



Project : 1194016/447 : PA_Project_301
Created : 2016-07-24 07:24:44.138
Optimize project optFactor=3

1. Total System Efficiency	87.843 %
2. Total System BOM Count	97.0
3. Total System Footprint	1.894 kmm ²
4. Total System BOM Cost	\$15.07
5. Total System Power Dissipation	8.863 W

No comments

Supply	Sequencer Flag	Load	Load Name
SUPPLY_1	0	LOAD_1	LOAD #1
SUPPLY_1	0	LOAD_3	LOAD #3
SUPPLY_2	0	DDRLOAD_1	DDRLOAD #1
SUPPLY_3	0	DDRLOAD_1_VTT	DDRVTT_DDRLOAD_1
SUPPLY_4	0	LOAD_2	LOAD #2
SUPPLY_5	0	LOAD_4	LOAD #4
SUPPLY_6	1	LOAD_5	AM3894ACYG120_CVDD
SUPPLY_6	1	LOAD_6	AM3894ACYG120_CVDDC
SUPPLY_6	1	LOAD_9	XC7Z100-2FFG900_VCCBRAM
SUPPLY_6	1	LOAD_10	XC7Z100-2FFG900_VCCINT
SUPPLY_6	1	LOAD_14	XC7Z100-2FFG900_VCCPINT
SUPPLY_7	0	LOAD_7	AM3894ACYG120_DVDD
SUPPLY_7	0	LOAD_8	XC7Z100-2FFG900_VCCAUX
SUPPLY_7	0	LOAD_13	XC7Z100-2FFG900_VCCPAUX
SUPPLY_7	0	LOAD_15	XC7Z100-2FFG900_VCCPLL
SUPPLY_8	0	LOAD_11	XC7Z100-2FFG900_VCCO
SUPPLY_8	0	LOAD_12	XC7Z100-2FFG900_VCCO_DDR
SUPPLY_9	NA		
SEQUENCER	NA		

#	Name	NSID	Description	Vout	Iout	Efficiency	Foot-print	Cost	Design	Page
1.	SUPPLY_1	TPS563200	Switcher : 17V, 3A,6-pin, Low Iq Synchronous buck converter with Advanced Eco-mode	3.3 V	1.0 A	92%	149	\$1.27	2184	6
2.	SUPPLY_2	TPS563201	Switcher : 17V, 3A Synchronous buck converter with Advanced Eco-mode	1.5 V	1.0 A	84.7%	162	\$1.16	2186	13
3.	SUPPLY_3	LP2996A	DDRLDO : DDR1,DDR2,DDR3,DDR3L	0.75 V	0.5 A	99.8%	87	\$1.35	2185	11
4.	SUPPLY_4	TPS563200	Switcher : 17V, 3A,6-pin, Low Iq Synchronous buck converter with Advanced Eco-mode	5 V	2.0 A	94.3%	126	\$1.31	2187	19
5.	SUPPLY_5	LM3481	Switcher : Low-Side Controller, SEPIC configuration	12 V	3.0 A	89.2%	819	\$3.42	2188	24
6.	SUPPLY_6	TPS40305	Switcher : Synchronous Buck Controller	1 V	11.375 A	81.3%	275	\$3.27	2189	34
7.	SUPPLY_7	TPS563200	Switcher : 17V, 3A,6-pin, Low Iq Synchronous buck converter with Advanced Eco-mode	1.8 V	1.029 A	88.3%	149	\$1.06	2190	42

#	Name	NSID	Description	Vout	Iout	Efficiency	Foot-print	Cost	Design	Page
8.	SUPPLY_8	TPS62175	Switcher : High Light-Load Efficiency Buck Converter	1.3 V	0.3 A	77.3%	65	\$1.08	2191	47
9.	SUPPLY_9	TPS62122	Switcher : 2V-15V,75mA, Buck Converter with DCS-Control	3.3 V	0.001 A	75.7%	43	\$0.67	2193	55
10.	SEQUENCER	LM3880	Sequencer : Power Sequencer	3.3 V	0.001 A	0%	19	\$0.48	2192	53

Power Loads

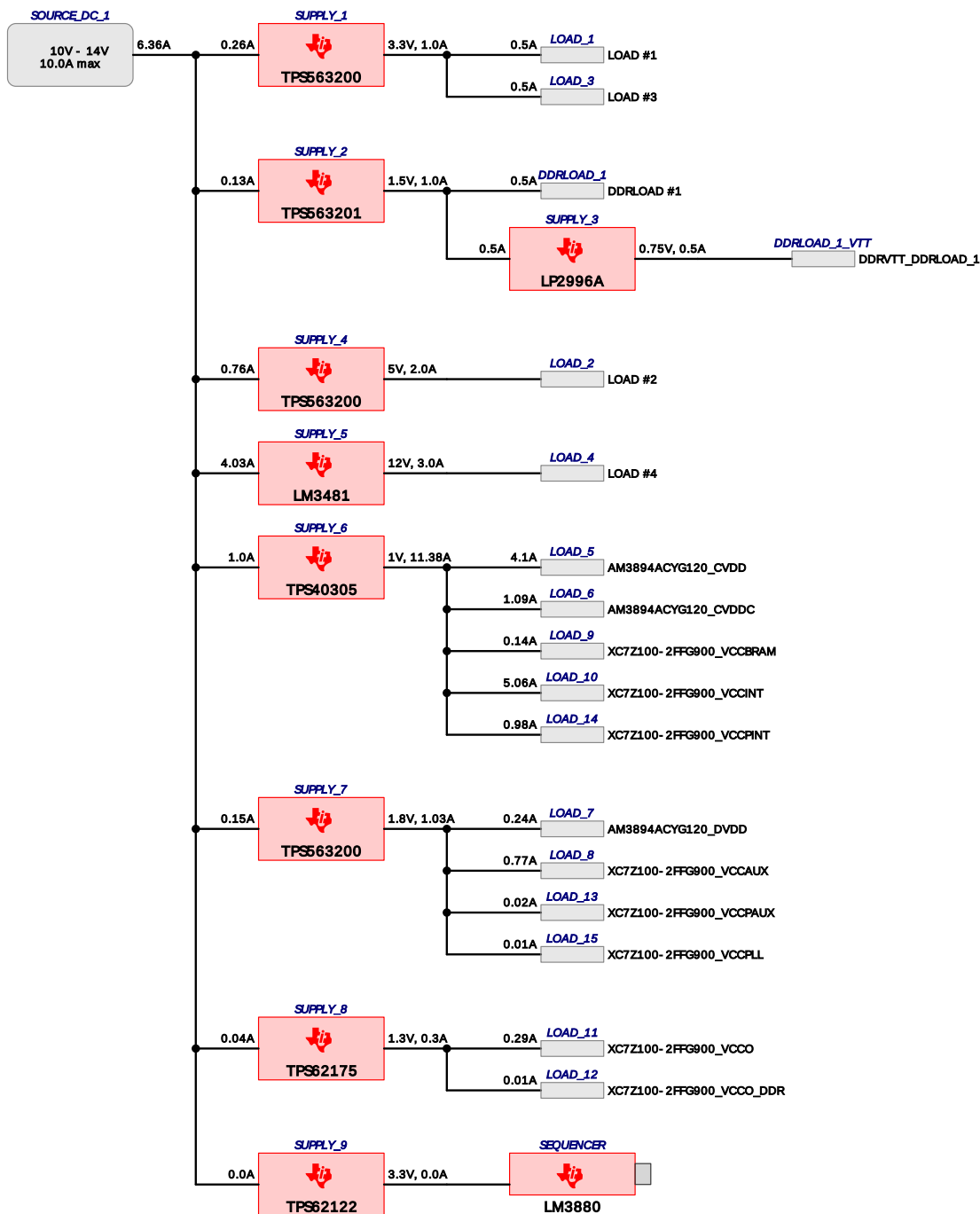
#	Name	VLoad	ILoad	Description
1.	LOAD #1	3.3 V	0.5 A	VoutRipple=10%
2.	LOAD #3	3.3 V	0.5 A	VoutRipple=10%
3.	DDRLOAD #1	1.5 V	0.5 A	VoutRipple=10%
4.	DDRVTT_DDRLOAD_1	0.75 V	0.5 A	VoutRipple=10%
5.	LOAD #2	5 V	2 A	VoutRipple=10%
6.	LOAD #4	12 V	3 A	VoutRipple=10%
7.	AM3894ACYG120_CVDD	1 V	4.099 A	VoutRipple=10%, Up Sequence Order=0 delay=2.0 mSec, Down Sequence Order=0 delay=2.0 mSec
8.	AM3894ACYG120_CVDDC	1 V	1.093 A	VoutRipple=10%, Up Sequence Order=0 delay=2.0 mSec, Down Sequence Order=0 delay=2.0 mSec
9.	XC7Z100-2FFG900_VCCBRAM	1 V	0.143 A	VoutRipple=10%
10.	XC7Z100-2FFG900_VCCINT	1 V	5.057 A	VoutRipple=10%
11.	XC7Z100-2FFG900_VCCPINT	1 V	0.983 A	VoutRipple=10%
12.	AM3894ACYG120_DVDD	1.8 V	0.235 A	VoutRipple=10%
13.	XC7Z100-2FFG900_VCCAUX	1.8 V	0.767 A	VoutRipple=10%
14.	XC7Z100-2FFG900_VCCPAUX	1.8 V	0.021 A	VoutRipple=10%
15.	XC7Z100-2FFG900_VCCPLL	1.8 V	0.006 A	VoutRipple=10%
16.	XC7Z100-2FFG900_VCCO	1.3 V	0.29 A	VoutRipple=10%
17.	XC7Z100-2FFG900_VCCO_DDR	1.3 V	0.01 A	VoutRipple=10%

FPGAs, Processors

#	Manufacturer	Part Number	Name	Series	Description
1.	Texas Instruments	AM3894ACYG120	FPGA_1	SITARA	FPGA Texas Instruments SITARA AM3894ACYG120
	http://www.ti.com/product/am3894				
2.	Xilinx	XC7Z100-2FFG900	FPGA_1	Zynq-7000	FPGA Xilinx Zynq-7000 XC7Z100-2FFG900

Project Diagram

WEBENCH® Power Architect Project ID : 447 PA_Project_301 FPGA Architect 2016-07-24 07:24:44.138



Electrical Procurement BOM

Manufacturer	Part Number	Description	Quantity	Budgetary Price	Footprint (mm ²)
AVX	08053C104KAT2A	0805	5	\$0.01	34
Panasonic	2R5TPE220MAFB	CAPSMT_6_B2S	1	\$0.50	17
Infineon Technologies	BSZ097N04LS G	PG-TSDSON-8	1	\$0.26	19
Kemet	C0603C104K3RACTU	0603	1	\$0.01	5
TDK	C3216JB0J107M	1206	2	\$0.39	11
TDK	C3216JB1A476M	1206	2	\$0.34	22
TDK	C3216X5R1E476M160AC	1206	1	\$0.35	11
TDK	C3216X6S0G476M	1206	1	\$0.13	11
Taiyo Yuden	CBC2012T220M	CBC2012	1	\$0.08	8
Yageo America	CC0805KRX7R9BB392	0805	1	\$0.01	7
Yageo America	CC0805KRX7R9BB561	0805	1	\$0.01	7
Samsung Electro-Mechanics	CL21C250JBANNNC	0805	1	\$0.01	7
Vishay-Dale	CRCW0402100KFKED	0402	6	\$0.01	18
Vishay-Dale	CRCW0402100RFKED	0402	1	\$0.01	3
Vishay-Dale	CRCW040210K0FKED	0402	6	\$0.01	18
Vishay-Dale	CRCW040213K7FKED	0402	1	\$0.01	3
Vishay-Dale	CRCW040215K0FKED	0402	1	\$0.01	3
Vishay-Dale	CRCW040218K7FKED	0402	1	\$0.01	3
Vishay-Dale	CRCW04021K62FKED	0402	1	\$0.01	3
Vishay-Dale	CRCW0402255KFKED	0402	1	\$0.01	3
Vishay-Dale	CRCW0402280RFKED	0402	1	\$0.01	3
Vishay-Dale	CRCW04022K74FKED	0402	1	\$0.01	3
Vishay-Dale	CRCW040233K2FKED	0402	1	\$0.01	3
Vishay-Dale	CRCW040234K0FKED	0402	1	\$0.01	3
Vishay-Dale	CRCW0402383KFKED	0402	1	\$0.01	3
Vishay-Dale	CRCW04023K09FKED	0402	1	\$0.01	3
Vishay-Dale	CRCW040256K2FKED	0402	1	\$0.01	3
Vishay-Dale	CRCW040284K5FKED	0402	1	\$0.01	3
Vishay-Dale	CRCW04029K76FKED	0402	1	\$0.01	3
Texas Instruments	CSD16411Q3	TRANS_NexFET_Q3	1	\$0.34	18
Texas Instruments	CSD17577Q3A	TRANS_NexFET_Q3A	2	\$0.28	18
MuRata	GRM0335C1H111JA01D	0201	1	\$0.01	2
MuRata	GRM033R61A332KA01D	0201	1	\$0.01	2
MuRata	GRM033R71C122KA01D	0201	1	\$0.01	2
MuRata	GRM1555C1H511JA01D	0402	1	\$0.01	3
MuRata	GRM155C80J124KE01D	0402	1	\$0.02	3
MuRata	GRM155R60J103KA01D	0402	1	\$0.01	3
MuRata	GRM155R60J104KA01D	0402	1	\$0.01	3
MuRata	GRM155R61A474KE15D	0402	1	\$0.01	3
MuRata	GRM188R60J475KE19D	0603	1	\$0.01	5
MuRata	GRM188R61C225KE15D	0603	1	\$0.02	5
MuRata	GRM188R61E105KA12D	0603	1	\$0.01	5
MuRata	GRM21BC80G226ME39L	0805	2	\$0.04	7
MuRata	GRM21BR61E475KA12L	0805	1	\$0.02	7
MuRata	GRM21BR61E475MA12L	0805	2	\$0.02	14
MuRata	GRM31CR61C226ME15L	1206_190	3	\$0.13	11
MuRata	GRM31CR61E106KA12L	1206_190	2	\$0.05	11
MuRata	GRM32ER61E226KE15L	1210	4	\$0.16	59
Taiyo Yuden	JMK212BJ476MG-T	0805	1	\$0.14	7
Texas Instruments	LM3481MM/NOPB	MUB10A	1	\$0.80	24
Texas Instruments	LM3880MF-1AE/NOPB	R-PDSO-G6	1	\$0.45	10
Texas Instruments	LP2996AMRE/NOPB	DDA0008A	1	\$0.69	57
Coilcraft	LPS4018-103MRB	LPS4018	1	\$0.35	24
Vishay-Semiconductor	MBRB745PBF	DDPAK	1	\$0.84	210
Susumu Co Ltd	PRL1632-R008-F-T1	0612	1	\$0.19	11
Yageo America	RC0603FR-07240KL	0603	1	\$0.01	5
Yageo America	RC0603FR-0782KL	0603	1	\$0.01	5
Bourns	SDR1307-180ML	SDR1307	1	\$0.35	227
Bourns	SDR1307-5R6ML	SDR1307	1	\$0.35	227
Coilcraft	SLC1175-231MEB	SLC1175	1	\$0.48	125
Bourns	SRN8040-2R2Y	SRN8040	2	\$0.22	200
Bourns	SRR6038-3R3Y	SRR6038	1	\$0.26	77
Taiyo Yuden	TMK212BJ475KG-T	0805	1	\$0.05	7
Texas Instruments	TPS40305DRCR	S-PVSON-N10	1	\$0.95	17
Texas Instruments	TPS563200DDCR	DDC0006A	3	\$0.52	31
Texas Instruments	TPS563201DDCR	DDC0006A	1	\$0.40	10
Texas Instruments	TPS62122DRVR	S-PWSON-N6	1	\$0.50	9

Manufacturer	Part Number	Description	Quantity	Budgetary Price	Footprint (mm ²)
Texas Instruments	TPS62175DQCR	R- PWSN- N10	1	\$0.60	12
TDK	VLP8040T-2R2N	VLP8040	1	\$0.22	113
Total			97	\$15825.5741999999998	

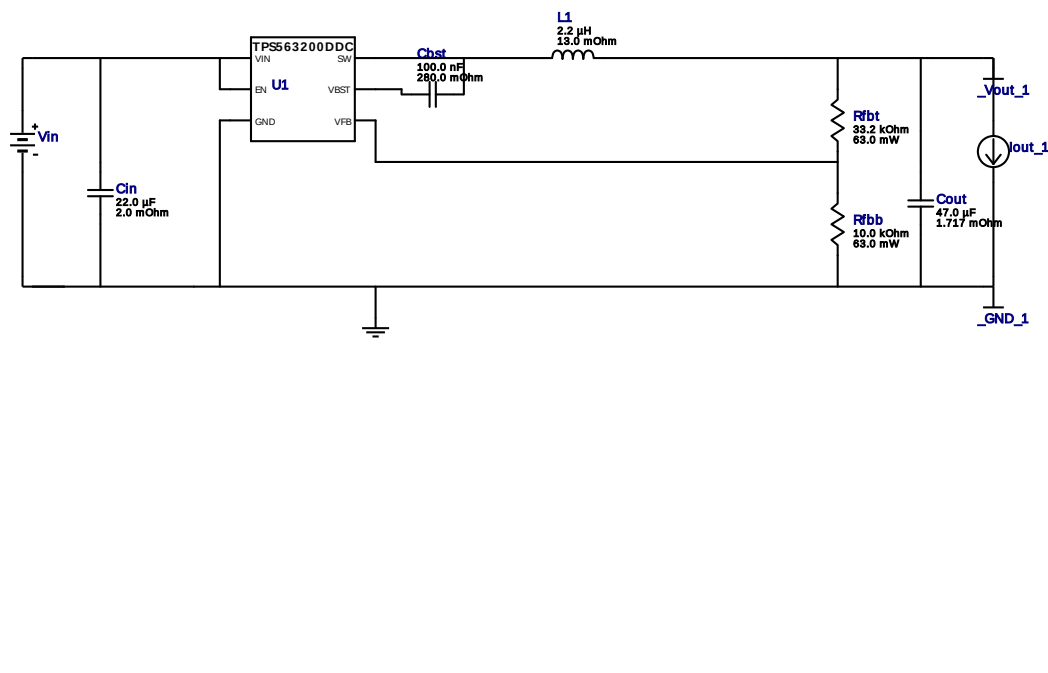


Vout = 3.3V
Iout = 1.0A

Device = TPS563200DDCR
Topology = Buck
Created = 7/24/16 7:24:33 AM
BOM Cost = \$1.27
BOM Count = 7
Total Pd = 0.29W

WEBENCH® Design Report

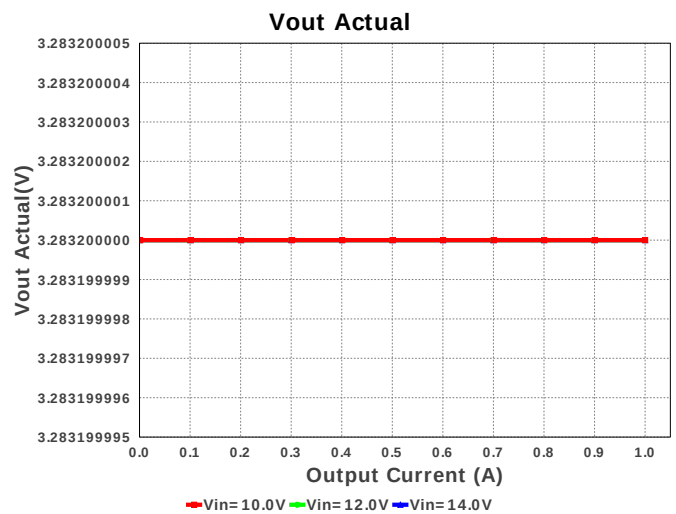
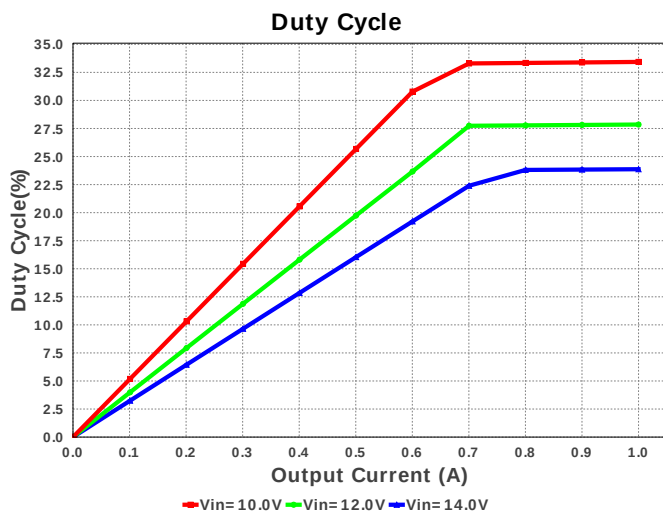
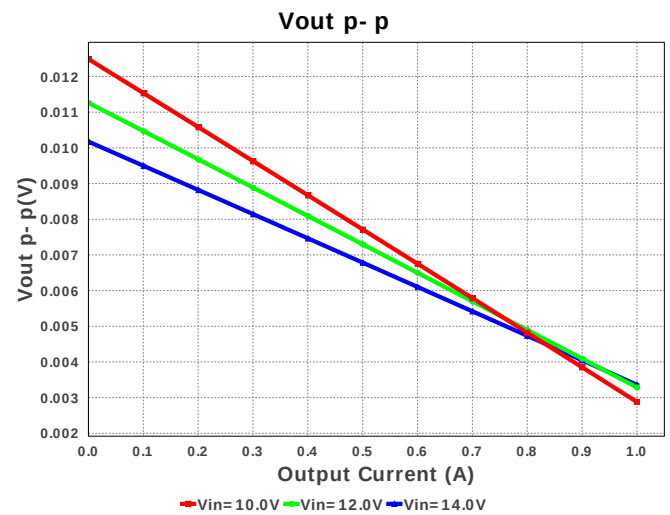
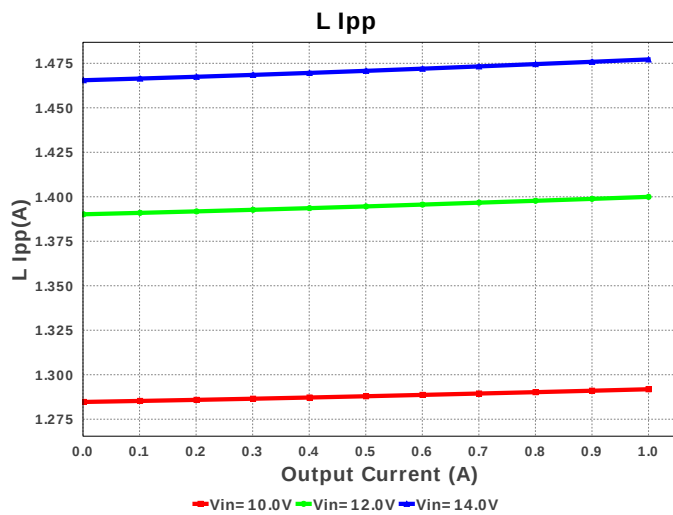
Design : 1194016/2184 TPS563200DDCR
TPS563200DDCR 10.0V-14.0V to 3.30V @ 1.0A

