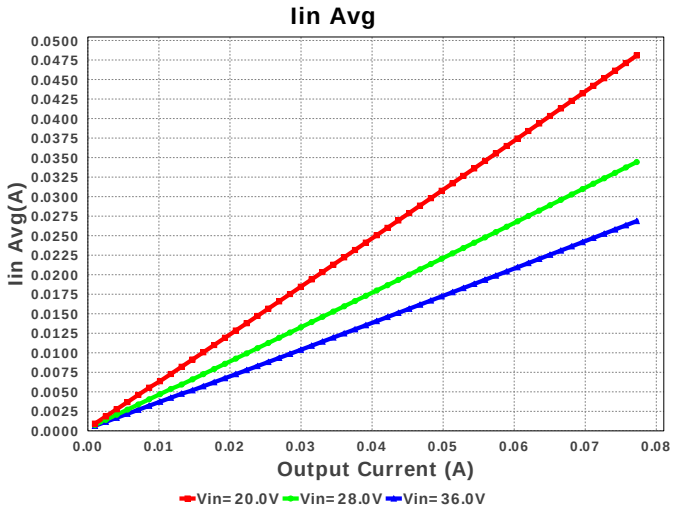

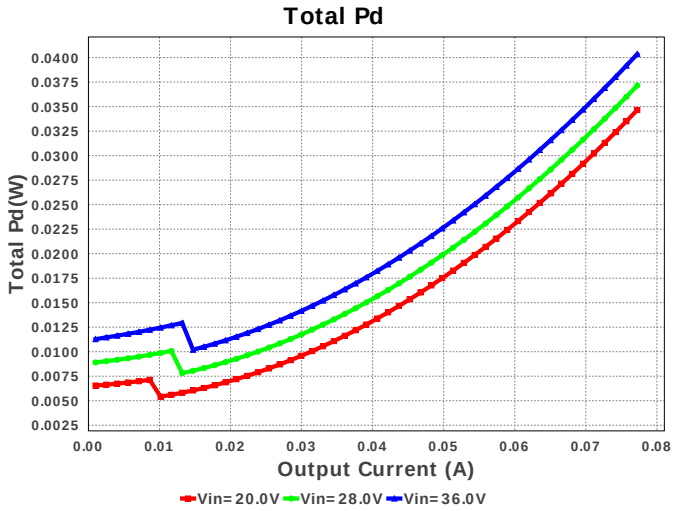

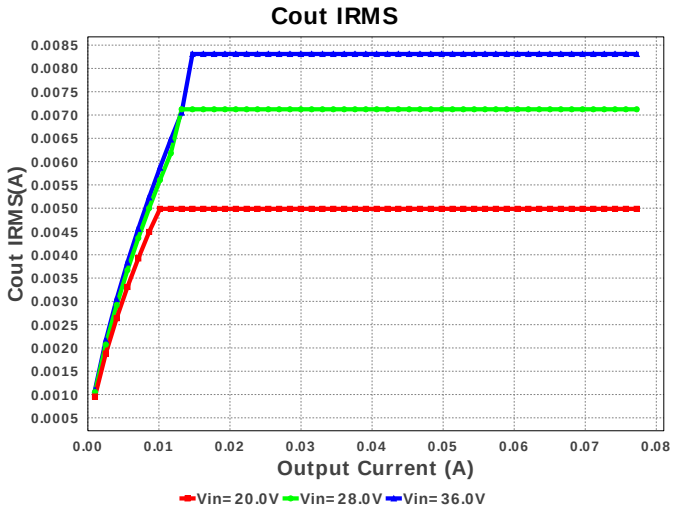

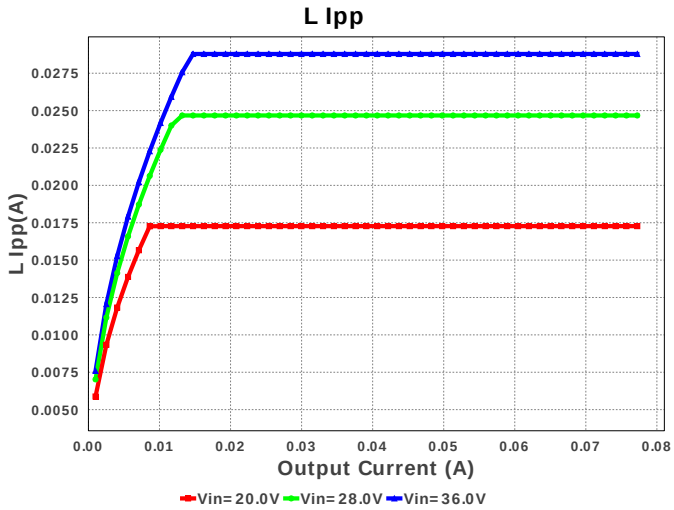