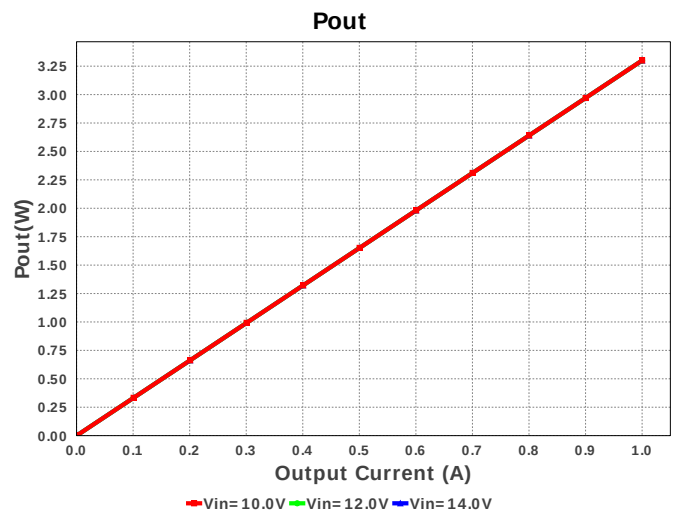
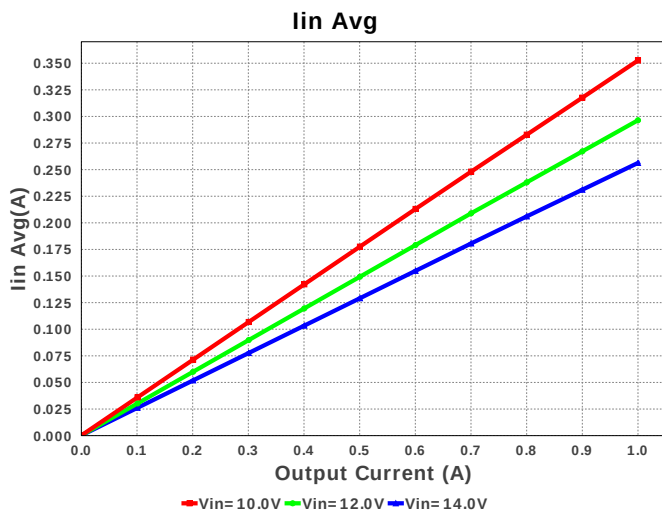
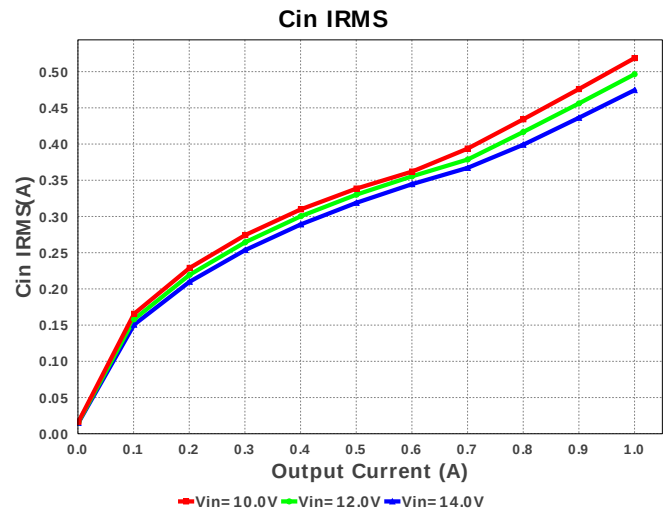
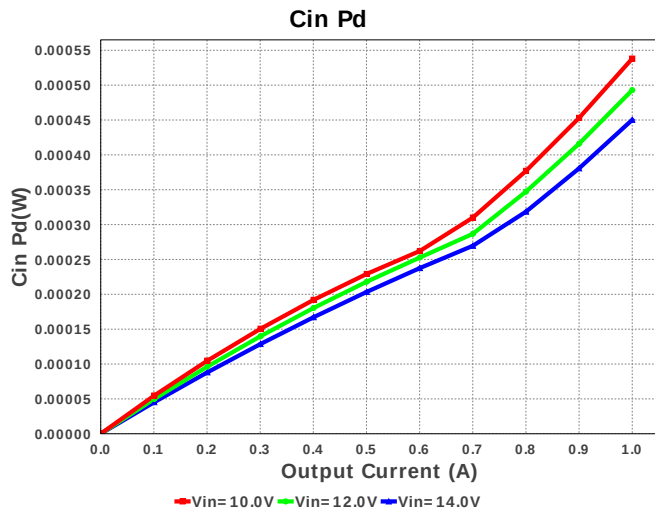
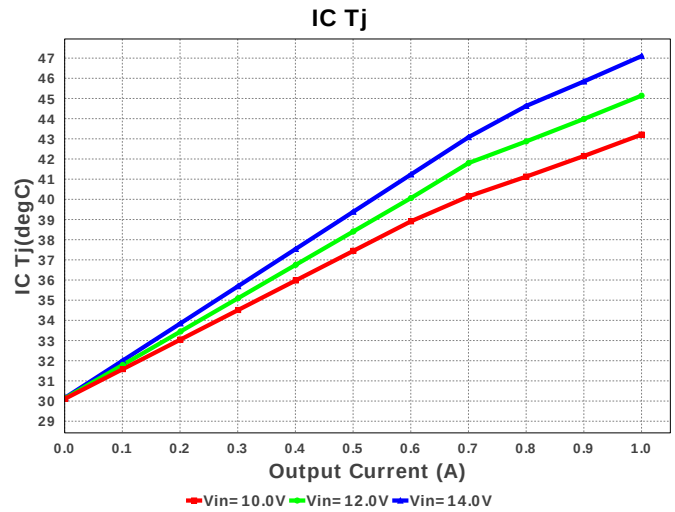
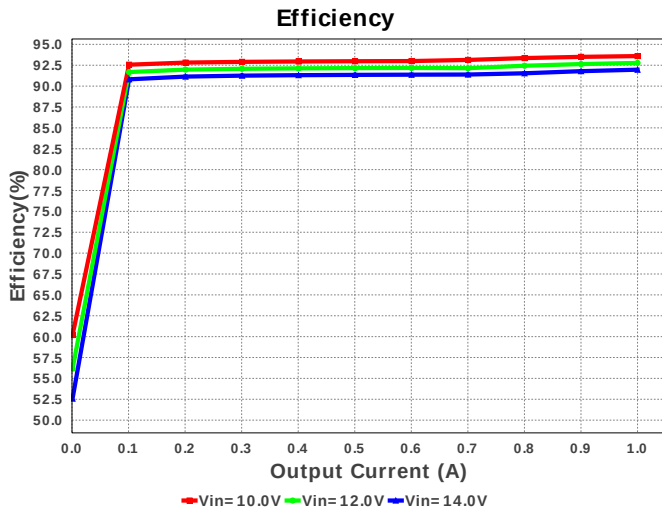


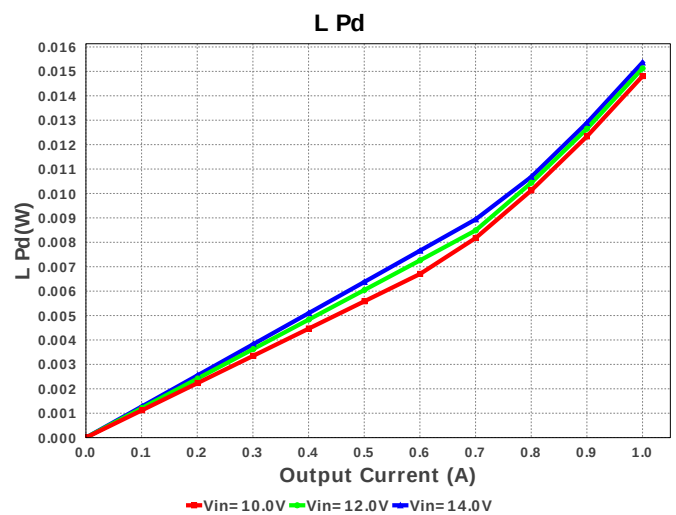
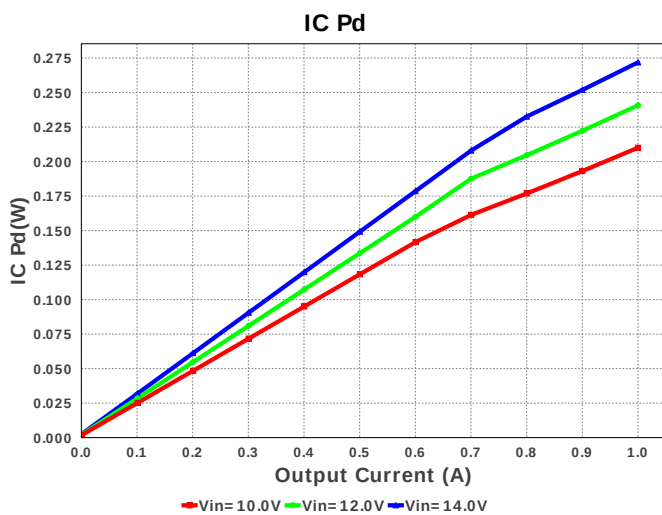
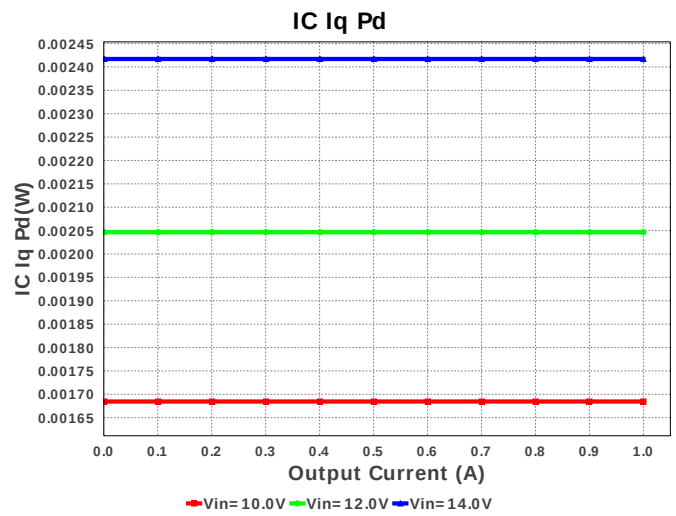
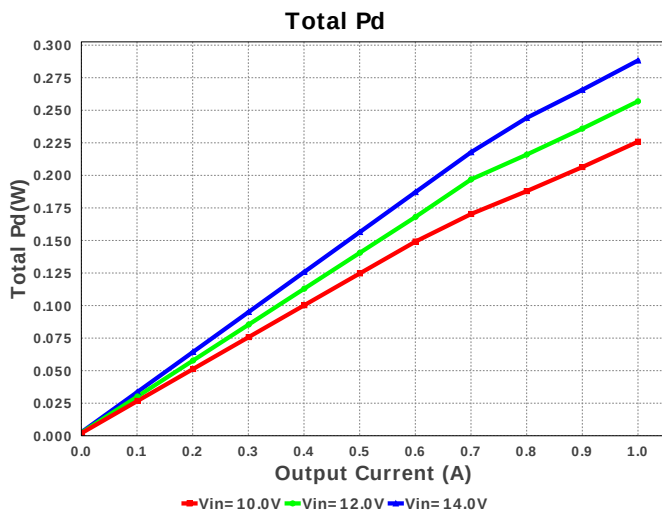
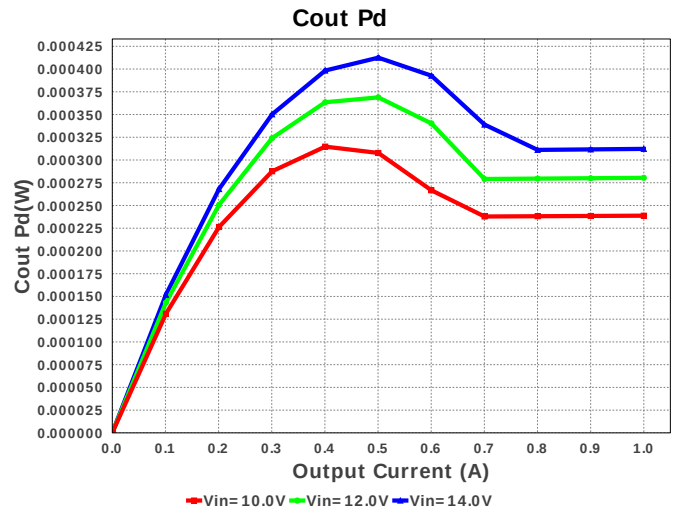
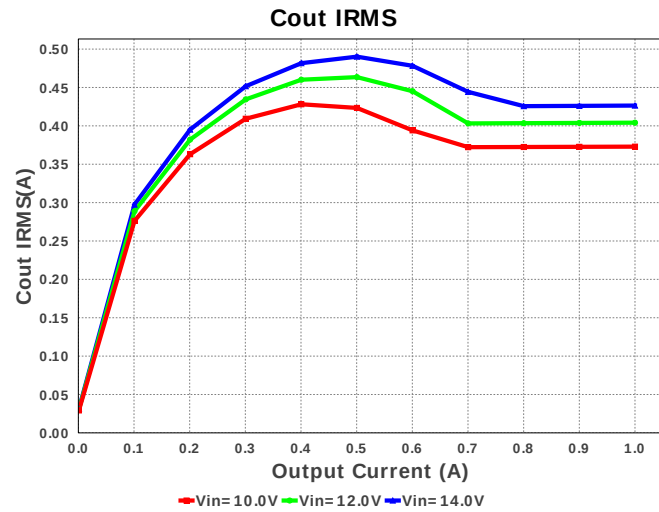
Electrical BOM

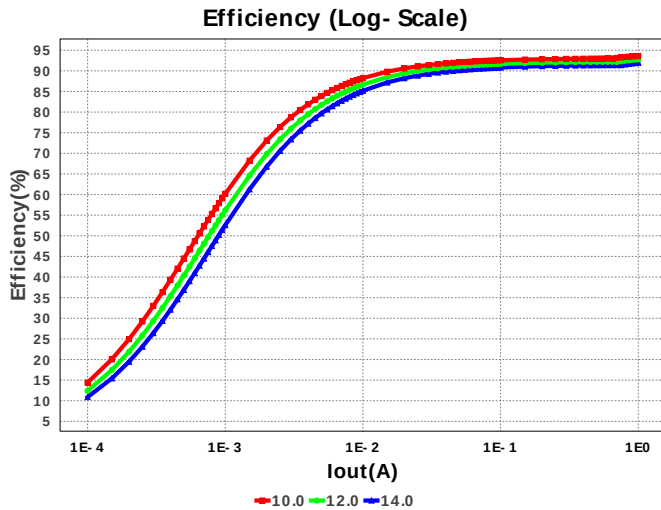
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbst	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm ²
2.	Cin	MuRata	GRM32ER61E226KE15L Series= X5R	Cap= 22.0 uF ESR= 2.0 mOhm VDC= 25.0 V IRMS= 3.67 A	1	\$0.16	 1210 15 mm ²
3.	Cout	TDK	C3216JB1A476M Series= JB	Cap= 47.0 uF ESR= 1.717 mOhm VDC= 10.0 V IRMS= 0.0 A	1	\$0.34	 1206 11 mm ²
4.	L1	Bourns	SRN8040-2R2Y	L= 2.2 uH DCR= 13.0 mOhm	1	\$0.22	 SRN8040 100 mm ²
5.	Rfbb	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
6.	Rfht	Vishay-Dale	CRCW040233K2FKED Series= CRCW..e3	Res= 33.2 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	TPS563200DDCR	Switcher	1	\$0.52	 DDC0006A 10 mm ²









Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	474.478 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	426.426 mA	Current	Output capacitor RMS ripple current
3.	Iin Avg	256.3 mA	Current	Average input current
4.	L Ipp	1.477 A	Current	Peak-to-peak inductor ripple current
5.	BOM Count	7	General	Total Design BOM count
6.	FootPrint	149.0 mm ²	General	Total Foot Print Area of BOM components
7.	Frequency	781.562 kHz	General	Switching frequency
8.	Pout	3.3 W	General	Total output power
9.	Total BOM	\$1.27	General	Total BOM Cost
10.	Vout Actual	3.283 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
11.	Vout OP	3.3 V	Op_Point	Operational Output Voltage
12.	Duty Cycle	23.87 %	Op_point	Duty cycle
13.	Efficiency	91.967 %	Op_point	Steady state efficiency
14.	IC Tj	47.101 degC	Op_point	IC junction temperature
15.	ICThetaJA	62.9 degC/W	Op_point	IC junction-to-ambient thermal resistance
16.	IOUT_OP	1.0 A	Op_point	Iout operating point
17.	VIN_OP	14.0 V	Op_point	Vin operating point
18.	Vout p-p	5.851 mV	Op_point	Peak-to-peak output ripple voltage
19.	Cin Pd	450.259 μW	Power	Input capacitor power dissipation
20.	Cout Pd	312.218 μW	Power	Output capacitor power dissipation
21.	IC Iq Pd	2.417 mW	Power	IC Iq Pd
22.	IC Pd	271.873 mW	Power	IC power dissipation
23.	L Pd	15.364 mW	Power	Inductor power dissipation
24.	Total Pd	288.24 mW	Power	Total Power Dissipation
25.	Vout Tolerance	2.889 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

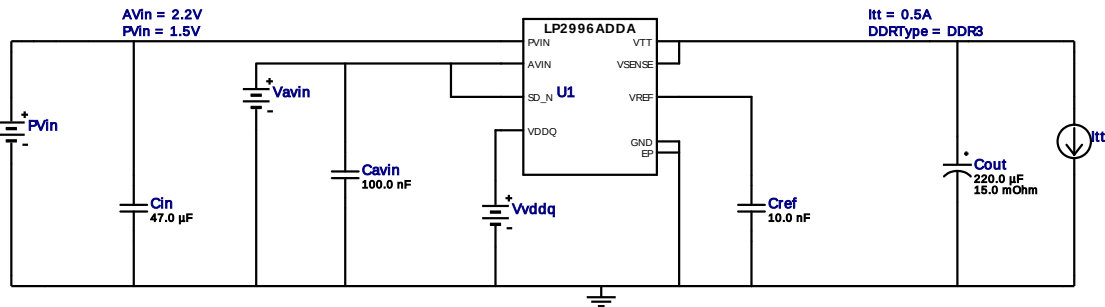
Design Inputs

#	Name	Value	Description
1.	Iout	1.0	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	TPS563200	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	30.0	Ambient temperature

Design Assistance

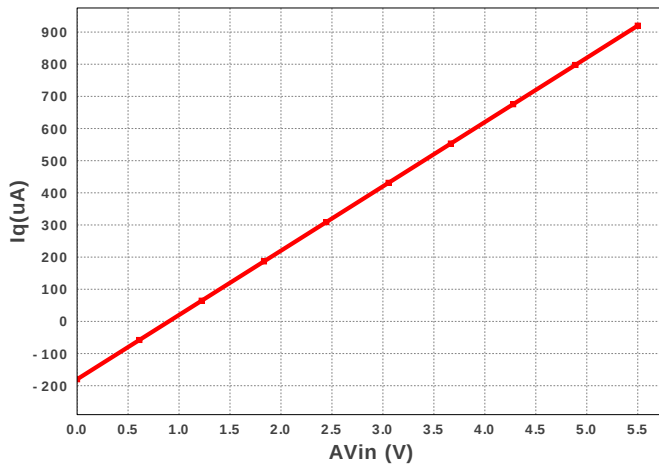
1. **TPS563200** Product Folder : <http://www.ti.com/product/TPS563200> : contains the data sheet and other resources.

Device = LP2996AMRE/NOPB
Topology = DDRLDO
Created = 7/24/16 7:24:33 AM
BOM Cost = \$1.35
BOM Count = 5
Total Pd = 0.38W

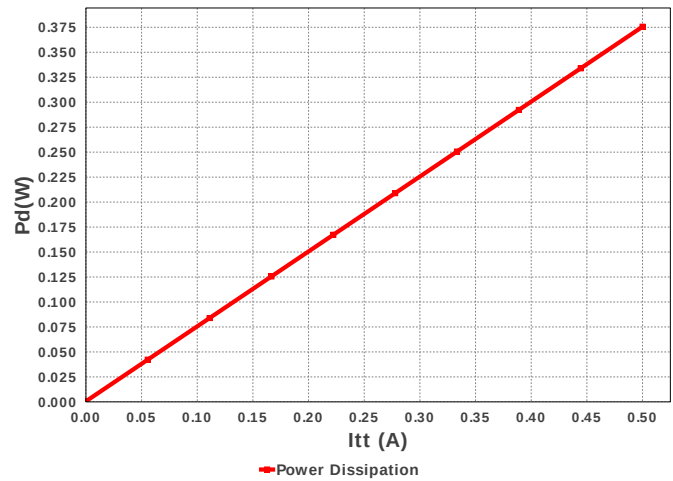


#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cavin	MuRata	GRM155R60J104KA01D Series= X5R	Cap= 100.0 nF VDC= 6.3 V IRMS= 0.0 A	1	\$0.01	 0402 3 mm²
2.	Cin	Taiyo Yuden	JMK212BJ476MG-T Series= X5R	Cap= 47.0 uF VDC= 6.3 V IRMS= 0.0 A	1	\$0.14	 0805 7 mm²
3.	Cout	Panasonic	2R5TPE220MAFB Series= ?	Cap= 220.0 uF ESR= 15.0 mOhm VDC= 2.5 V IRMS= 2.0 A	1	\$0.50	 CAPSMT_6_B2S 17 mm²
4.	Cref	MuRata	GRM155R60J103KA01D Series= X5R	Cap= 10.0 nF VDC= 6.3 V IRMS= 0.0 A	1	\$0.01	 0402 3 mm²
5.	U1	Texas Instruments	LP2996AMRE/NOPB	Switcher	1	\$0.69	 DDA0008A 57 mm²

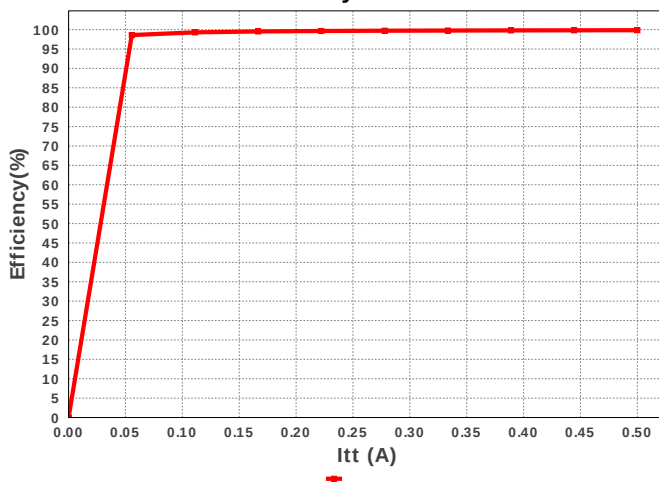
Quiescent Current Iq Vs. AVin



Power Dissipation Vs. Ilt



Efficiency Vs. Ilt



Operating Values

#	Name	Value	Category	Description
1.	BOM Count	5	General	Total Design BOM count
2.	FootPrint	87.0 mm ²	General	Total Foot Print Area of BOM components
3.	Total BOM	\$1.35	General	Total BOM Cost
4.	AVin_OP	2.2 V	Op_Point	Pvin operating point
5.	Ilt_OP	500.0 mA	Op_Point	Ilt Operating Point
6.	PVin_OP	1.5 V	Op_Point	Pvin operating point
7.	Ta_OP	30.0 degC	Op_Point	Operating Ambient Temperature
8.	Vddq_OP	1.5 V	Op_Point	Vddq operating point
9.	Vtt_OP	750.0 mV	Op_Point	Vtt operating point
10.	Efficiency	99.842 %	Op_point	Steady state efficiency
11.	IC TJ	46.151 degC	Op_point	IC junction temperature
12.	ICThetaJA	43.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
13.	Total Pd	375.594 mW	Power	Total Power Dissipation

Design Inputs

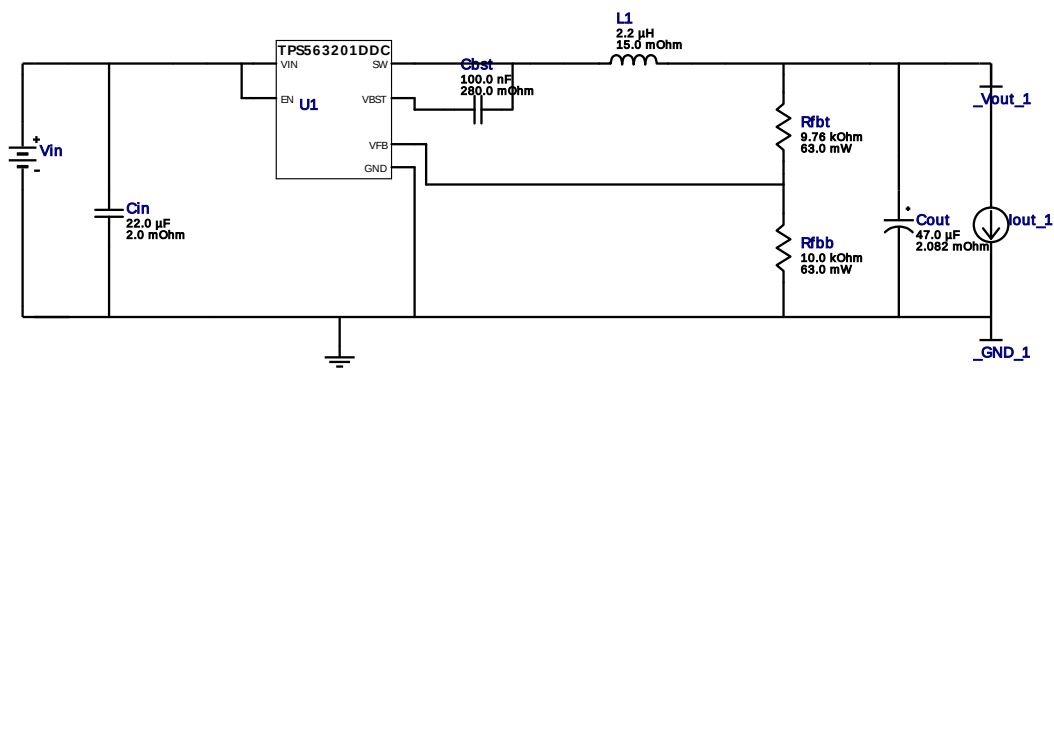
#	Name	Value	Description
1.	AVin	2.2 A	AVin
2.	DDRTYPE	DDR3	DDRTYPE
3.	Ilt	500.0 mA	Ilt
4.	PVin	1.5 A	PVin
5.	application	DDRPower	application
6.	base_pn	LP2996A	Base Product Number
7.	Ta	30.0 A	Ambient temperature

Design Assistance

1. **LP2996A** Product Folder : <http://www.ti.com/product/lp2996a> : contains the data sheet and other resources.

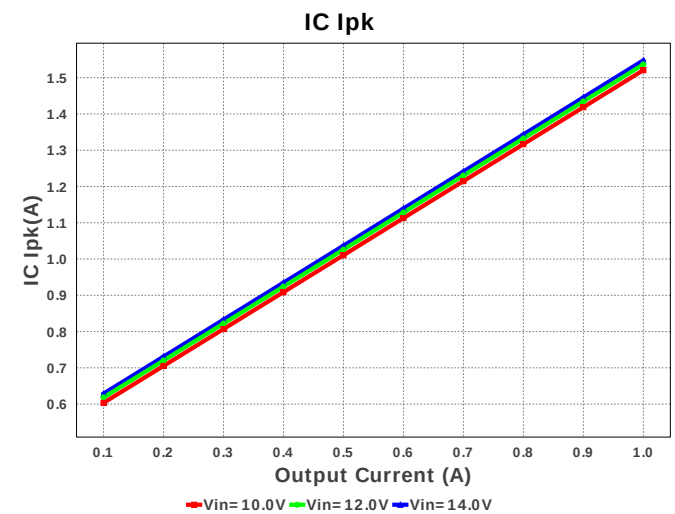
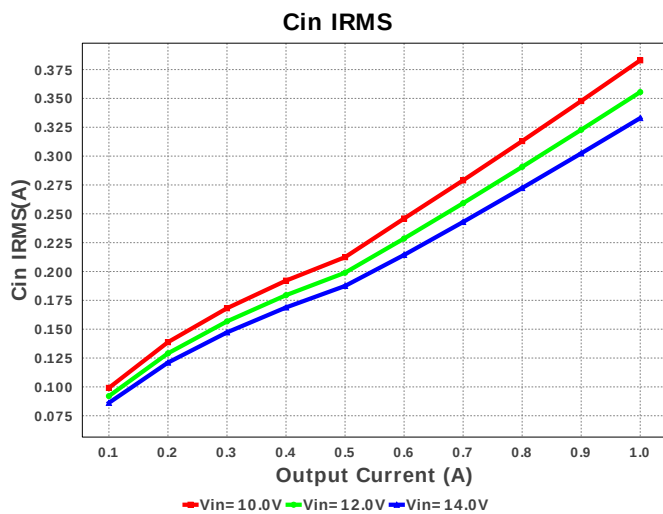
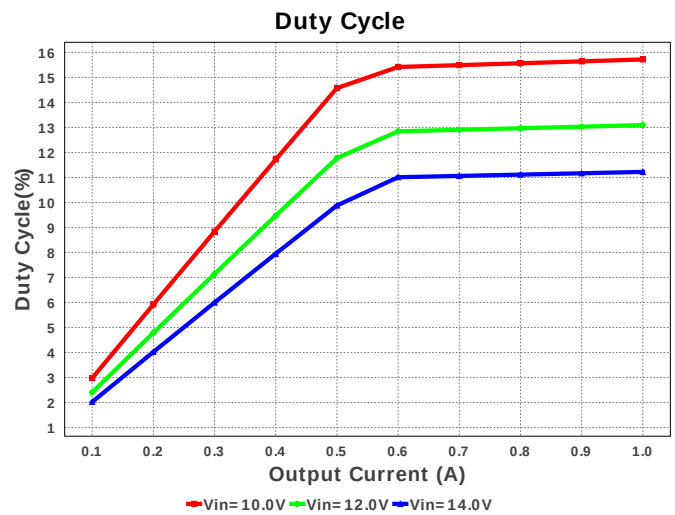
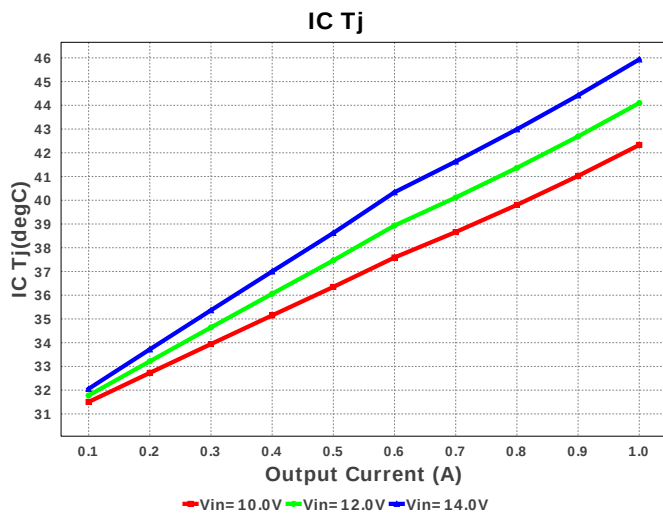
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BOM Count = 7
Total Pd = 0.27W

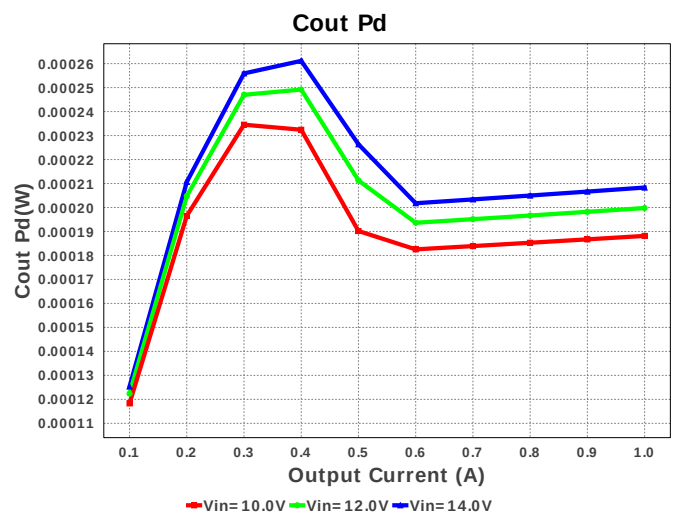
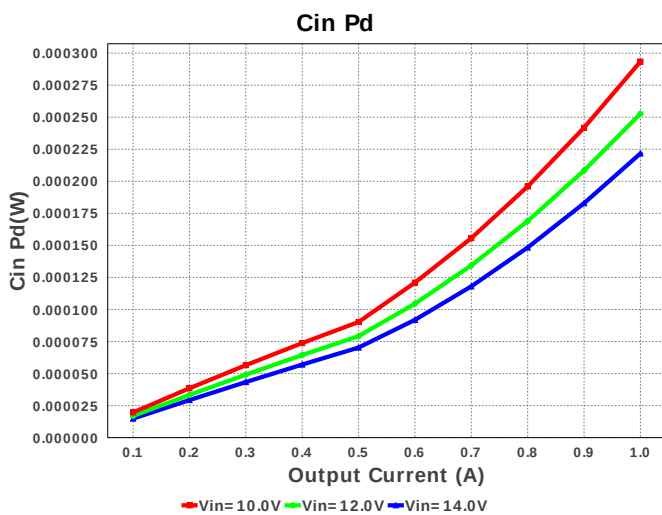
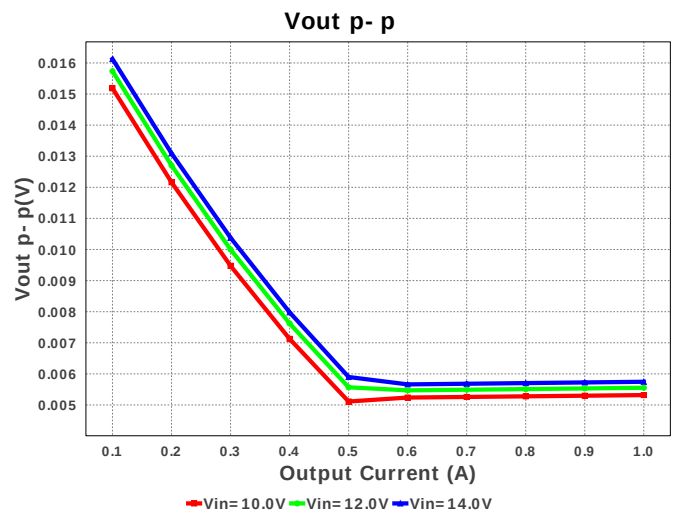
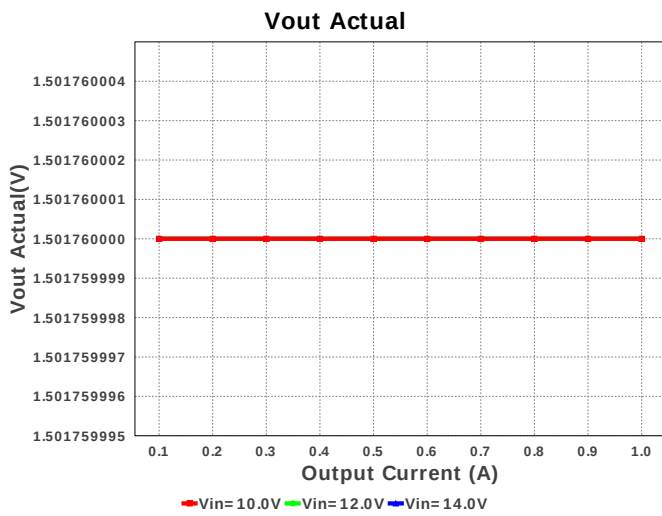
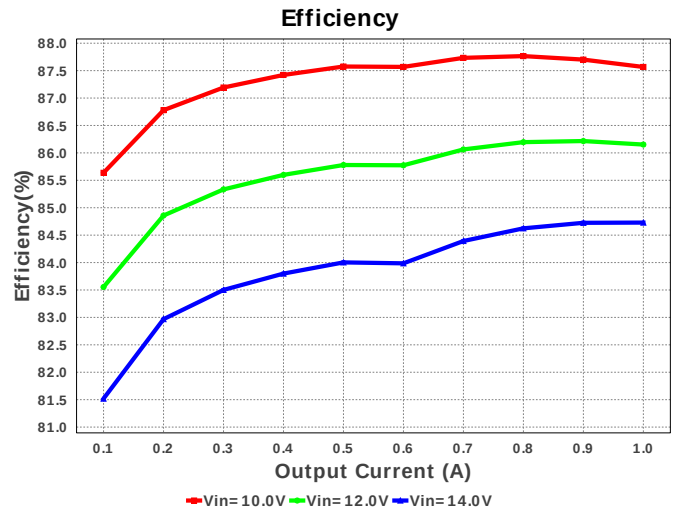
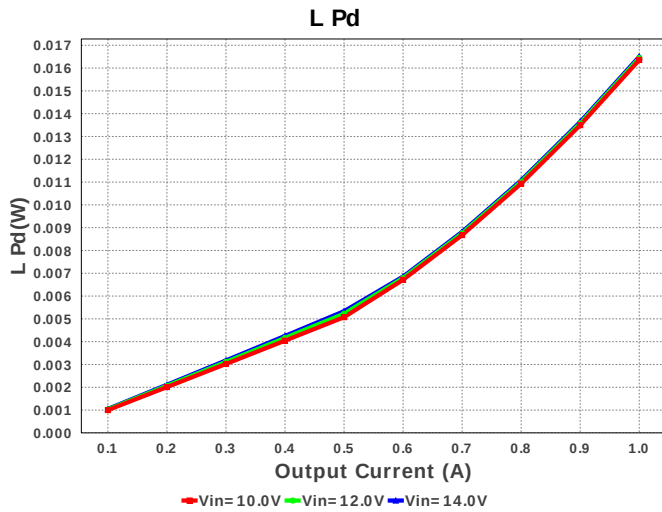
Design : 1194016/2186 TPS563201DDCR
TPS563201DDCR 10.0V-14.0V to 1.50V @ 1.0A

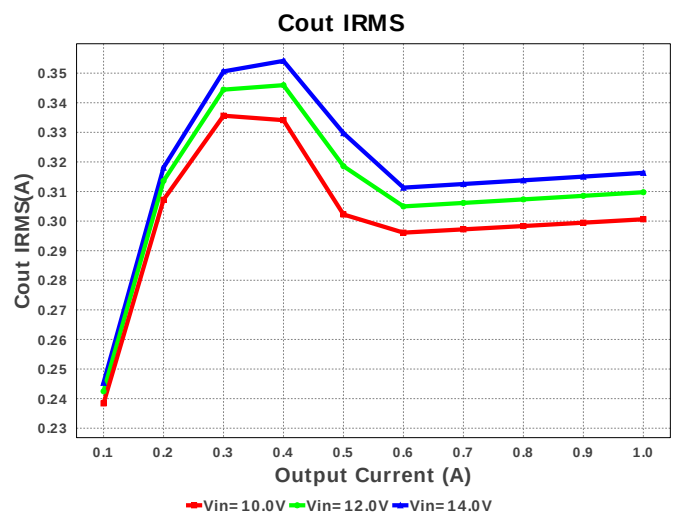
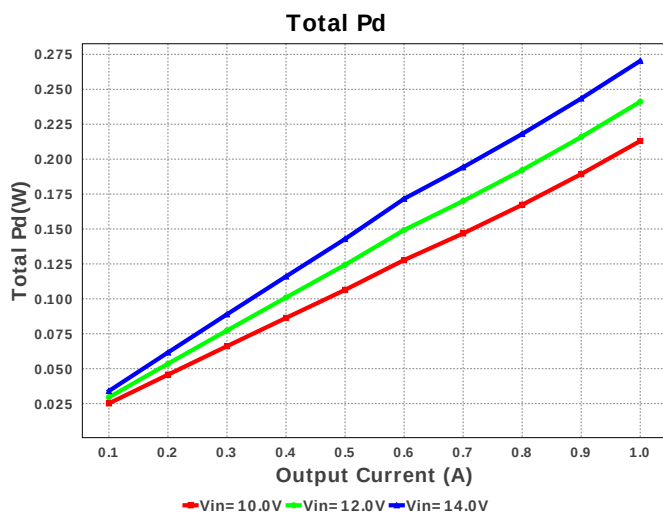
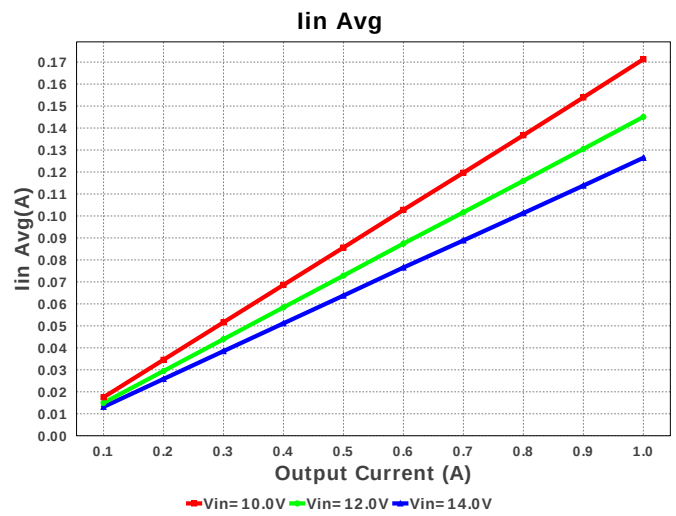
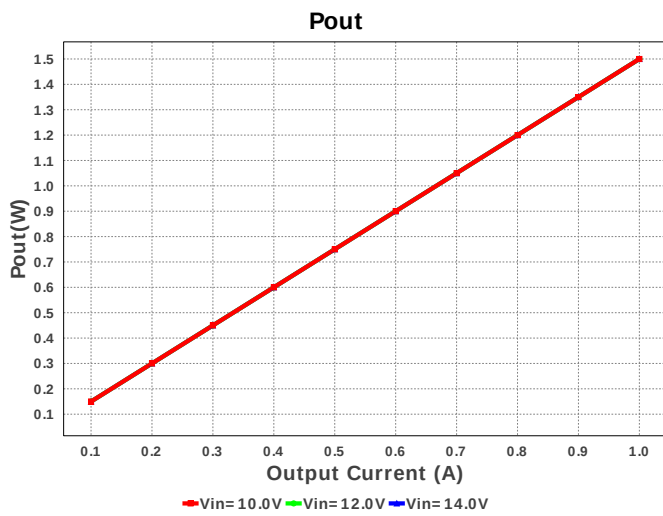
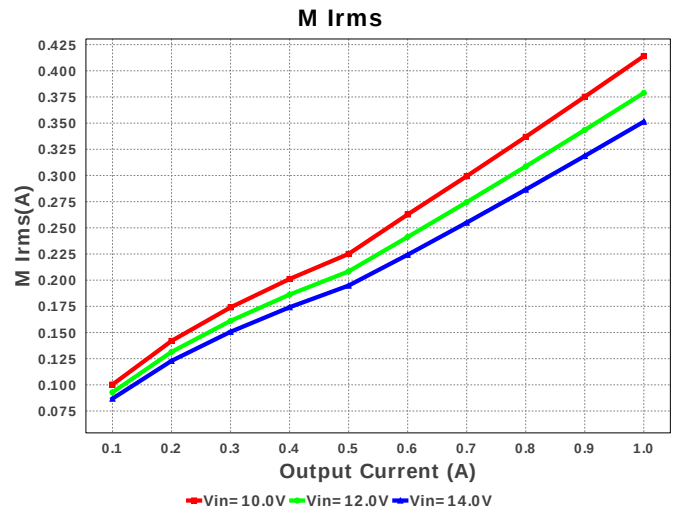
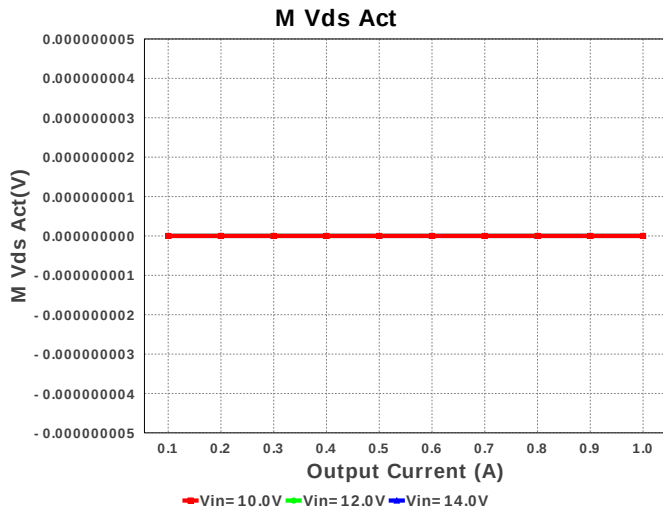


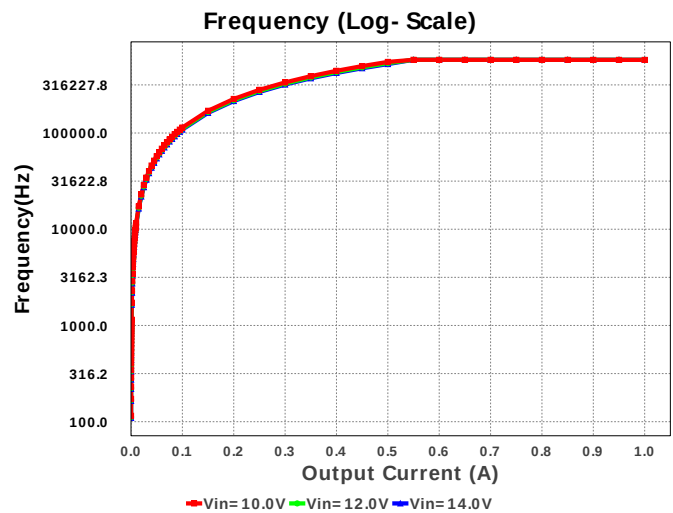
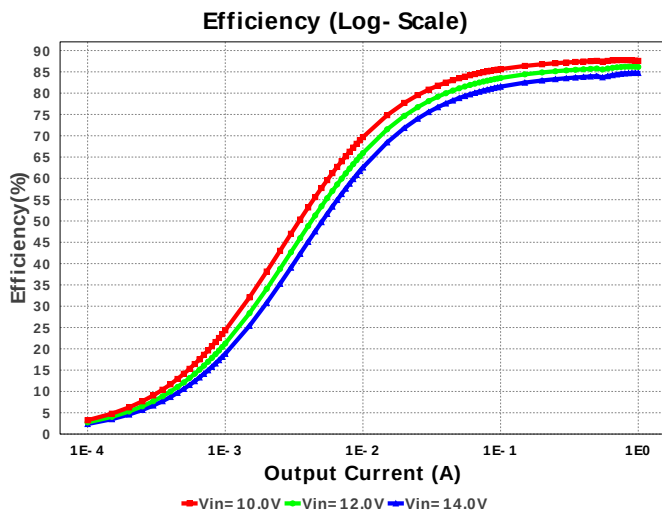
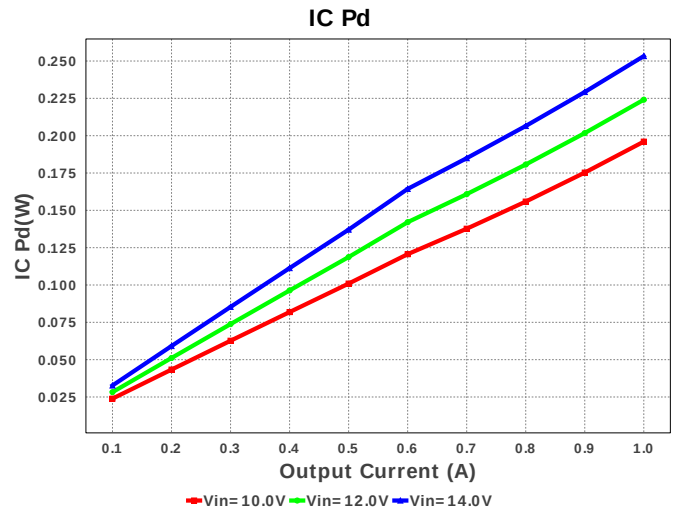
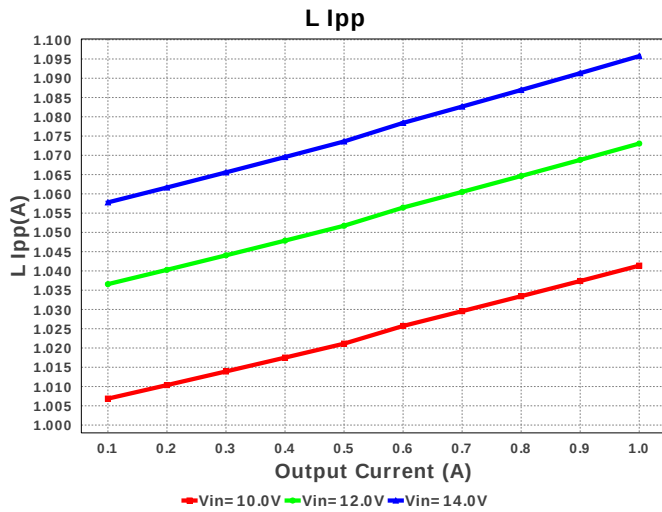
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbst	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm ²
2.	Cin	MuRata	GRM32ER61E226KE15L Series= X5R	Cap= 22.0 uF ESR= 2.0 mOhm VDC= 25.0 V IRMS= 3.67 A	1	\$0.16	 1210 15 mm ²
3.	Cout	TDK	C3216X5R1E476M160AC Series= X5R	Cap= 47.0 uF ESR= 2.082 mOhm VDC= 25.0 V IRMS= 5.0279 A	1	\$0.35	 1206 11 mm ²
4.	L1	TDK	VLP8040T-2R2N	L= 2.2 uH DCR= 15.0 mOhm	1	\$0.22	 VLP8040 113 mm ²
5.	Rfbb	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
6.	Rfbt	Vishay-Dale	CRCW04029K76FKED Series= CRCW..e3	Res= 9.76 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	TPS563201DDCR	Switcher	1	\$0.40	 DDC0006A 10 mm ²









Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	332.963 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	316.315 mA	Current	Output capacitor RMS ripple current
3.	IC Ipk	1.548 A	Current	Peak switch current in IC
4.	Iin Avg	126.45 mA	Current	Average input current
5.	L Ipp	1.096 A	Current	Peak-to-peak inductor ripple current
6.	M1 Irms	351.369 mA	Current	Q lavg
7.	BOM Count	7	General	Total Design BOM count
8.	FootPrint	162.0 mm ²	General	Total Foot Print Area of BOM components
9.	Frequency	576.353 kHz	General	Switching frequency
10.	IC Tolerance	19.0 mV	General	IC Feedback Tolerance
11.	M Vds Act	0.0 V	General	Voltage drop across the MosFET
12.	Pout	1.5 W	General	Total output power
13.	Total BOM	\$1.16	General	Total BOM Cost
14.	Vout Actual	1.502 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	11.223 %	Op_point	Duty cycle
17.	Efficiency	84.729 %	Op_point	Steady state efficiency
18.	IC Tj	45.932 degC	Op_point	IC junction temperature
19.	ICThetaJA	62.9 degC/W	Op_point	IC junction-to-ambient thermal resistance
20.	IOUT_OP	1.0 A	Op_point	Iout operating point
21.	VIN_OP	14.0 V	Op_point	Vin operating point
22.	Vout p-p	5.746 mV	Op_point	Peak-to-peak output ripple voltage
23.	Cin Pd	221.729 μ W	Power	Input capacitor power dissipation
24.	Cout Pd	208.315 μ W	Power	Output capacitor power dissipation
25.	IC Pd	253.299 mW	Power	IC power dissipation
26.	L Pd	16.501 mW	Power	Inductor power dissipation
27.	Total Pd	270.343 mW	Power	Total Power Dissipation
28.	Vout Tolerance	3.523 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	1.0	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	TPS563201	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	30.0	Ambient temperature

Design Assistance

1. **TPS563201** Product Folder : <http://www.ti.com/product/TPS563201> : contains the data sheet and other resources.