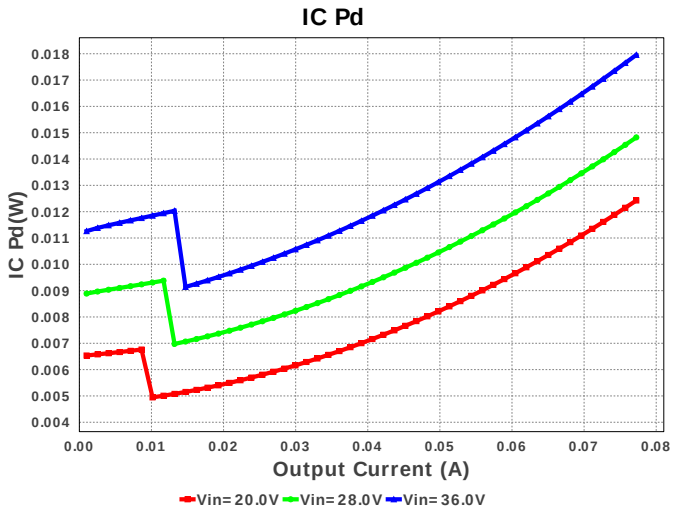

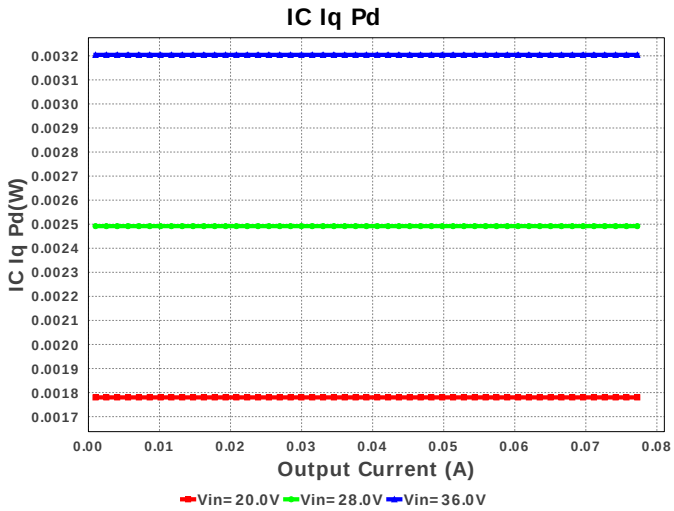

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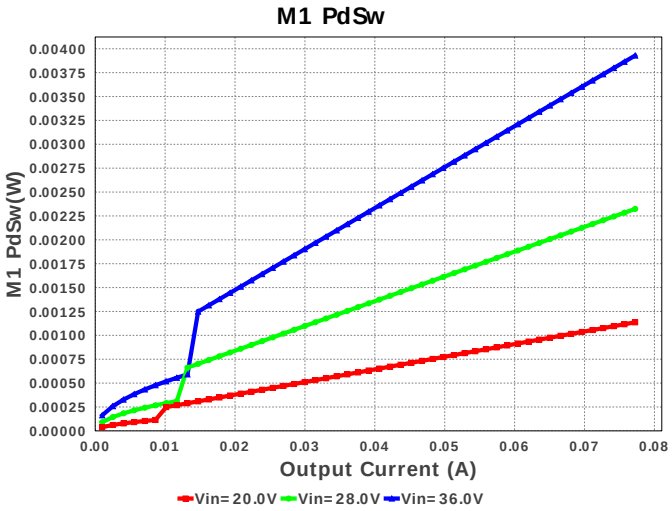