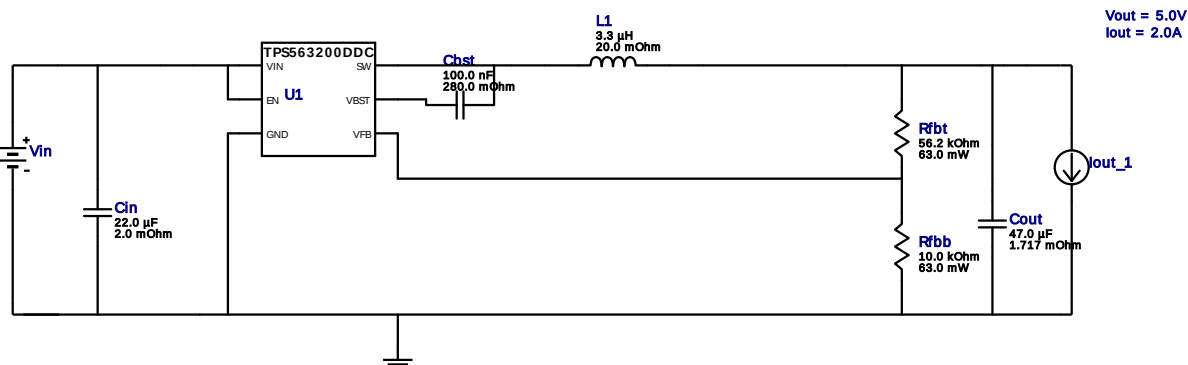


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Iout = 2.0A

Device = TPS563200DDCR
Topology = Buck
Created = 7/24/16 7:24:34 AM
BOM Cost = \$1.31
BOM Count = 7
Total Pd = 0.6W

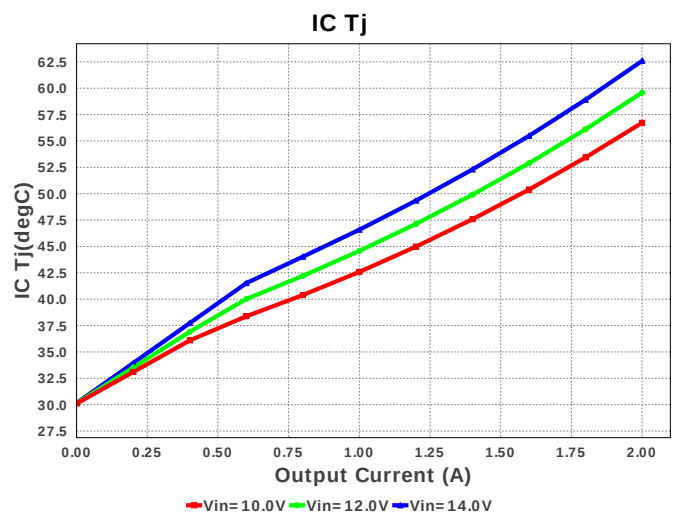
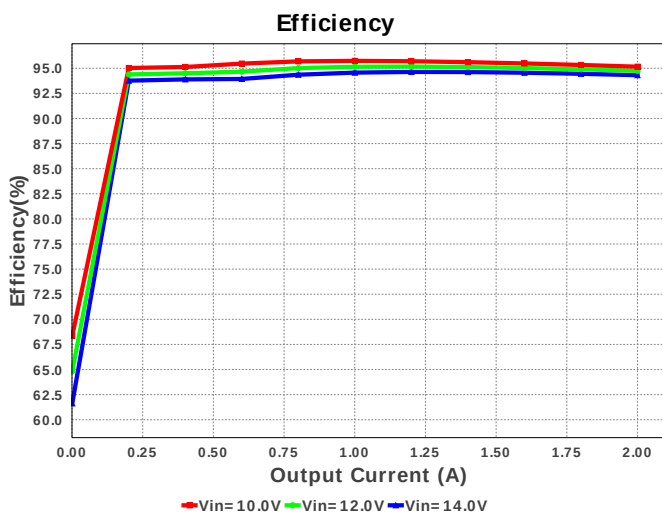
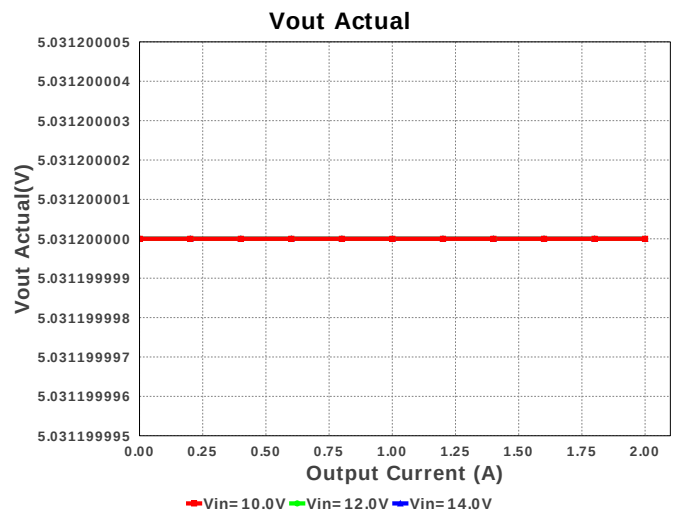
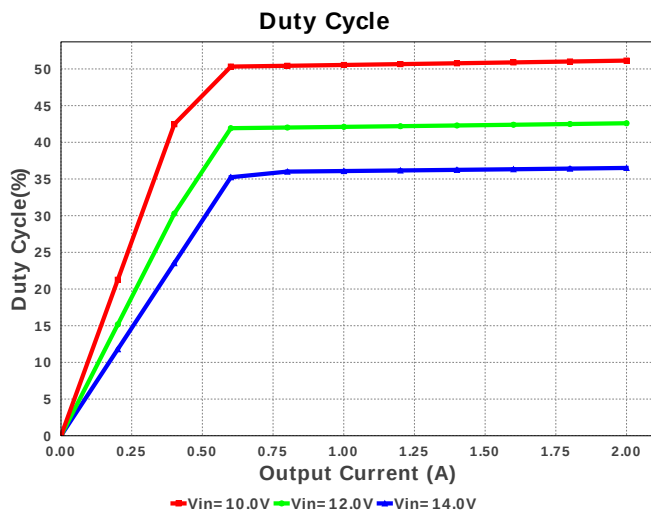
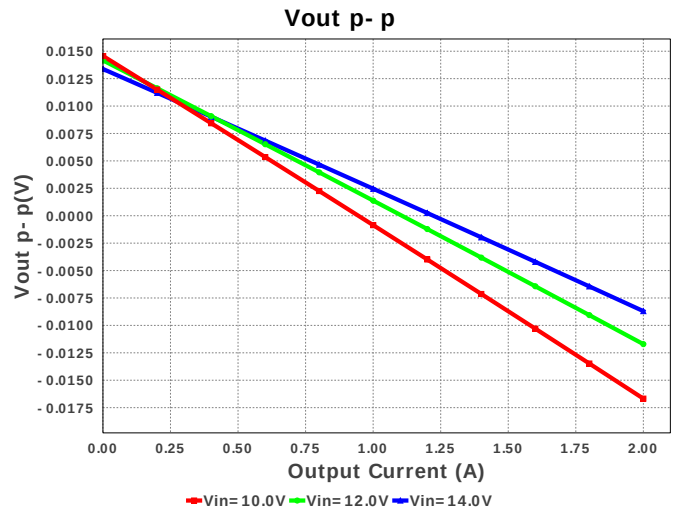
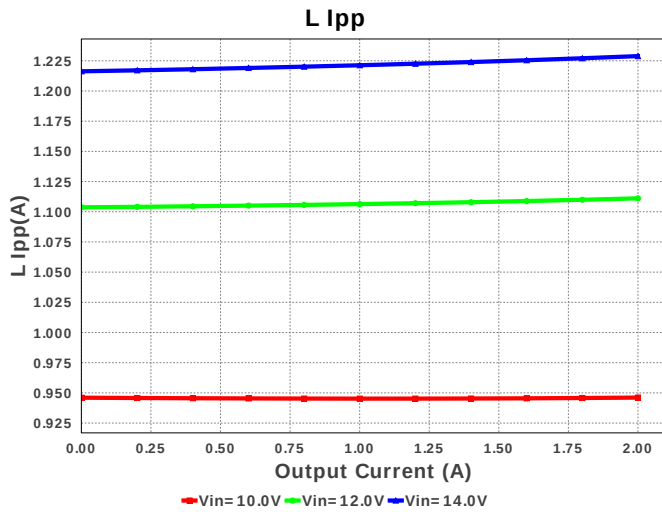
WEBENCH® Design Report

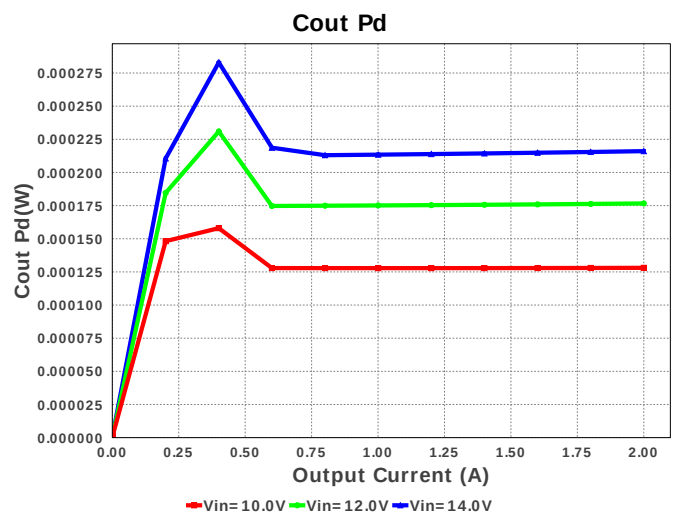
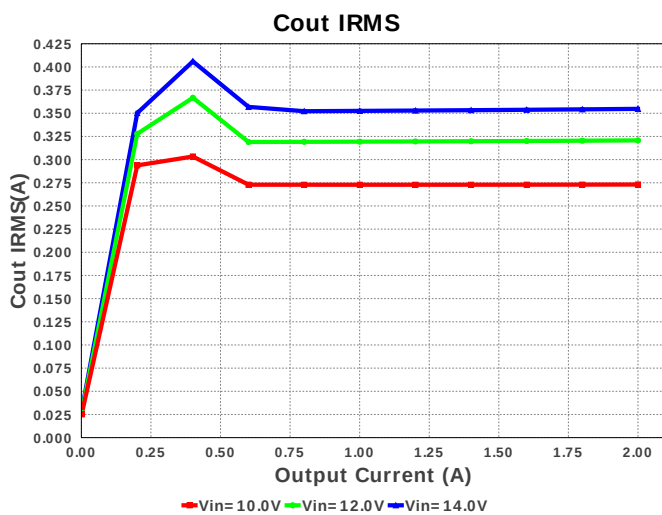
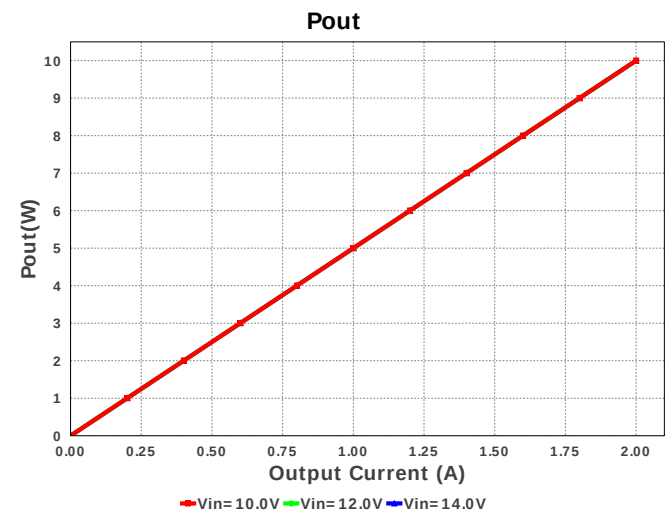
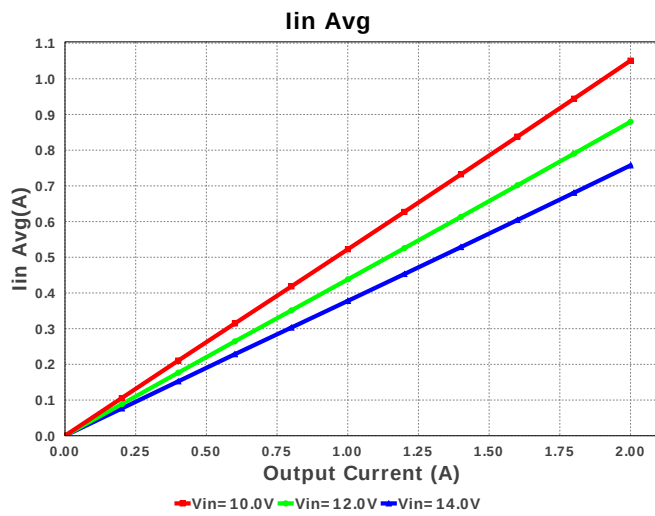
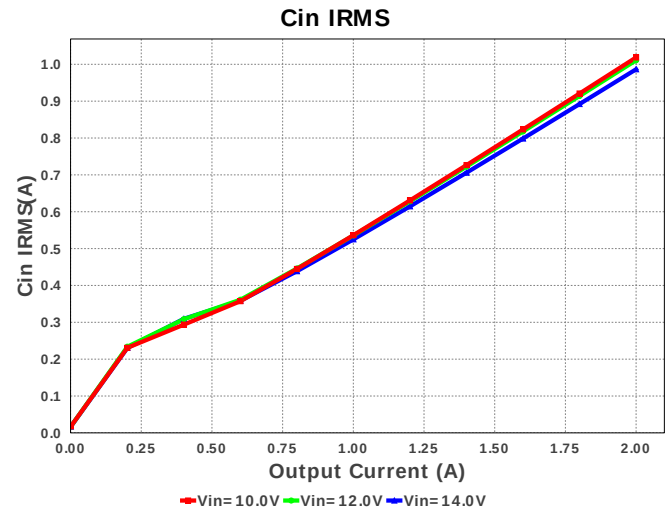
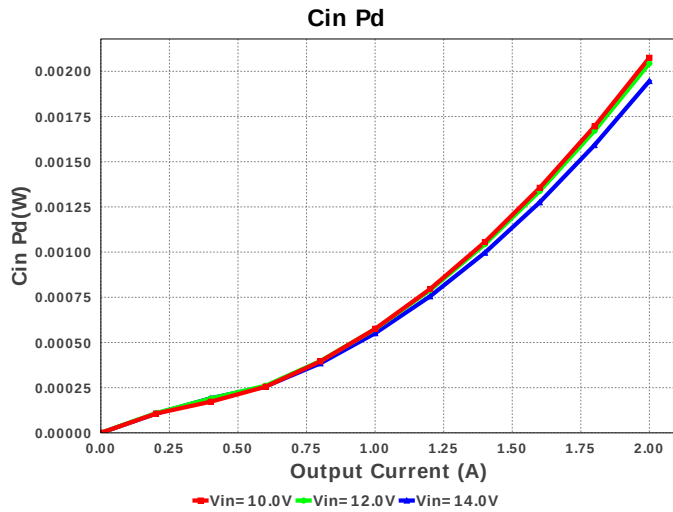
Design : 1194016/2187 TPS563200DDCR
TPS563200DDCR 10.0V-14.0V to 5.00V @ 2.0A

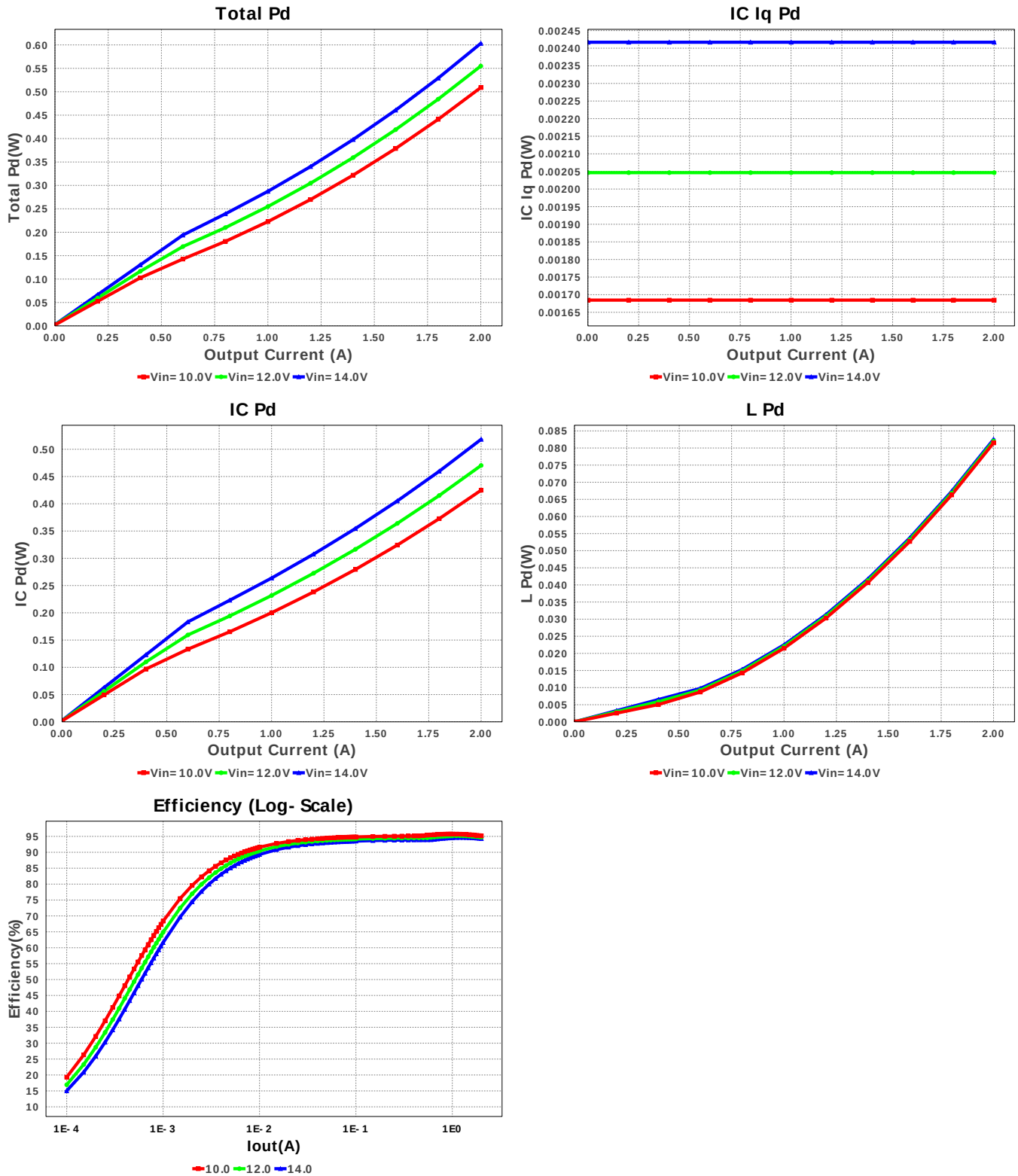


Electrical BOM

#	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 mm ²
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 mm ²
3.	Cout	TDK	C3216JB1A476M Series= JB	Cap= 47.0 uF ESR= 1.717 mOhm VDC= 10.0 V IRMS= 0.0 A	1	\$0.34	1206 11 mm ²
4.	L1	Bourns	SRR6038-3R3Y	L= 3.3 uH DCR= 20.0 mOhm	1	\$0.26	SRR6038 77 mm ²
5.	Rfbb	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
6.	Rfht	Vishay-Dale	CRCW040256K2FKED Series= CRCW..e3	Res= 56.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
7.	U1	Texas Instruments	TPS563200DDCR	Switcher	1	\$0.52	DDC0006A 10 mm ²







Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	986.458 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	354.75 mA	Current	Output capacitor RMS ripple current
3.	Iin Avg	757.37 mA	Current	Average input current
4.	L Ipp	1.229 A	Current	Peak-to-peak inductor ripple current
5.	BOM Count	7	General	Total Design BOM count
6.	FootPrint	126.0 mm ²	General	Total Foot Print Area of BOM components
7.	Frequency	798.19 kHz	General	Switching frequency
8.	Pout	10.0 W	General	Total output power
9.	Total BOM	\$1.31	General	Total BOM Cost
10.	Vout Actual	5.031 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
11.	Vout OP	5.0 V	Op_Point	Operational Output Voltage

#	Name	Value	Category	Description
12.	Duty Cycle	36.505 %	Op_point	Duty cycle
13.	Efficiency	94.311 %	Op_point	Steady state efficiency
14.	IC Tj	62.592 degC	Op_point	IC junction temperature
15.	ICThetaJA	62.9 degC/W	Op_point	IC junction-to-ambient thermal resistance
16.	IOUT_OP	2.0 A	Op_point	Iout operating point
17.	VIN_OP	14.0 V	Op_point	Vin operating point
18.	Vout p-p	5.0 mV	Op_point	Peak-to-peak output ripple voltage
19.	Cin Pd	1.946 mW	Power	Input capacitor power dissipation
20.	Cout Pd	216.08 µW	Power	Output capacitor power dissipation
21.	IC Iq Pd	2.417 mW	Power	IC Iq Pd
22.	IC Pd	518.151 mW	Power	IC power dissipation
23.	L Pd	82.517 mW	Power	Inductor power dissipation
24.	Total Pd	603.215 mW	Power	Total Power Dissipation
25.	Vout Tolerance	3.053 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	2.0	Maximum Output Current
2.	VinMax	14.0	Maximum input voltage
3.	VinMin	10.0	Minimum input voltage
4.	Vout	5.0	Output Voltage
5.	base_pn	TPS563200	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	30.0	Ambient temperature

Design Assistance

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

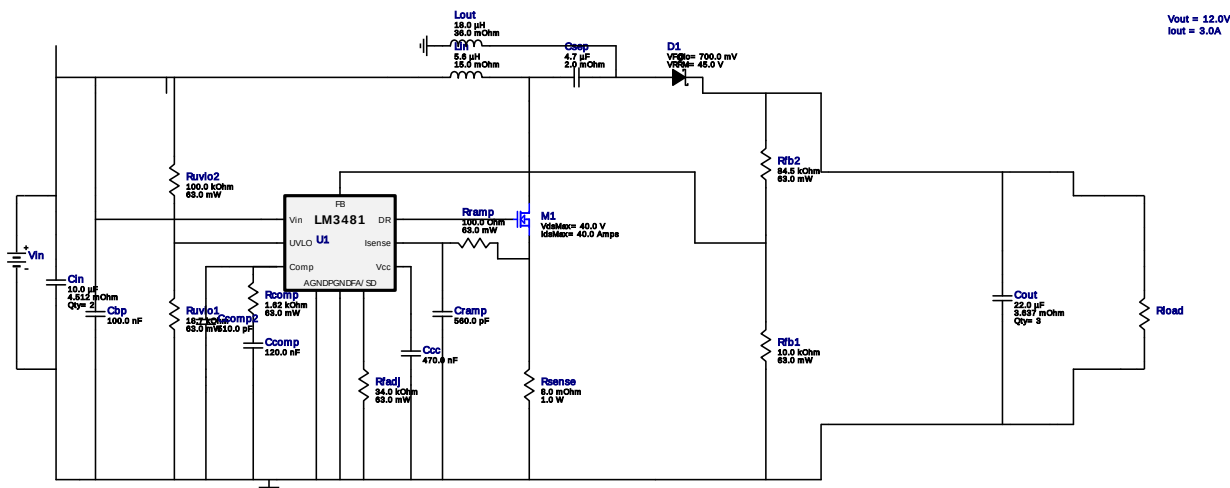


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Iout = 3.0A

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Topology = SEPIC
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BOM Count = 24
Total Pd = 4.34W

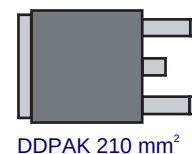
WEBENCH® Design Report

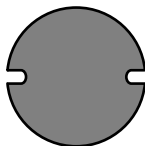
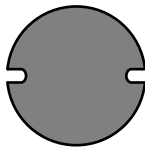
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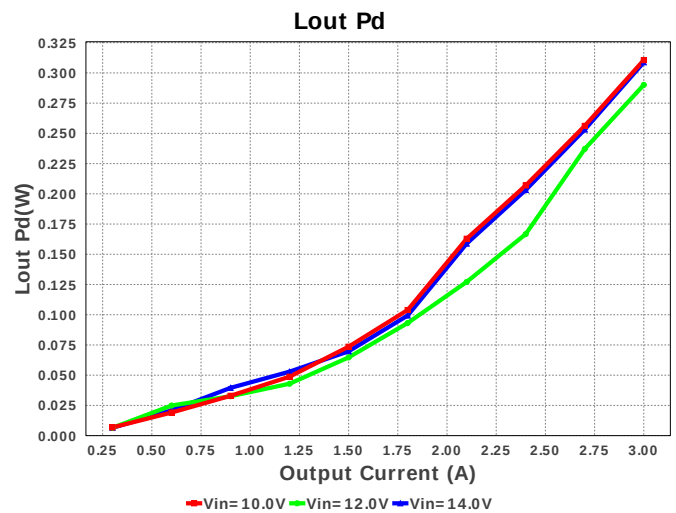
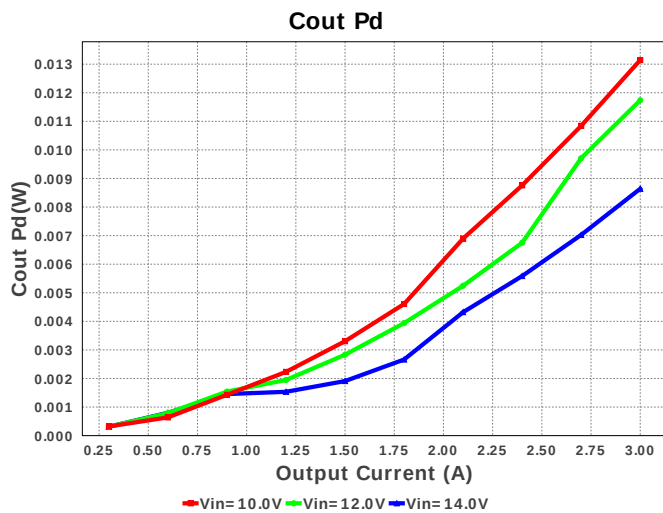
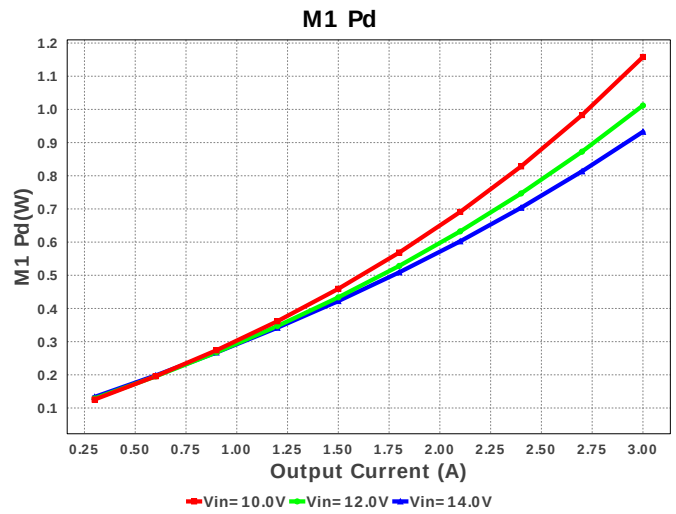
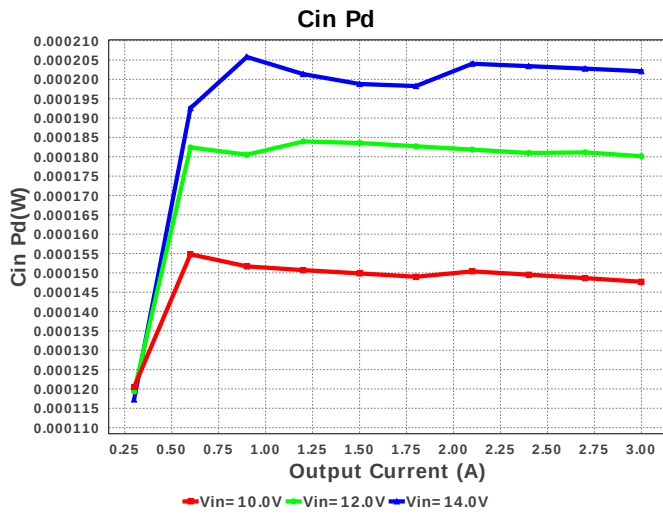
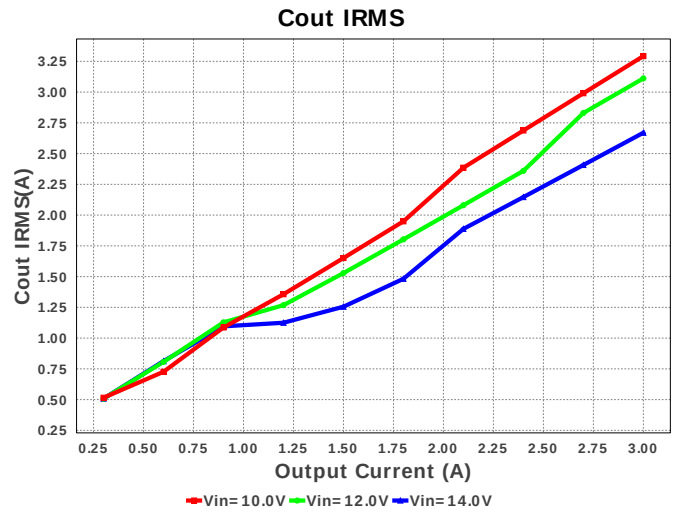
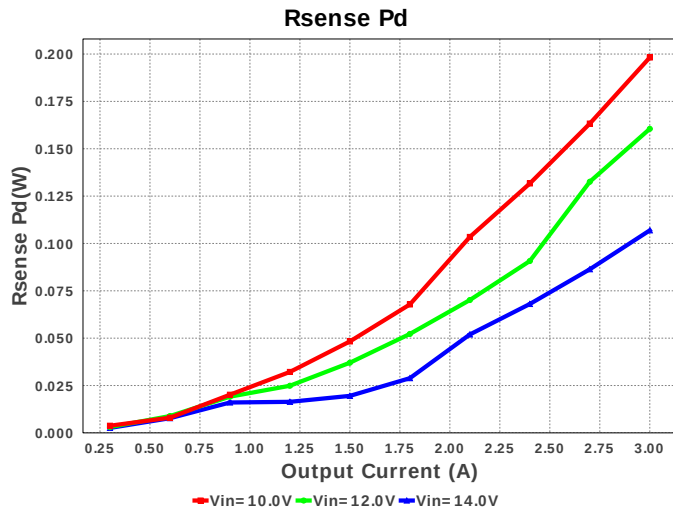


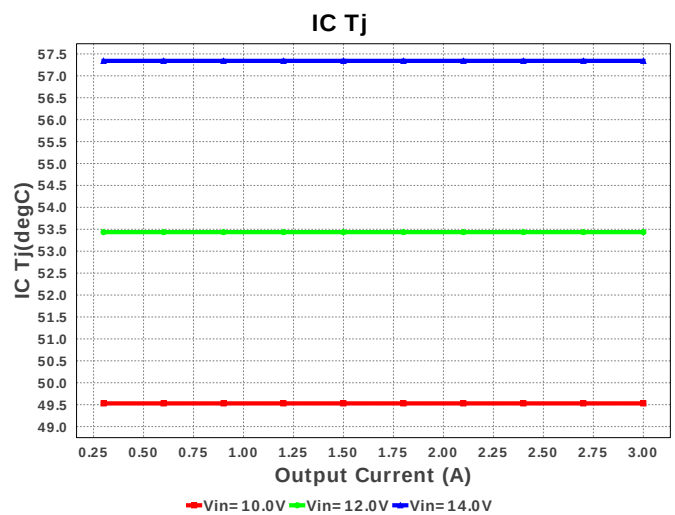
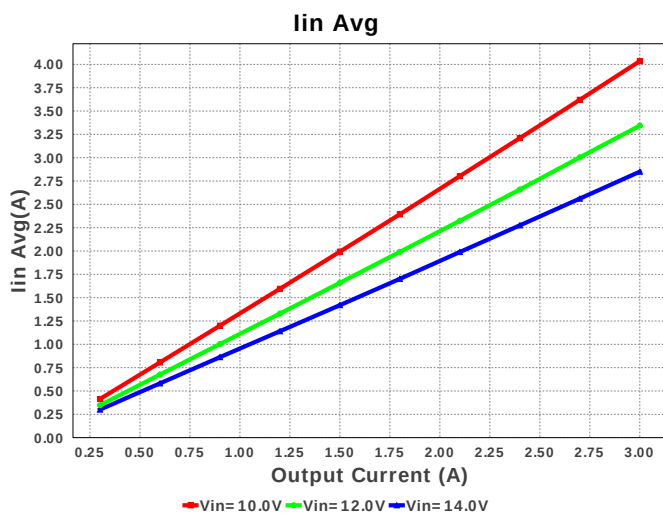
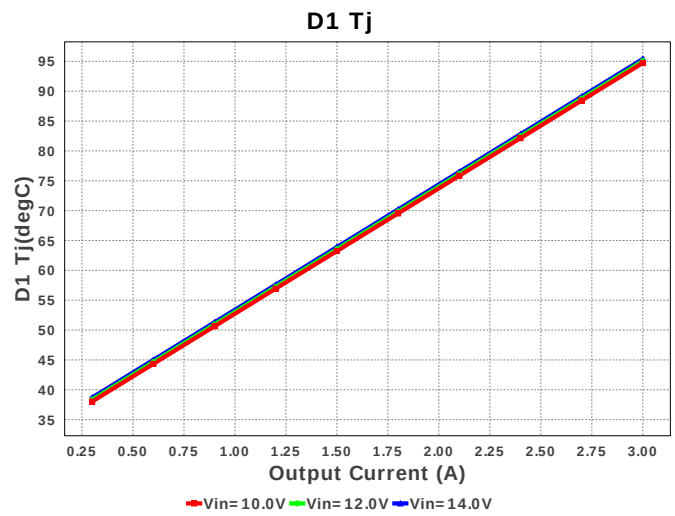
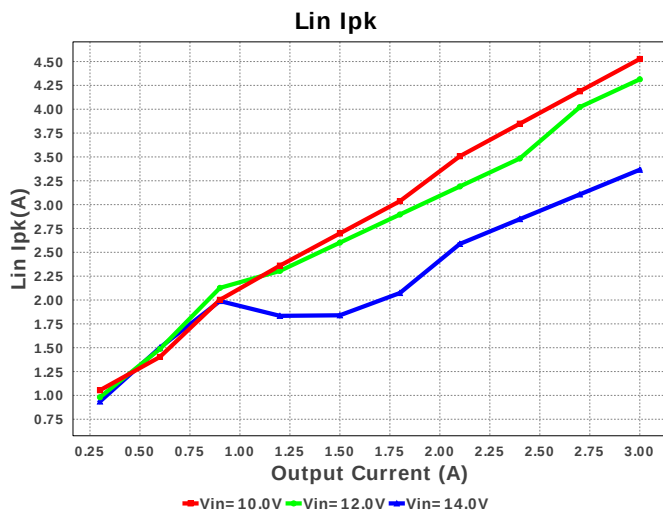
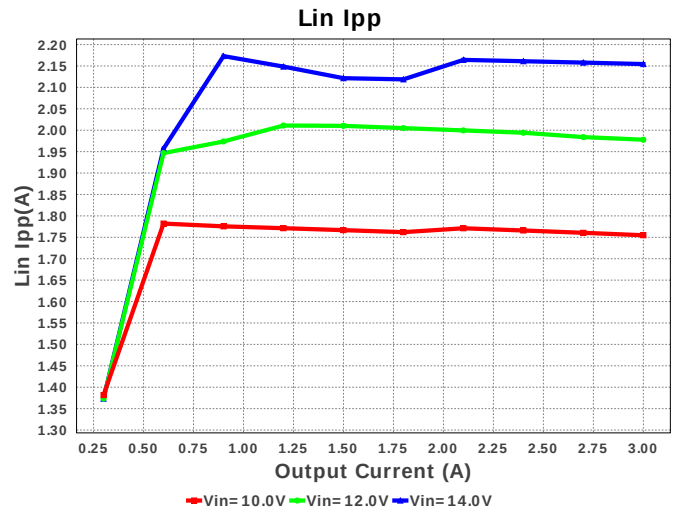
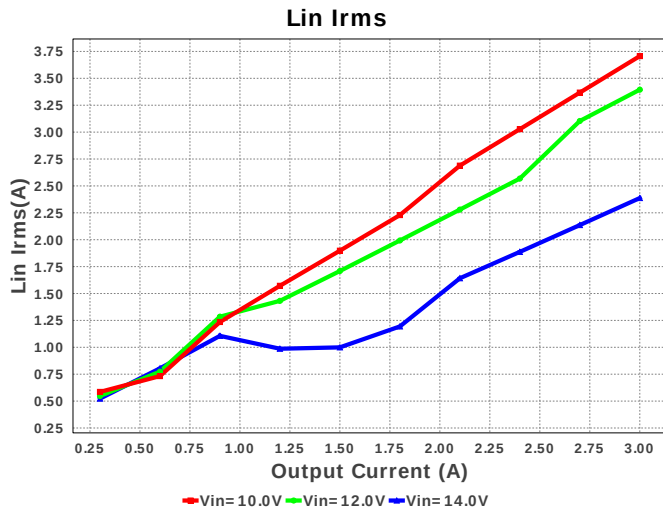
Electrical BOM

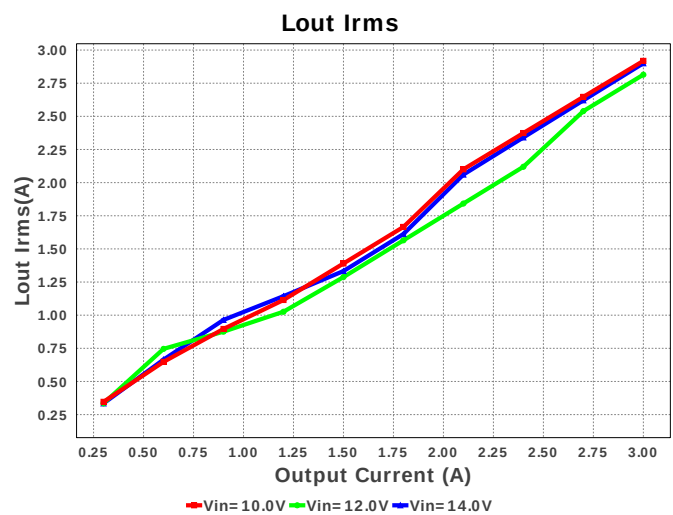
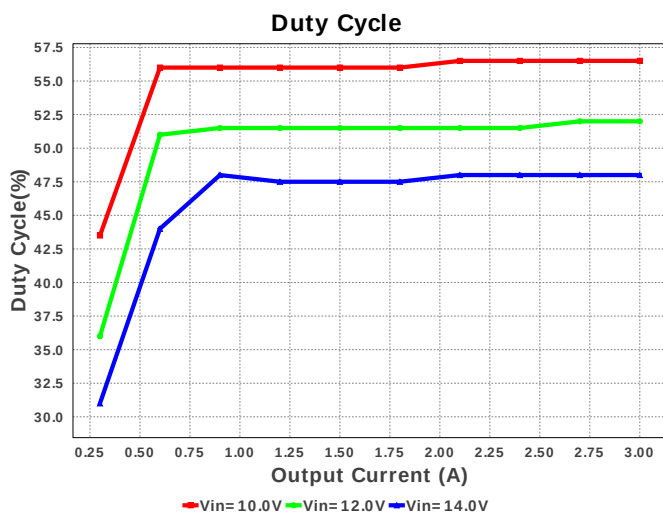
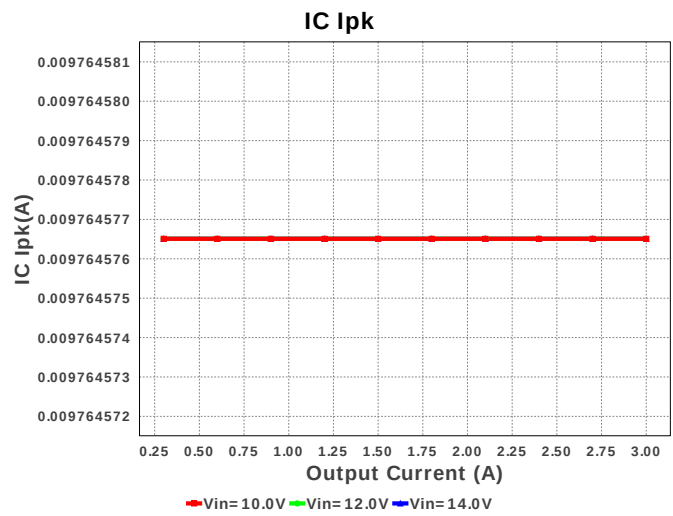
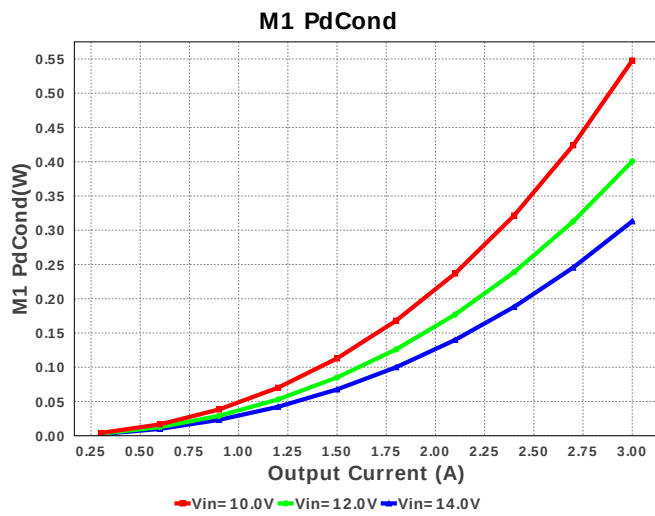
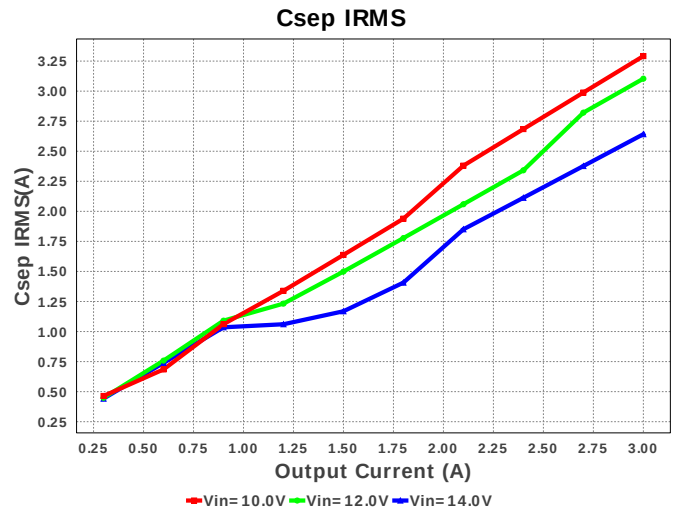
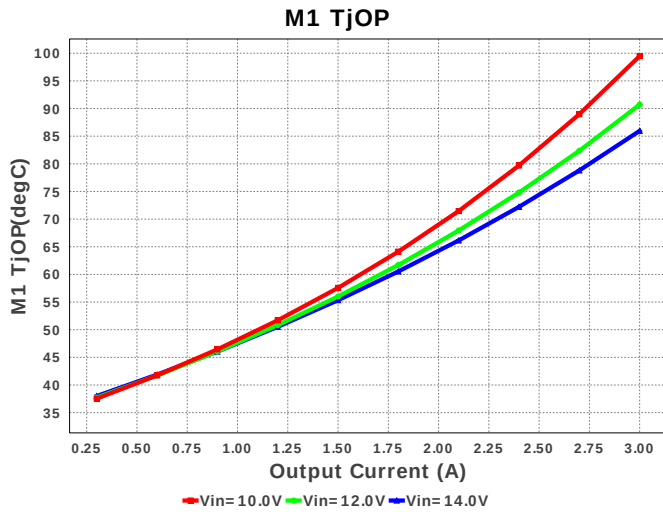
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbp	Kemet	C0603C104K3RACTU Series= X7R	Cap= 100.0 nF VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	0603 5 mm ²
2.	Ccc	MuRata	GRM155R61A474KE15D Series= X5R	Cap= 470.0 nF VDC= 10.0 V IRMS= 0.0 A	1	\$0.01	0402 3 mm ²
3.	Ccomp	MuRata	GRM155C80J124KE01D Series= X6S	Cap= 120.0 nF VDC= 6.3 V IRMS= 0.0 A	1	\$0.02	0402 3 mm ²
4.	Ccomp2	MuRata	GRM1555C1H511JA01D Series= C0G/NP0	Cap= 510.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0402 3 mm ²
5.	Cin	MuRata	GRM31CR61E106KA12L Series= X5R	Cap= 10.0 uF ESR= 4.512 mOhm VDC= 25.0 V IRMS= 2.447 A	2	\$0.05	1206_190 11 mm ²
6.	Cout	MuRata	GRM31CR61C226ME15L Series= X5R	Cap= 22.0 uF ESR= 3.637 mOhm VDC= 16.0 V IRMS= 3.4771 A	3	\$0.13	1206_190 11 mm ²
7.	Cramp	Yageo America	CC0805KRX7R9BB561 Series= X7R	Cap= 560.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
8.	Csep	MuRata	GRM21BR61E475MA12L Series= X5R	Cap= 4.7 uF ESR= 2.0 mOhm VDC= 25.0 V IRMS= 7.29 A	1	\$0.02	0805 7 mm ²
9.	D1	Vishay-Semiconductor	MBRB745PBF	VF@Io= 700.0 mV VRRM= 45.0 V	1	\$0.84	

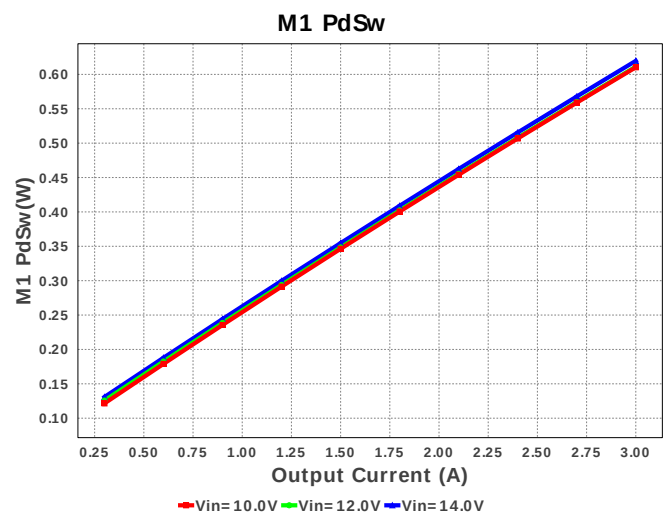
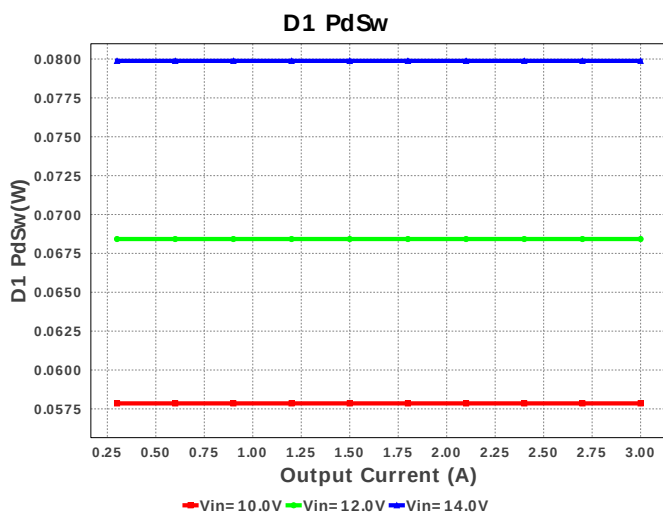
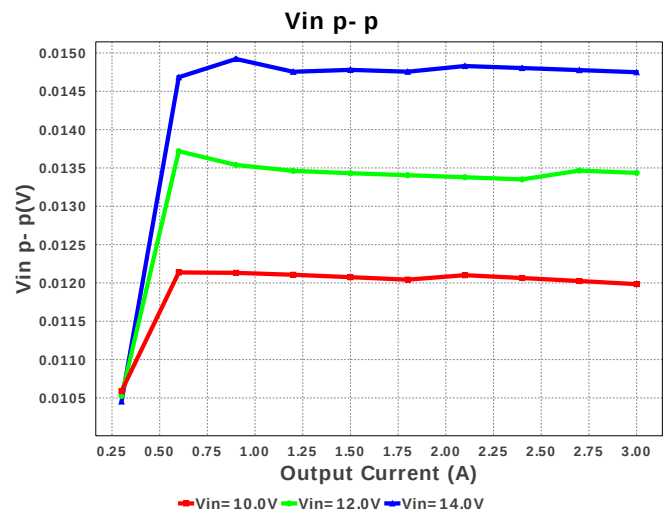
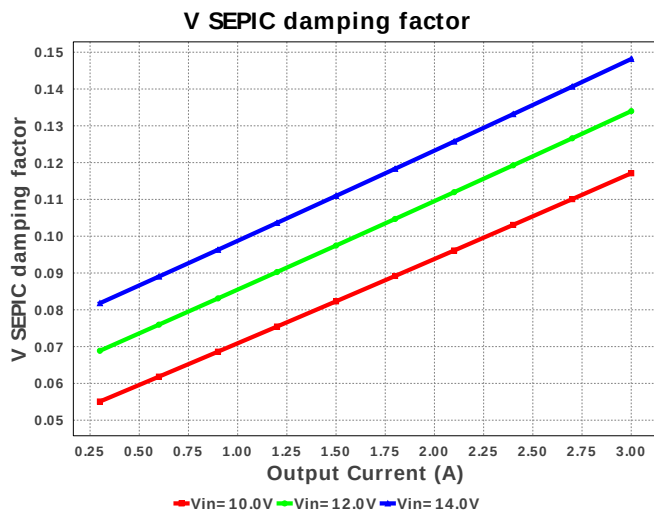
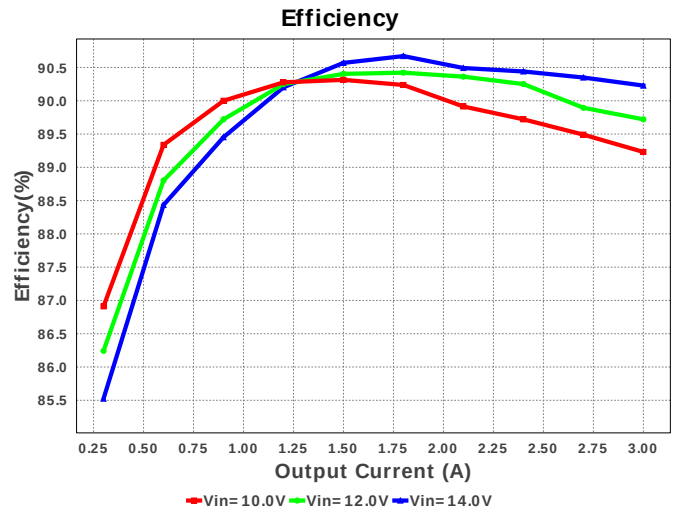
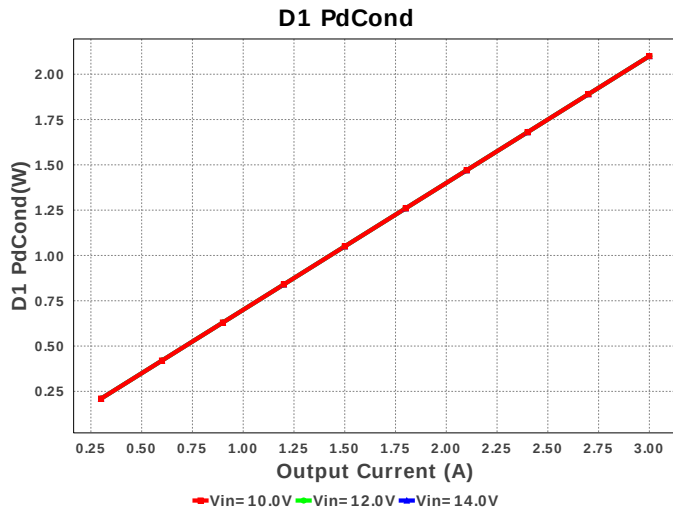