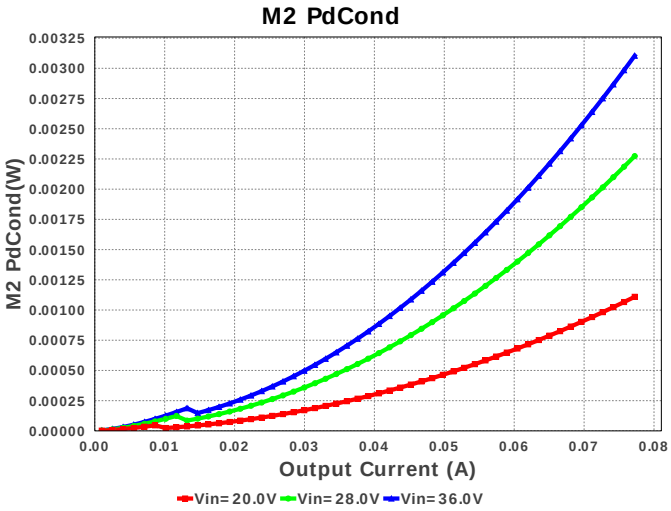

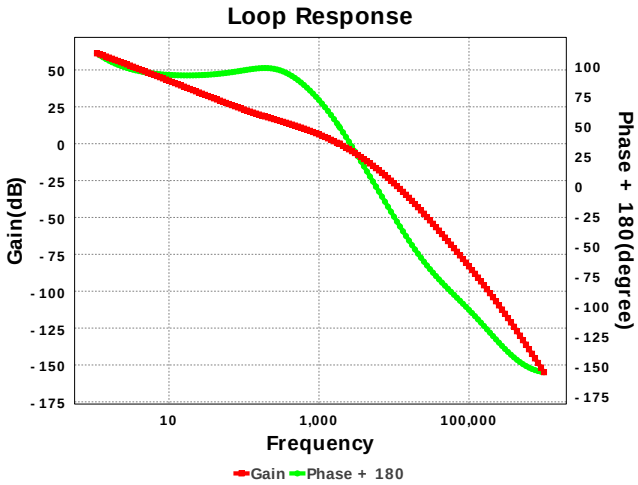

Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	36.726 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	8.31 mA	Current	Output capacitor RMS ripple current
3.	IC Ipk	106.027 mA	Current	Peak switch current in IC
4.	Iin Avg	26.868 mA	Current	Average input current
5.	L Ipp	28.787 mA	Current	Peak-to-peak inductor ripple current
6.	M1 Irms	44.852 mA	Current	Q Iavg
7.	BOM Count	13	General	Total Design BOM count
8.	FootPrint	295.0 mm^2	General	Total Foot Print Area of BOM components
9.	Frequency	49.625 kHz	General	Switching frequency
10.	IC Tolerance	20.0 mV	General	IC Feedback Tolerance
11.	M Vds Act	32.699 mV	General	Voltage drop across the MosFET
12.	Pout	926.88 mW	General	Total output power
13.	Total BOM	$2.05	General	Total BOM Cost
14.	Low Freq Gain	61.263 dB	Op_Point	Gain at 10Hz
15.	Vout Actual	12.0 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
16.	Vout OP	12.0 V	Op_Point	Operational Output Voltage
17.	Cross Freq	1.841 kHz	Op_point	Bode plot crossover frequency
18.	Duty Cycle	33.333 %	Op_point	Duty cycle
19.	Efficiency	95.828 %	Op_point	Steady state efficiency
20.	Gain Marg	-16.53 dB	Op_point	Bode Plot Gain Margin
21.	IC Tj	30.722 degC	Op_point	IC junction temperature
22.	ICThetaJA	40.2 degC/W	Op_point	IC junction-to-ambient thermal resistance
23.	IOUT_OP	77.24 mA	Op_point	Iout operating point
24.	Phase Marg	50.51 deg	Op_point	Bode Plot Phase Margin
25.	VIN_OP	36.0 V	Op_point	Vin operating point
26.	Vout p-p	4.913 mV	Op_point	Peak-to-peak output ripple voltage
27.	Cin Pd	4.046 µW	Power	Input capacitor power dissipation
28.	Cout Pd	285.002 nW	Power	Output capacitor power dissipation
29.	IC Iq Pd	3.204 mW	Power	IC Iq Pd
30.	IC Pd	17.957 mW	Power	IC power dissipation
31.	L Pd	22.39 mW	Power	Inductor power dissipation

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#	Name	Value	Category	Description
32.	M1 PdCond	2.933 mW	Power	M1 MOSFET conduction losses
33.	M1 PdSw	3.929 mW	Power	M1 MOSFET switching losses
34.	M1 PdCond	3.104 mW	Power	M2 MOSFET conduction losses
35.	M2 PdSw	4.048 mW	Power	M2 MOSFET switching losses
36.	Total Pd	40.354 mW	Power	Total Power Dissipation
37.	Vout Tolerance	3.392 %		Vout Tolerance based on IC Tolerance and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	77.24 m	Maximum Output Current
2.	VinMax	36.0	Maximum input voltage
3.	VinMin	20.0	Minimum input voltage
4.	Vout	12.0	Output Voltage
5.	base_pn	TPS54061	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	30.0	Ambient temperature

Design Assistance

1. **TPS54061** Product Folder : http://www.ti.com/product/TPS54061 : contains the data sheet and other resources.

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