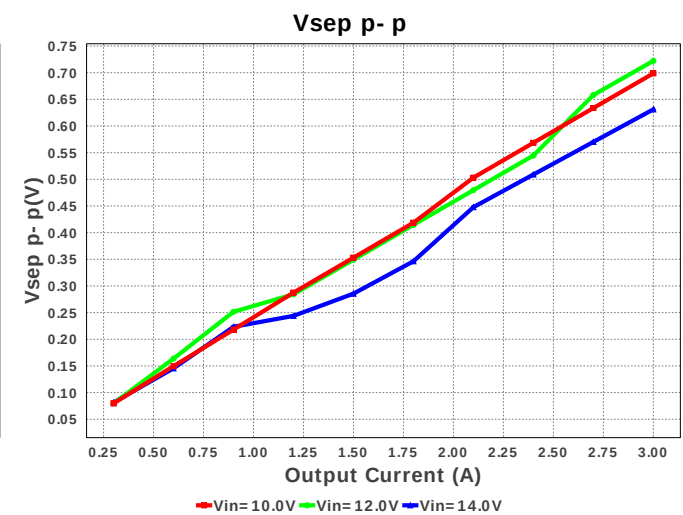
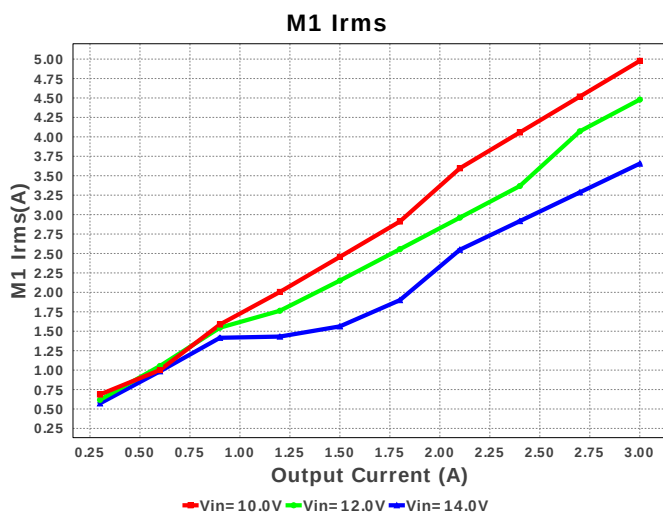
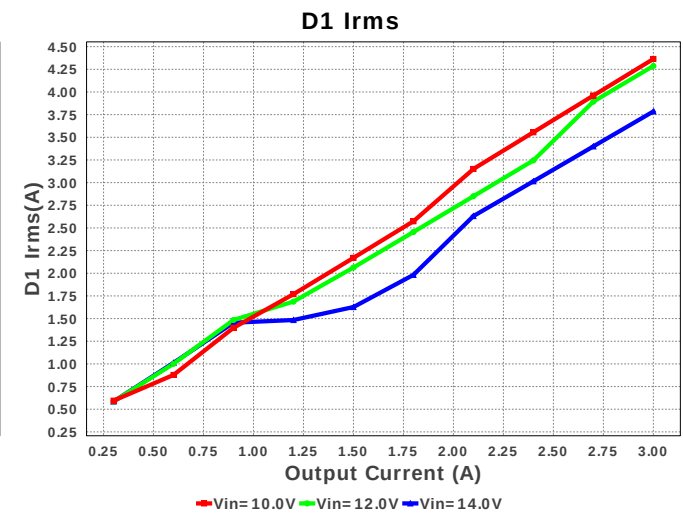
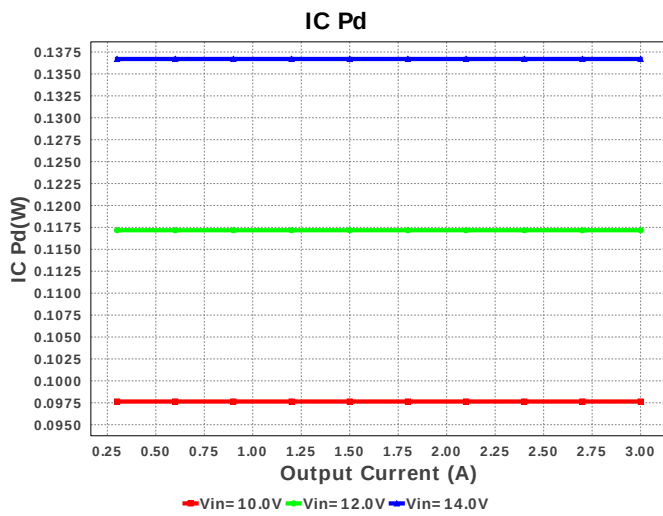
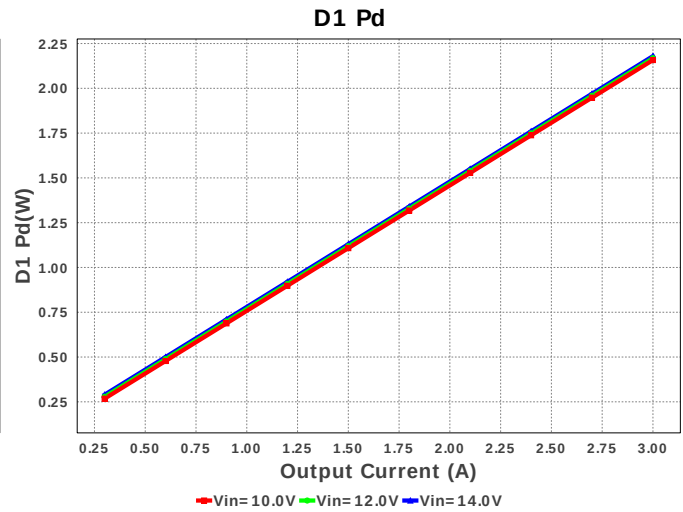
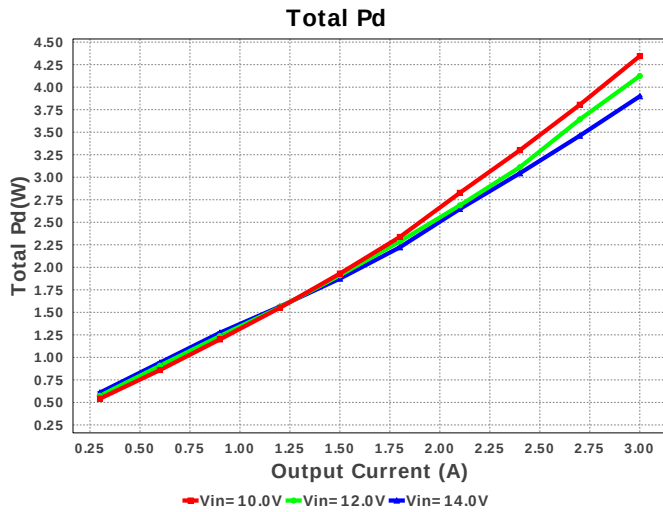
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	Lin	Bourns	SDR1307-5R6ML	L= 5.6 μ H DCR= 15.0 mOhm	1	\$0.35	 SDR1307 227 mm ²
11.	Lout	Bourns	SDR1307-180ML	L= 18.0 μ H DCR= 36.0 mOhm	1	\$0.35	 SDR1307 227 mm ²
12.	M1	Infineon Technologies	BSZ097N04LS G	VdsMax= 40.0 V IdsMax= 40.0 Amps	1	\$0.26	 PG-TSDSON-8 19 mm ²
13.	Rcomp	Vishay-Dale	CRCW04021K62FKED Series= CRCW..e3	Res= 1.62 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
14.	Rfadj	Vishay-Dale	CRCW040234K0FKED Series= CRCW..e3	Res= 34.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
15.	Rfb1	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
16.	Rfb2	Vishay-Dale	CRCW040284K5FKED Series= CRCW..e3	Res= 84.5 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
17.	Rramp	Vishay-Dale	CRCW0402100RFKED Series= CRCW..e3	Res= 100.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
18.	Rsense	Susumu Co Ltd	PRL1632-R008-F-T1 Series= PRL1632	Res= 8.0 mOhm Power= 1.0 W Tolerance= 1.0%	1	\$0.19	 0612 11 mm ²
19.	Ruvlo1	Vishay-Dale	CRCW040218K7FKED Series= CRCW..e3	Res= 18.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
20.	Ruvlo2	Vishay-Dale	CRCW0402100KFKED Series= CRCW..e3	Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
21.	U1	Texas Instruments	LM3481MM/NOPB	Switcher	1	\$0.80	 MUB10A 24 mm ²

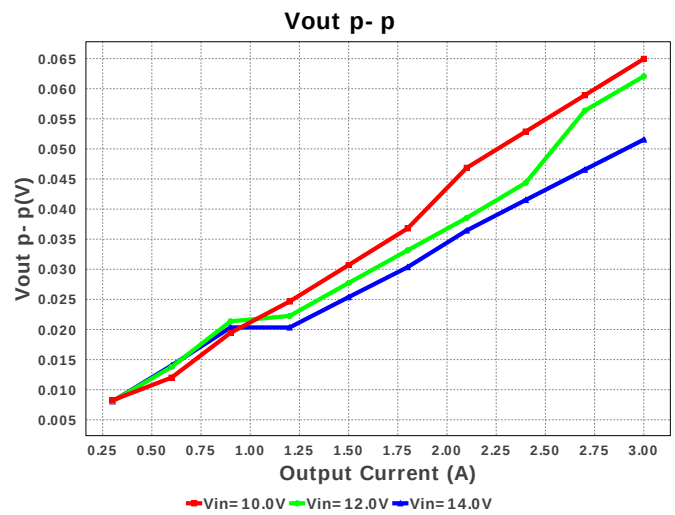
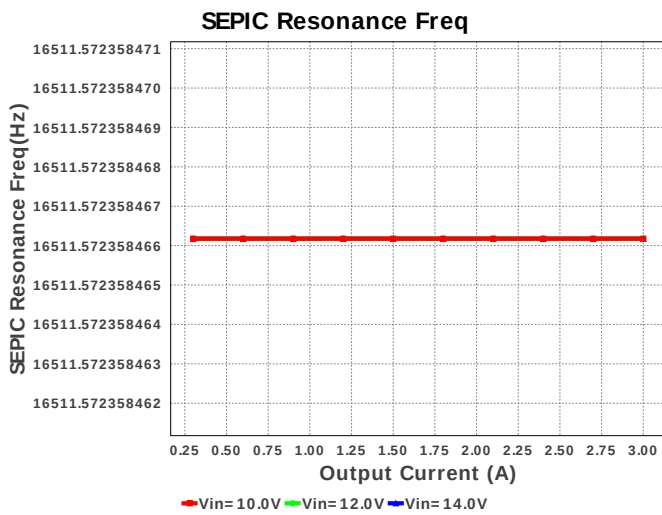
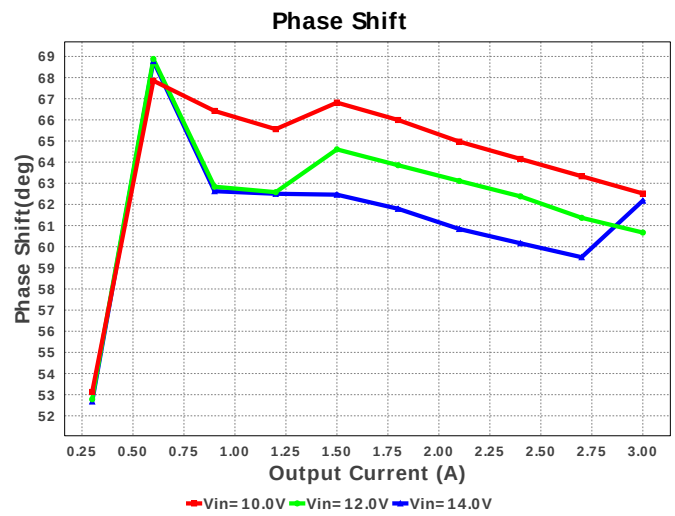
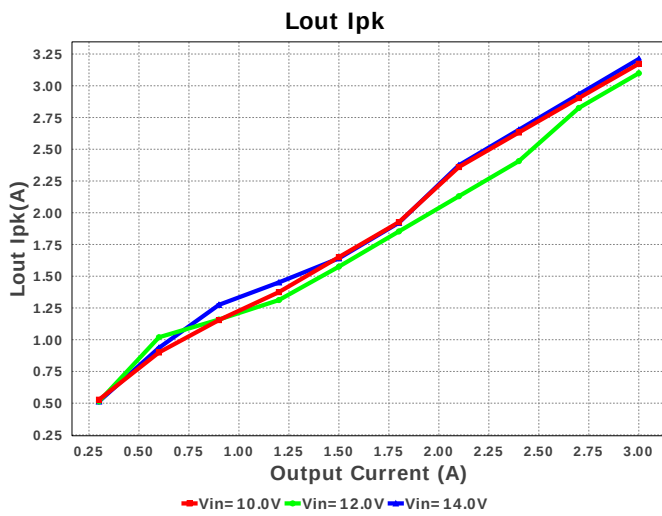
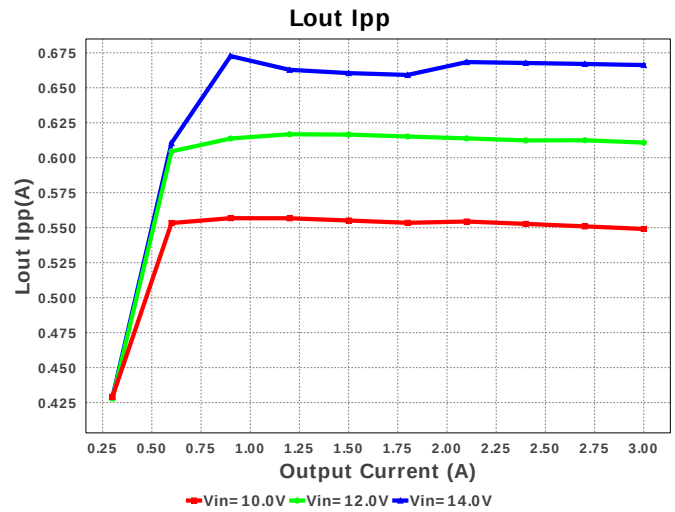
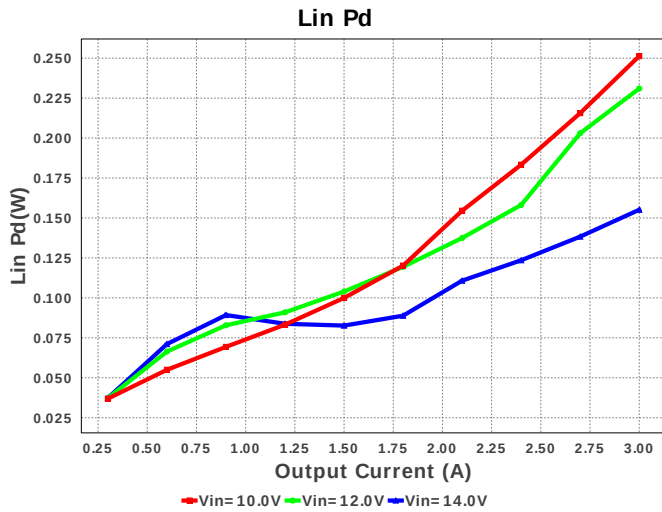


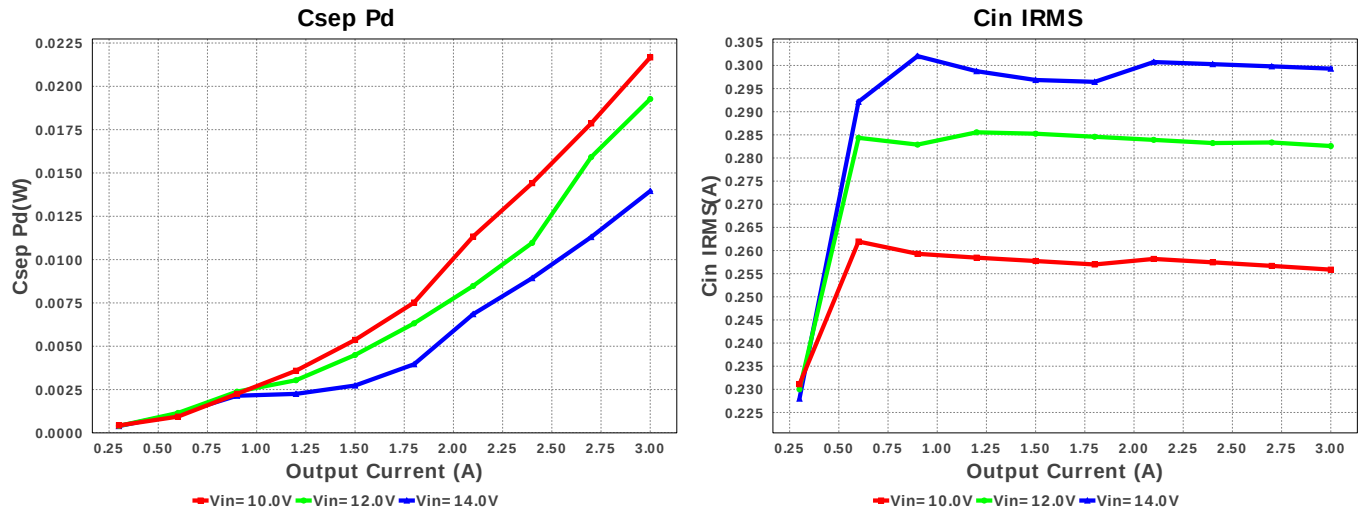












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	256.511 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	3.299 A	Current	Output capacitor RMS ripple current
3.	Csep IRMS	3.298 A	Current	SEPIC capacitor RMS ripple current
4.	D1 Irms	4.373 A	Current	D1 Irms
5.	IC Ipk	9.73 mA	Current	Peak switch current in IC
6.	Iin Avg	4.034 A	Current	Average input current
7.	Iin Ipk	4.569 A	Current	Iin peak current
8.	Iin Ipp	1.767 A	Current	Peak-to-peak input inductor ripple current
9.	Iin Irms	3.743 A	Current	Iin ripple current
10.	Iout Ipk	3.151 A	Current	Iout peak current
11.	Iout Ipp	552.988 mA	Current	Peak-to-peak output inductor ripple current
12.	Iout Irms	2.895 A	Current	Iout ripple current
13.	M1 Irms	4.987 A	Current	M1 MOSFET Irms
14.	BOM Count	24	General	Total Design BOM count
15.	FootPrint	819.0 mm ²	General	Total Foot Print Area of BOM components
16.	Frequency	550.0 kHz	General	Switching frequency
17.	IC Tolerance	19.0 mV	General	IC Feedback Tolerance
18.	Total BOM	\$3.42	General	Total BOM Cost
19.	D1 Tj	94.723 degC	Op_Point	D1 junction temperature
20.	SEPIC Resonance Freq	16.512 kHz	Op_Point	SEPIC Resonance Frequency
21.	V SEPIC damping factor	117.173 m	Op_Point	V SEPIC damping factor
22.	Vin p-p	12.11 mV	Op_Point	Peak-to-peak input voltage
23.	Vsep p-p	710.626 mV	Op_Point	Peak-to-peak sepic voltage
24.	Cross Freq	11.623 kHz	Op_point	Bode plot crossover frequency
25.	Duty Cycle	56.5 %	Op_point	Duty cycle
26.	Efficiency	89.237 %	Op_point	Steady state efficiency
27.	Gain Marg	10.436 db	Op_point	Bode Plot Gain Margin
28.	IC Tj	57.244 degC	Op_point	IC junction temperature
29.	IOUT_OP	3.0 A	Op_point	Iout operating point
30.	M1 TjOP	99.173 degC	Op_point	M1 MOSFET junction temperature
31.	Phase Marg	59.699 deg	Op_point	Bode Plot Phase Margin
32.	Phase Shift	62.481 deg	Op_point	Bode Plot Phase Shift
33.	VIN_OP	10.0 V	Op_point	Vin operating point
34.	Vout p-p	65.605 mV	Op_point	Peak-to-peak output ripple voltage
35.	Cin Pd	148.44 μ W	Power	Input capacitor power dissipation
36.	Cout Pd	13.197 mW	Power	Output capacitor power dissipation
37.	Csep Pd	21.755 mW	Power	SEPIC capacitor power dissipation
38.	D1 Pd	2.157 W	Power	Diode power dissipation
39.	D1 PdCond	2.1 W	Power	Diode conduction losses
40.	D1 PdSw	57.433 mW	Power	Diode switching losses
41.	IC Pd	136.22 mW	Power	IC power dissipation
42.	Iin Pd	255.685 mW	Power	Iin power dissipation
43.	Iout Pd	305.66 mW	Power	Iout power dissipation
44.	M1 Pd	1.153 W	Power	M1 MOSFET total power dissipation
45.	M1 PdCond	546.987 mW	Power	M1 MOSFET conduction losses
46.	M1 PdSw	605.882 mW	Power	M1 MOSFET switching losses
47.	Rsense Pd	198.972 mW	Power	LED Current Rsns Power Dissipation
48.	Total Pd	4.342 W	Power	Total Power Dissipation

Design Inputs

#	Name	Value	Description
1.	Iout	3.0	Maximum Output Current
2.	VinMax	14.0	Maximum input voltage
3.	VinMin	10.0	Minimum input voltage
4.	Vout	12.0	Output Voltage
5.	base_pn	LM3481	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	30.0	Ambient temperature

Design Assistance

1. **LM3481** Product Folder : <http://www.ti.com/product/LM3481> : contains the data sheet and other resources.

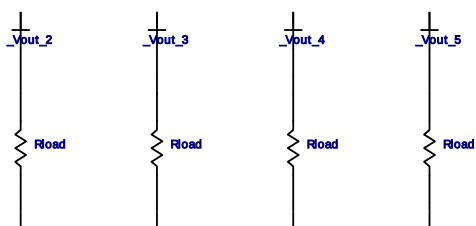
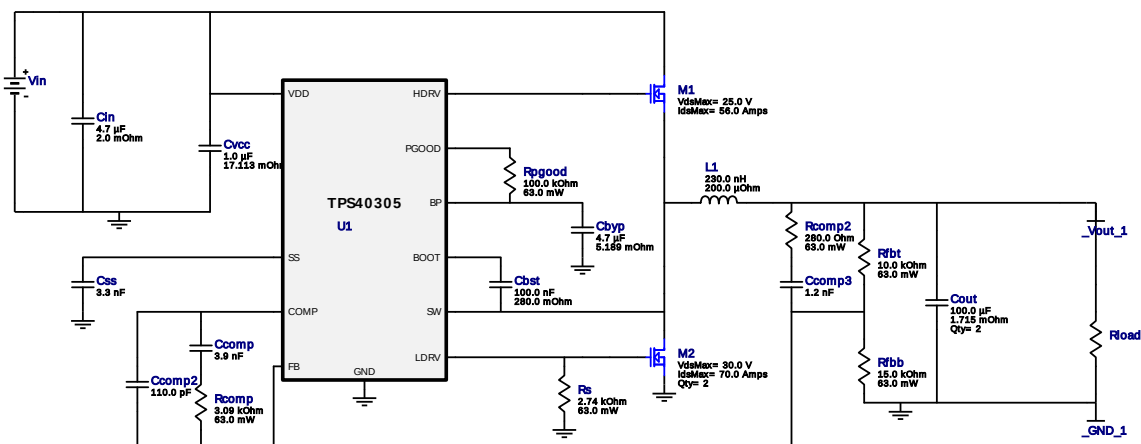


Vout = 1.0V
Iout = 11.38A

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Topology = Buck
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BOM Cost = \$3.27
BOM Count = 21
Total Pd = 2.62W

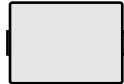
WEBENCH® Design Report

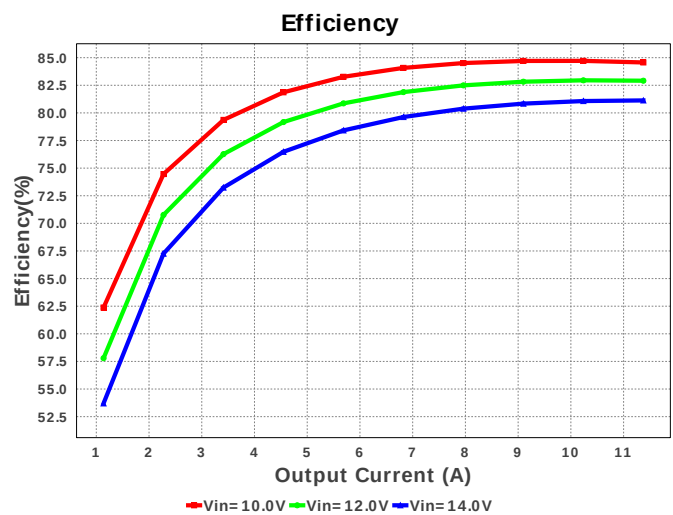
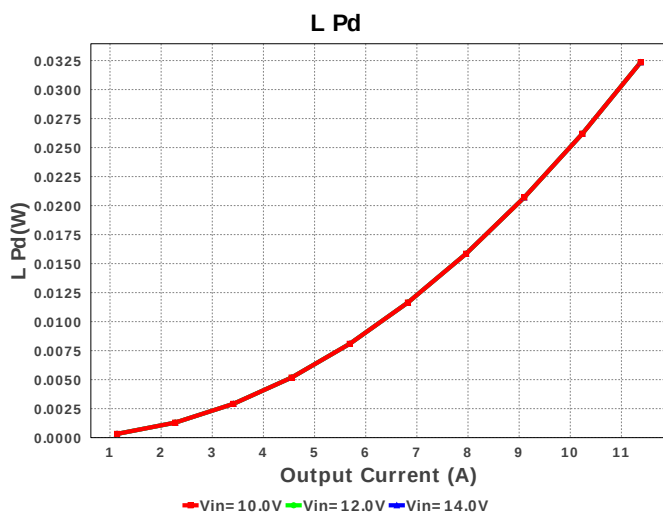
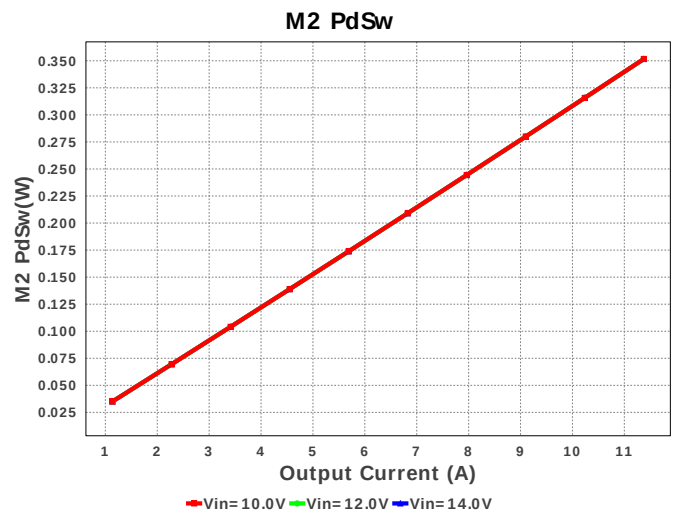
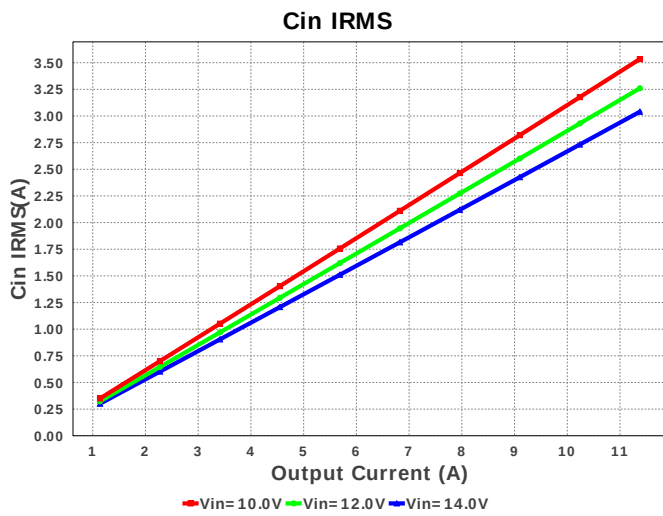
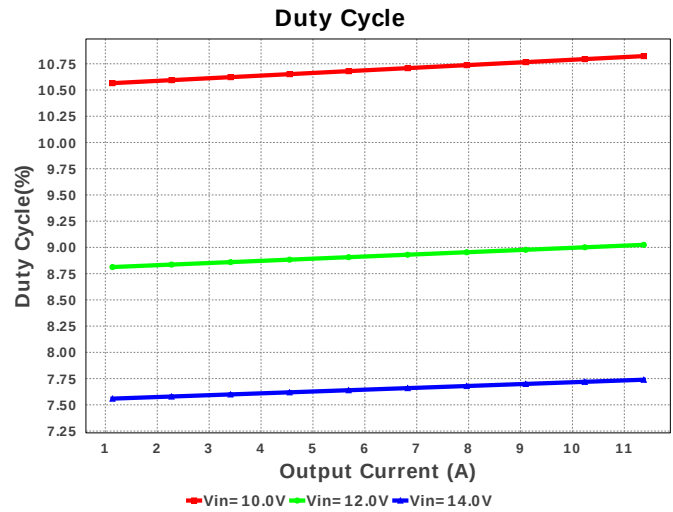
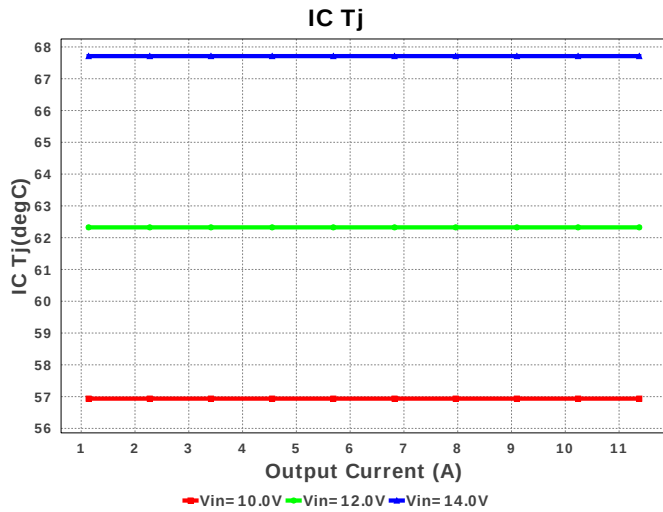
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TPS40305DRCR 10.0V-14.0V to 1.00V @ 11.375A

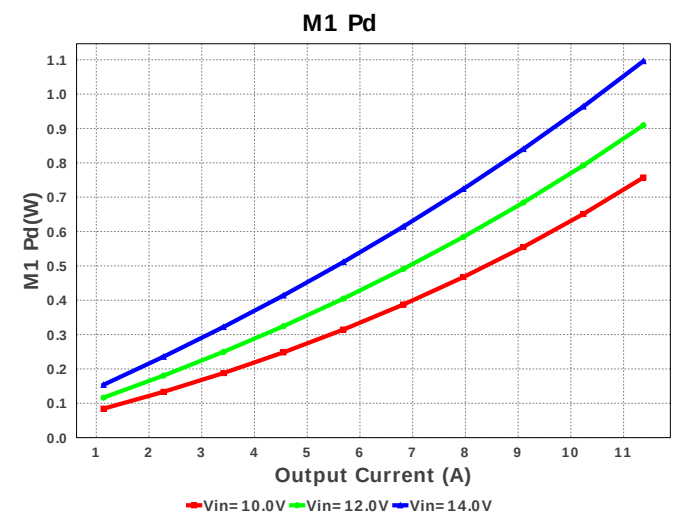
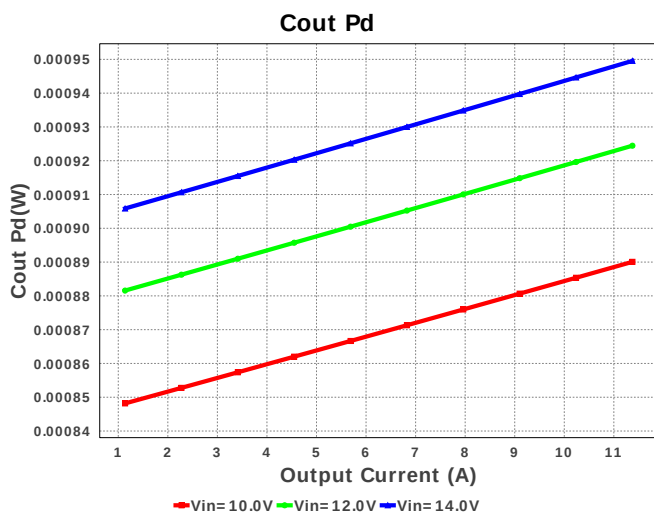
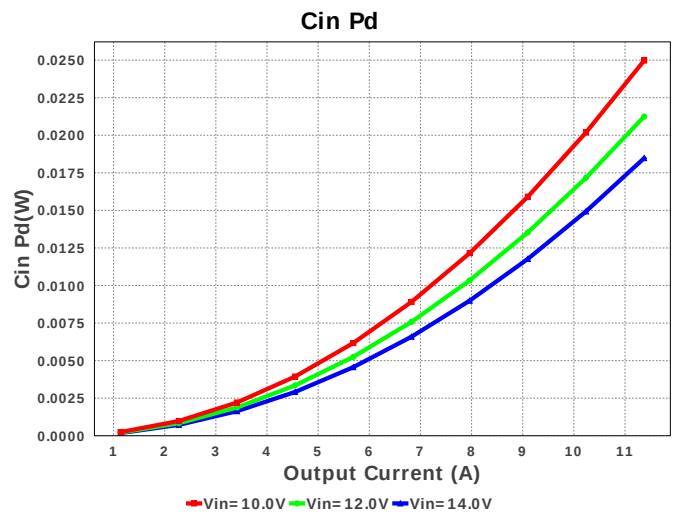
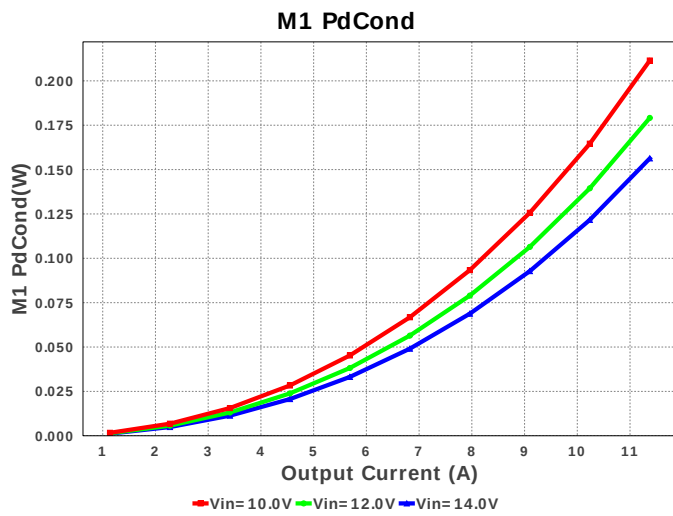
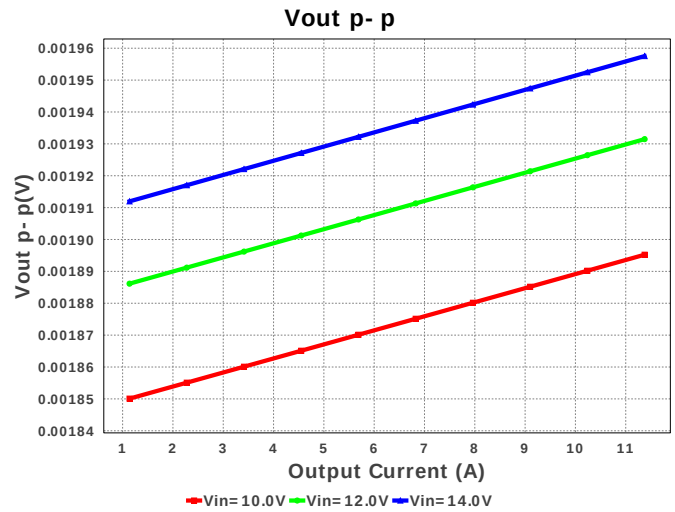
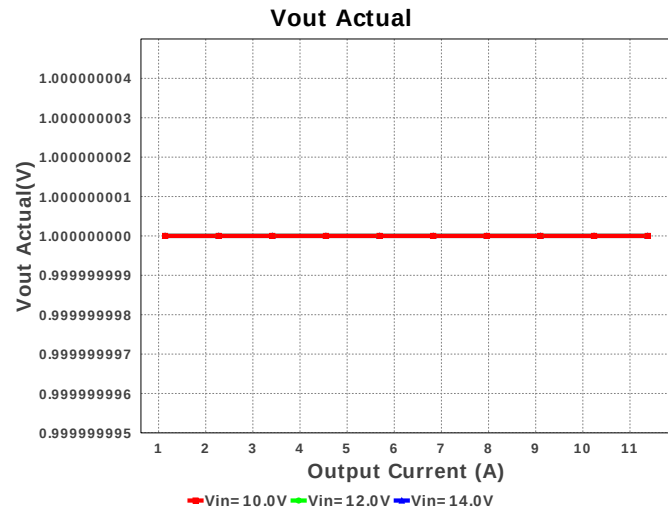


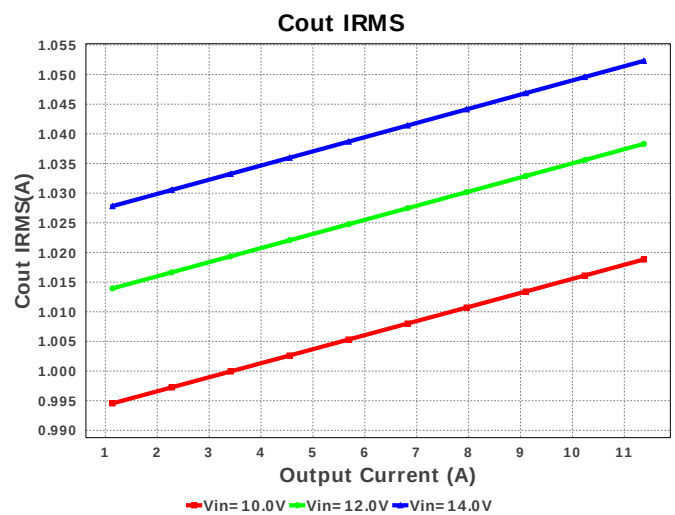
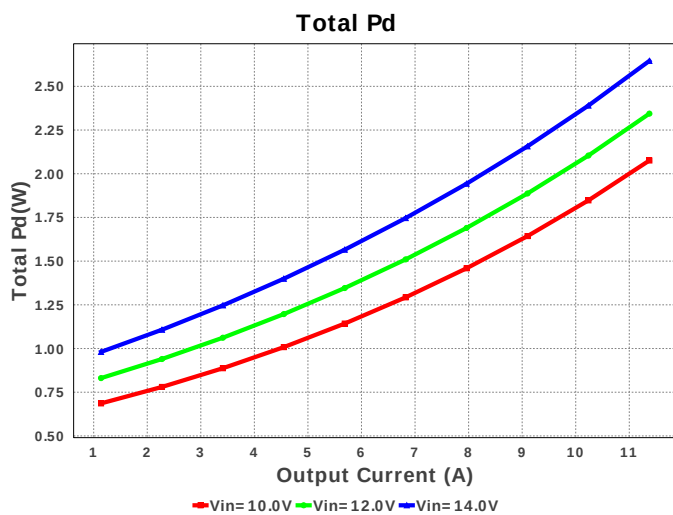
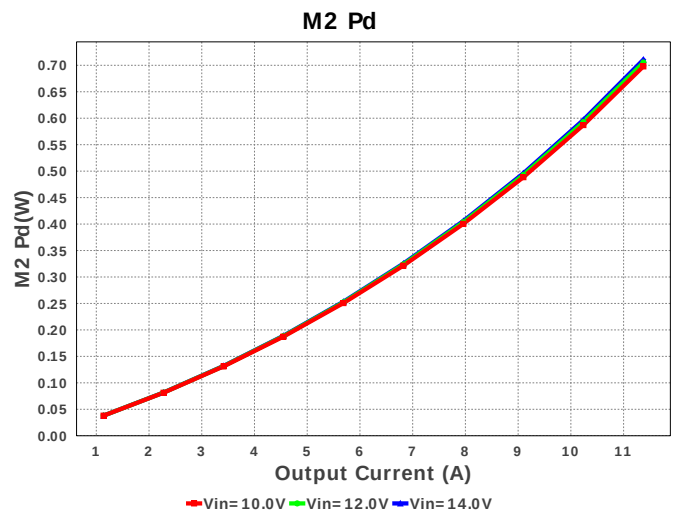
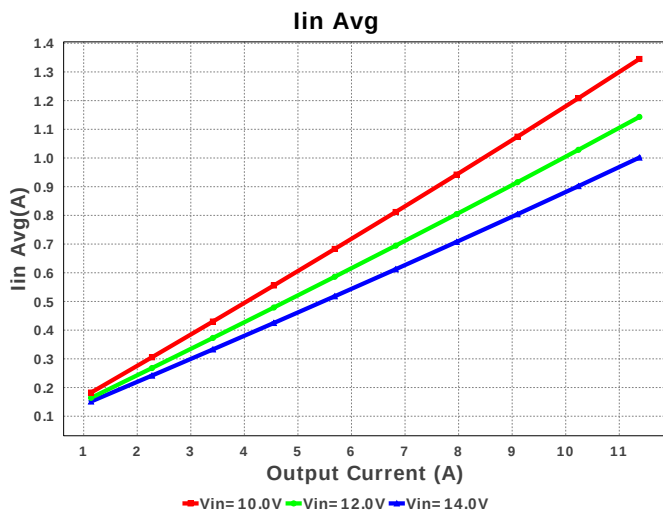
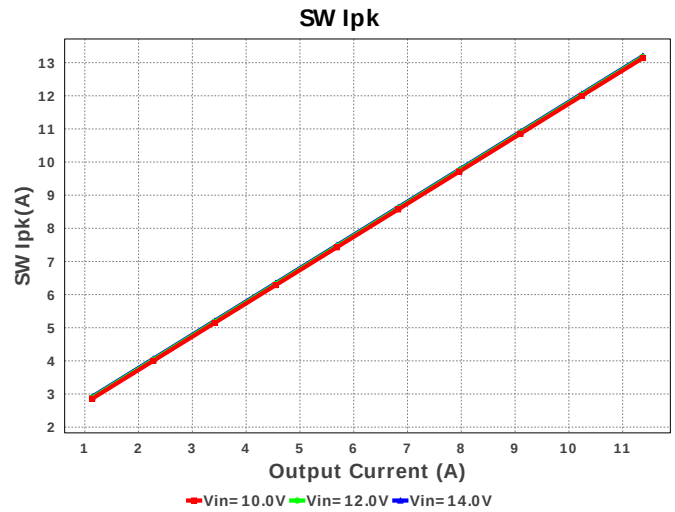
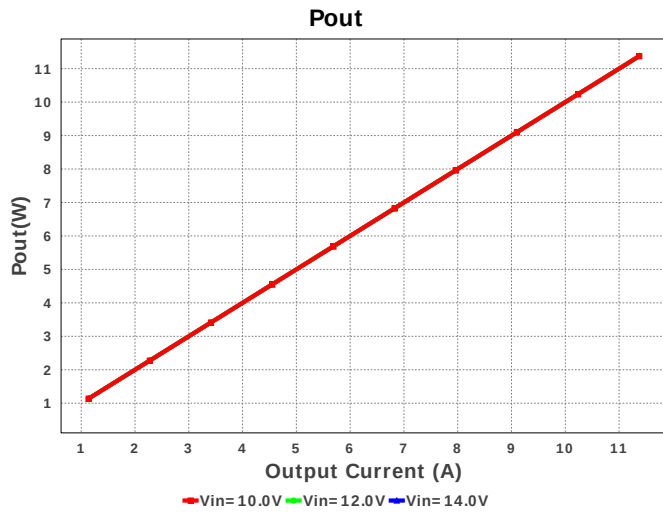
Electrical BOM

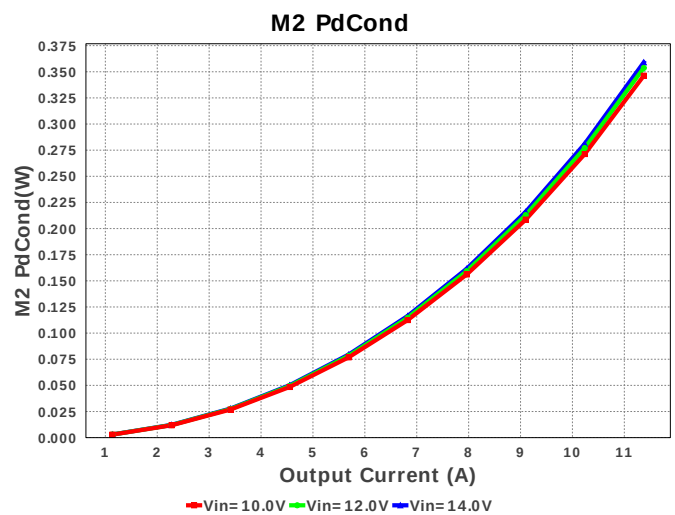
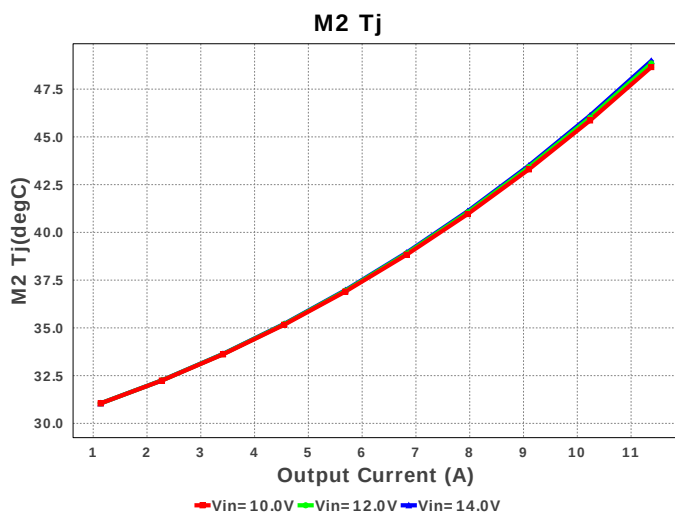
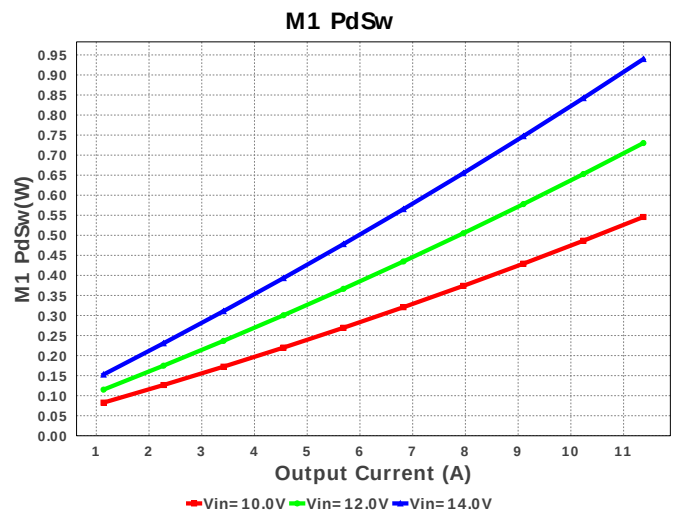
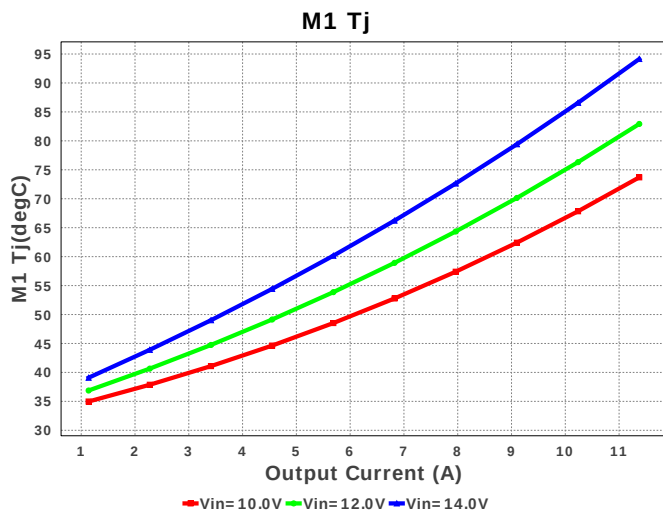
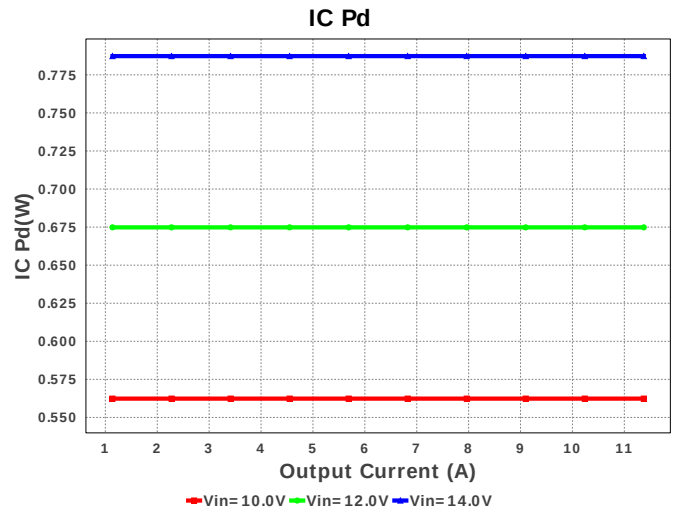
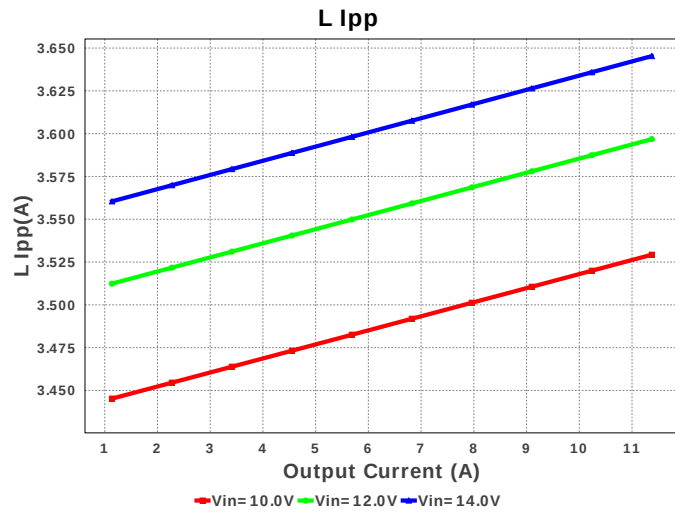
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbst	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
2.	Cbyp	MuRata	GRM21BR61E475KA12L Series= X5R	Cap= 4.7 uF ESR= 5.189 mOhm VDC= 25.0 V IRMS= 2.03531 A	1	\$0.02	0805 7 mm ²
3.	Ccomp	Yageo America	CC0805KRX7R9BB392 Series= X7R	Cap= 3.9 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
4.	Ccomp2	MuRata	GRM0335C1H111JA01D Series= C0G/NP0	Cap= 110.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0201 2 mm ²
5.	Ccomp3	MuRata	GRM033R71C122KA01D Series= X7R	Cap= 1.2 nF VDC= 16.0 V IRMS= 0.0 A	1	\$0.01	0201 2 mm ²
6.	Cin	MuRata	GRM21BR61E475MA12L Series= X5R	Cap= 4.7 uF ESR= 2.0 mOhm VDC= 25.0 V IRMS= 7.29 A	1	\$0.02	0805 7 mm ²

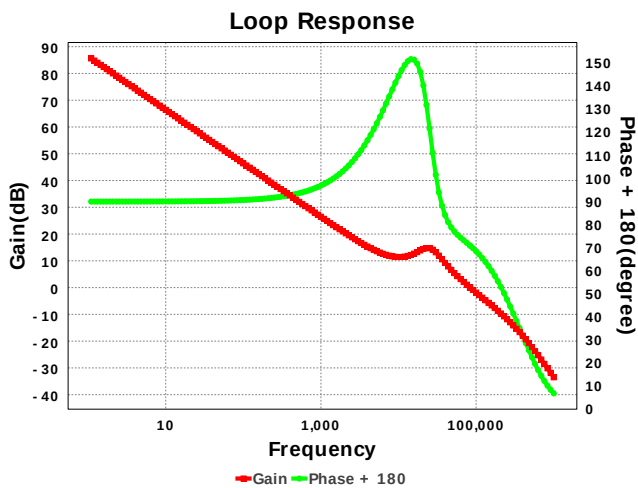
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7.	Cout	TDK	C3216JB0J107M Series= JB	Cap= 100.0 uF ESR= 1.715 mOhm VDC= 6.3 V IRMS= 0.0 A	2	\$0.39	 1206 11 mm ²
8.	Css	MuRata	GRM033R61A332KA01D Series= X5R	Cap= 3.3 nF VDC= 10.0 V IRMS= 0.0 A	1	\$0.01	 0201 2 mm ²
9.	Cvcc	MuRata	GRM188R61E105KA12D Series= X5R	Cap= 1.0 uF ESR= 17.113 mOhm VDC= 25.0 V IRMS= 979.39 mA	1	\$0.01	 0603 5 mm ²
10.	L1	Coilcraft	SLC1175-231MEB	L= 230.0 nH DCR= 200.0 uOhm	1	\$0.48	 SLC1175 125 mm ²
11.	M1	Texas Instruments	CSD16411Q3	VdsMax= 25.0 V IdsMax= 56.0 Amps	1	\$0.34	 TRANS_NexFET_Q3 18 mm ²
12.	M2	Texas Instruments	CSD17577Q3A	VdsMax= 30.0 V IdsMax= 70.0 Amps	2	\$0.28	 TRANS_NexFET_Q3A 18 mm ²
13.	Rcomp	Vishay-Dale	CRCW04023K09FKED Series= CRCW..e3	Res= 3.09 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
14.	Rcomp2	Vishay-Dale	CRCW0402280RFKED Series= CRCW..e3	Res= 280.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
15.	Rfbb	Vishay-Dale	CRCW040215K0FKED Series= CRCW..e3	Res= 15.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
16.	Rfbt	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
17.	Rpgood	Vishay-Dale	CRCW0402100KFKED Series= CRCW..e3	Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
18.	Rs	Vishay-Dale	CRCW04022K74FKED Series= CRCW..e3	Res= 2.74 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
19.	U1	Texas Instruments	TPS40305DRCR	Switcher	1	\$0.95	 S-PVSON-N10 17 mm ²











Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	3.04 A	Current	Input capacitor RMS ripple current
2.	Cout IRMS	1.052 A	Current	Output capacitor RMS ripple current
3.	Iin Avg	999.78 mA	Current	Average input current
4.	L Ipp	3.645 A	Current	Peak-to-peak inductor ripple current
5.	SW Ipk	13.198 A	Current	Peak switch current
6.	BOM Count	21	General	Total Design BOM count
7.	FootPrint	275.0 mm ²	General	Total Foot Print Area of BOM components
8.	Frequency	1.2 MHz	General	Switching frequency
9.	IC Tolerance	10.0 mV	General	IC Feedback Tolerance
10.	Pout	11.375 W	General	Total output power
11.	Total BOM	\$3.27	General	Total BOM Cost
12.	Low Freq Gain	86.717 dB	Op_Point	Gain at 10Hz
13.	Vout Actual	1000.0 mV	Op_Point	Vout Actual calculated based on selected voltage divider resistors
14.	Cross Freq	82.264 kHz	Op_point	Bode plot crossover frequency
15.	Duty Cycle	7.739 %	Op_point	Duty cycle
16.	Efficiency	81.268 %	Op_point	Steady state efficiency
17.	Gain Marg	-40.114 dB	Op_point	Bode Plot Gain Margin
18.	IC Tj	67.712 degC	Op_point	IC junction temperature
19.	IOUT_OP	11.375 A	Op_point	Iout operating point
20.	M1 Tj	94.142 degC	Op_point	M1 MOSFET junction temperature
21.	M2 Tj	48.98 degC	Op_point	M2 MOSFET junction temperature
22.	Phase Marg	64.786 deg	Op_point	Bode Plot Phase Margin
23.	VIN_OP	14.0 V	Op_point	Vin operating point
24.	Vout p-p	1.899 mV	Op_point	Peak-to-peak output ripple voltage
25.	Cin Pd	18.478 mW	Power	Input capacitor power dissipation
26.	Cout Pd	949.555 μ W	Power	Output capacitor power dissipation
27.	IC Pd	787.304 mW	Power	IC power dissipation
28.	L Pd	32.348 mW	Power	Inductor power dissipation
29.	M1 Pd	1.091 W	Power	M1 MOSFET total power dissipation
30.	M1 PdCond	151.468 mW	Power	M1 MOSFET conduction losses
31.	M1 PdSw	939.729 mW	Power	M1 MOSFET switching losses
32.	M2 Pd	691.629 mW	Power	M2 MOSFET total power dissipation
33.	M2 PdCond	339.975 mW	Power	M2 MOSFET conduction losses
34.	M2 PdSw	351.653 mW	Power	M2 MOSFET switching losses
35.	Total Pd	2.622 W	Power	Total Power Dissipation
36.	Vout Tolerance	2.488 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	11.375	Maximum Output Current
2.	VinMax	14.0	Maximum input voltage
3.	VinMin	10.0	Minimum input voltage
4.	Vout	1.0	Output Voltage
5.	base_pn	TPS40305	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	30.0	Ambient temperature

Design Assistance

1. **TPS40305** Product Folder : <http://www.ti.com/product/TPS40305> : contains the data sheet and other resources.

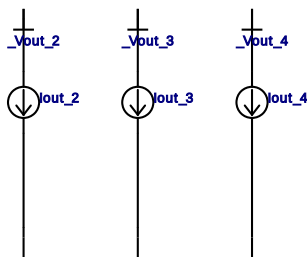
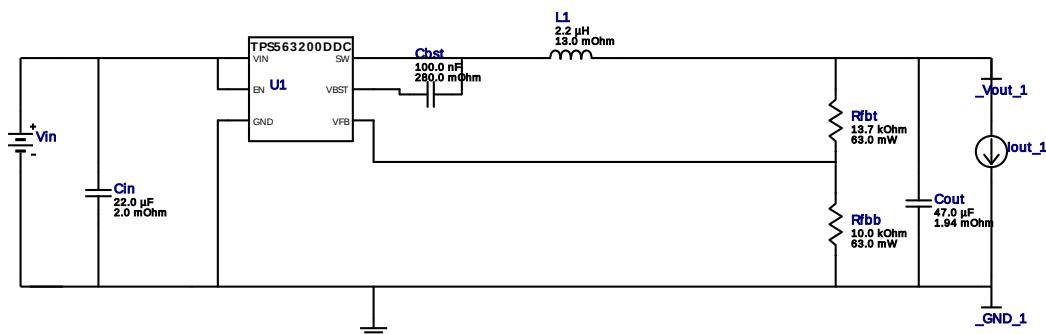


Vout = 1.8V
Iout = 1.03A

Device = TPS563200DDCR
Topology = Buck
Created = 7/24/16 7:24:37 AM
BOM Cost = \$1.06
BOM Count = 7
Total Pd = 0.25W

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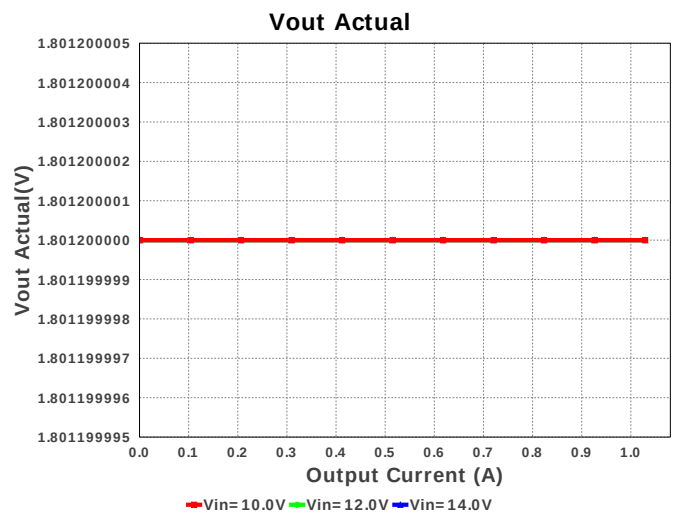
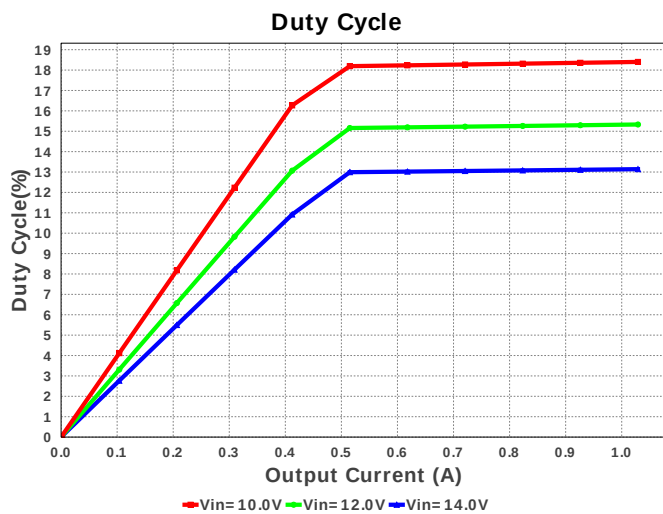
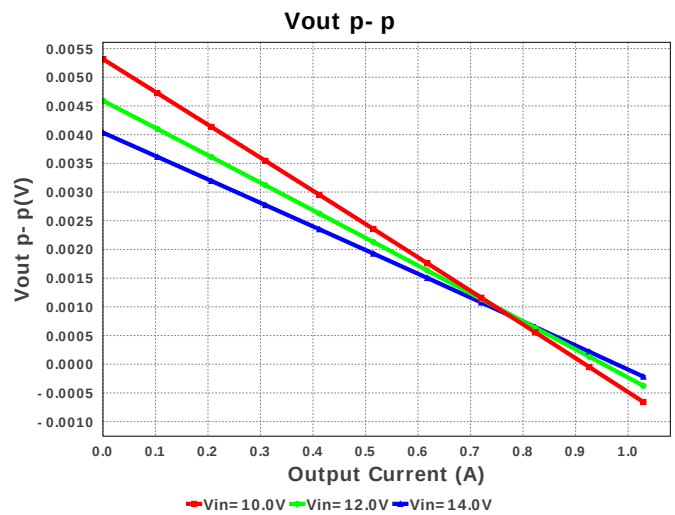
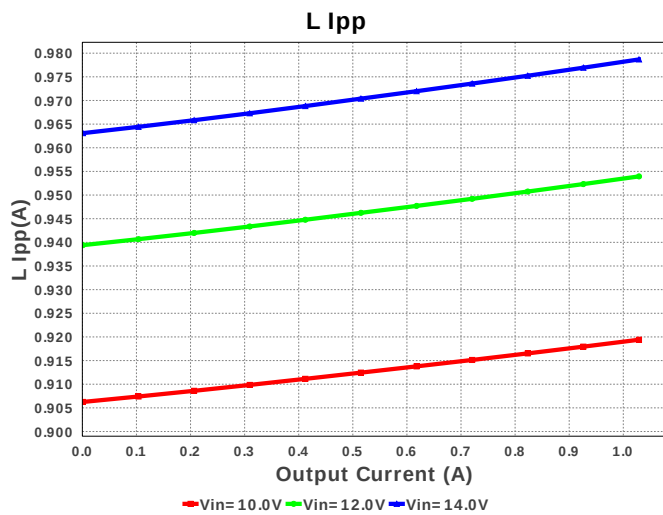
Design : 1194016/2190 TPS563200DDCR
TPS563200DDCR 10.0V-14.0V to 1.80V @ 1.029A

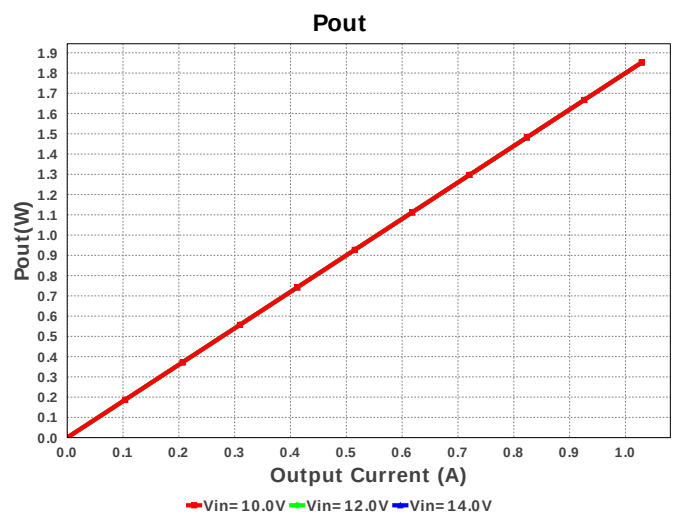
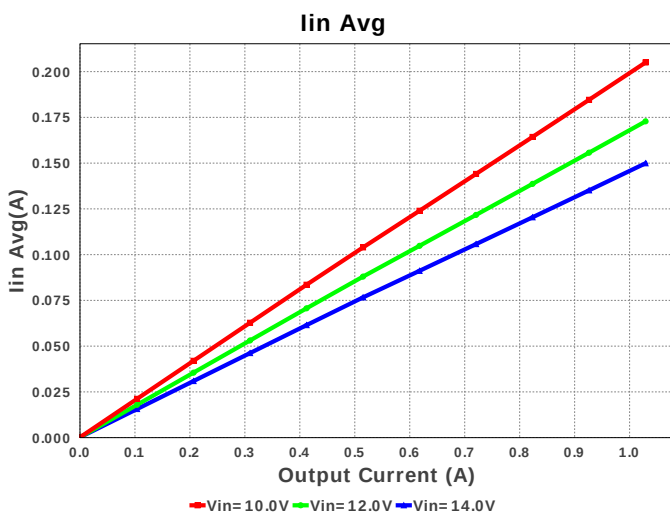
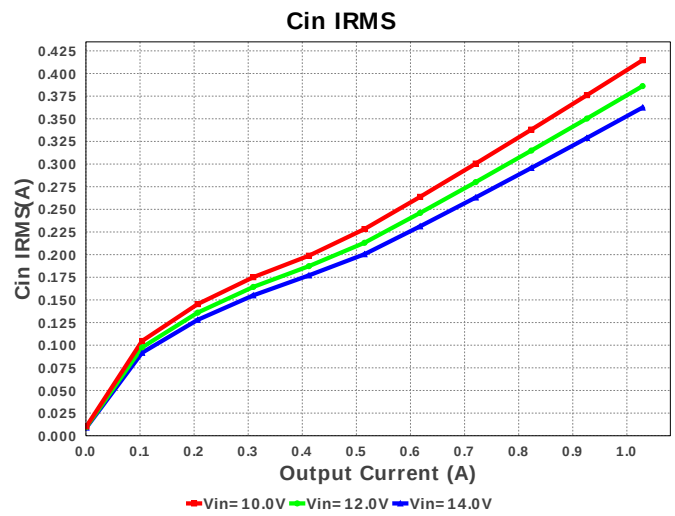
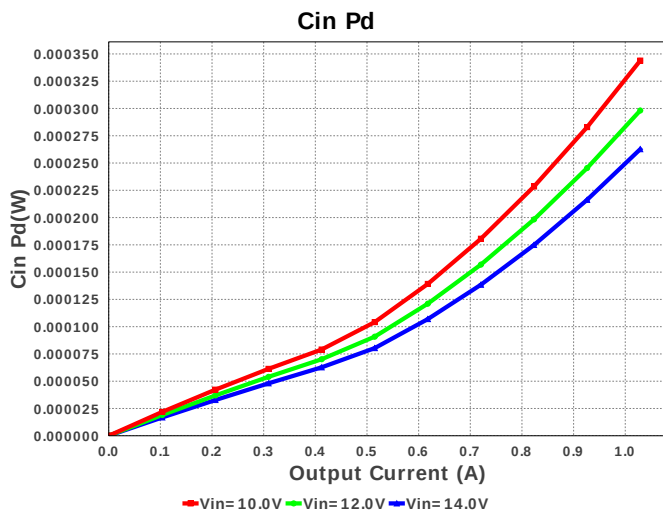
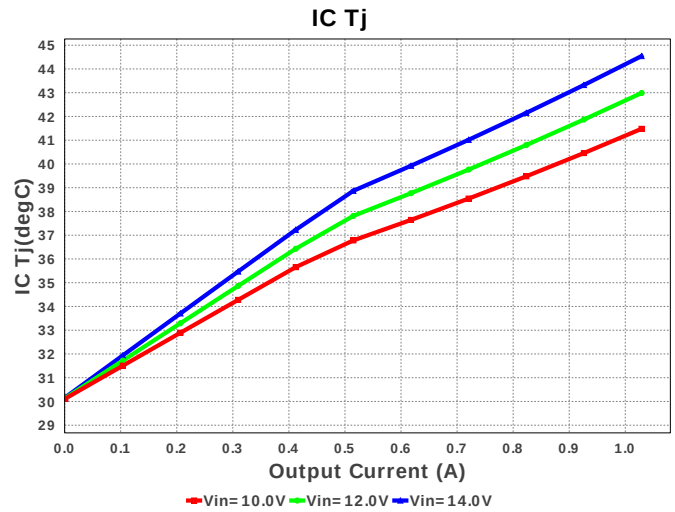
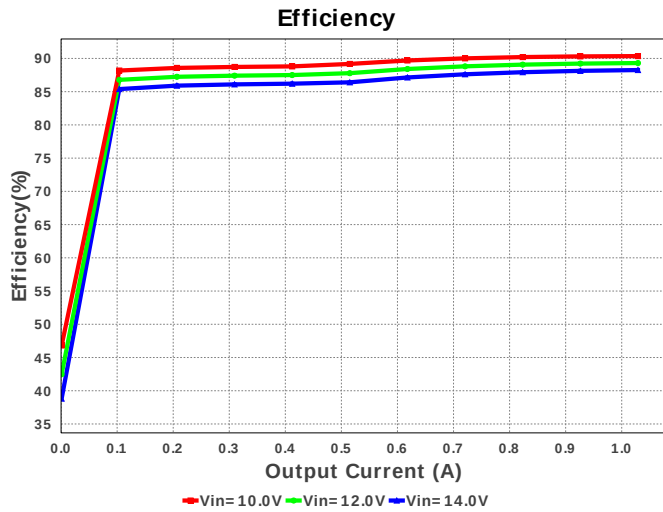


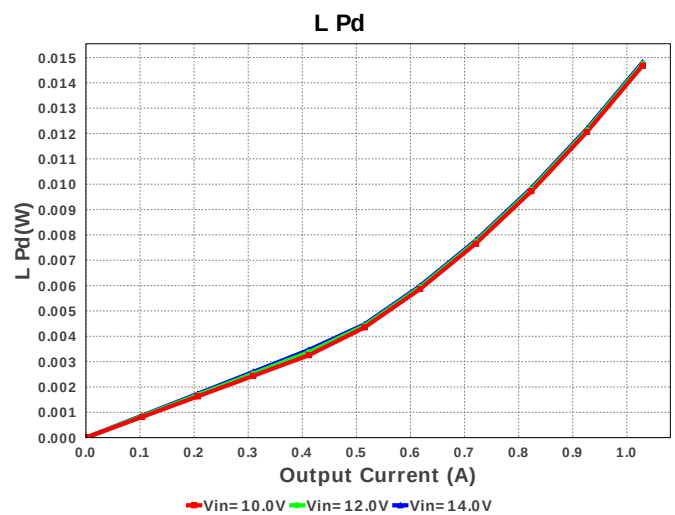
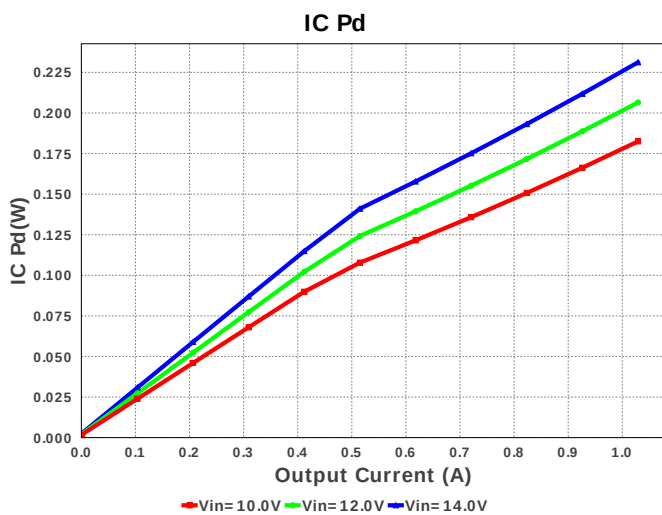
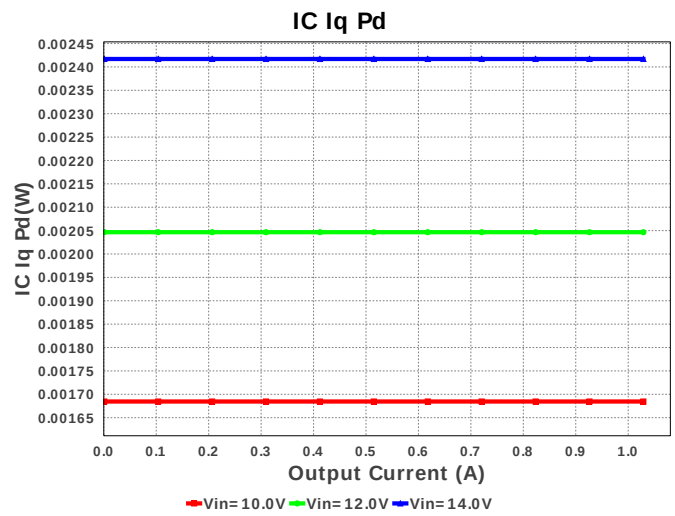
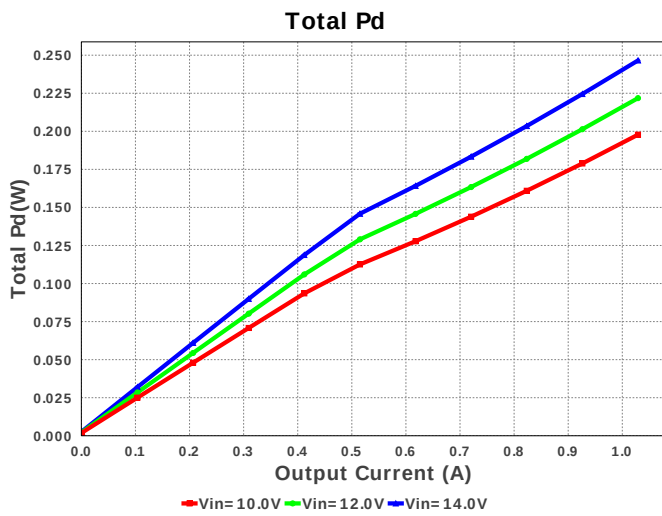
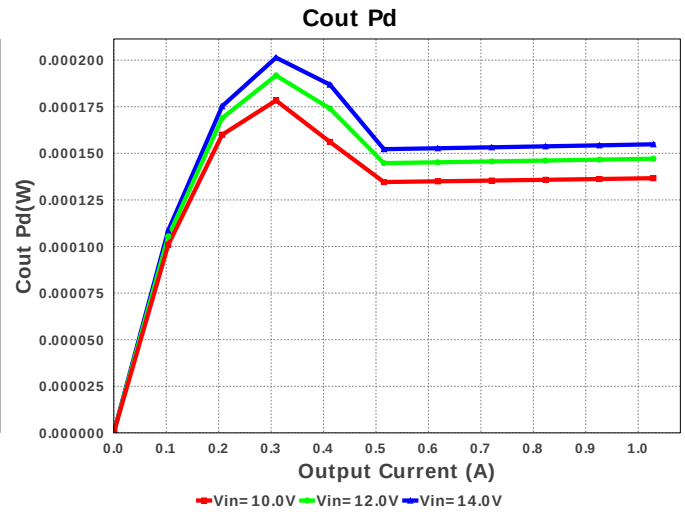
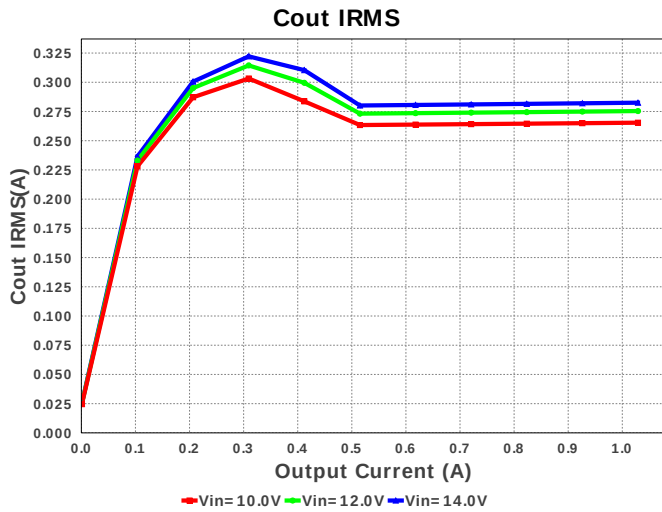
Electrical BOM

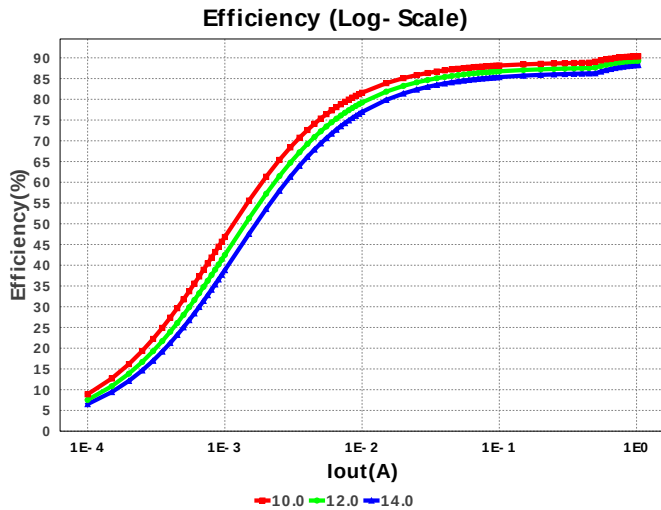
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbst	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm ²
2.	Cin	MuRata	GRM32ER61E226KE15L Series= X5R	Cap= 22.0 uF ESR= 2.0 mOhm VDC= 25.0 V IRMS= 3.67 A	1	\$0.16	 1210 15 mm ²
3.	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 mm ²
4.	L1	Bourns	SRN8040-2R2Y	L= 2.2 uH DCR= 13.0 mOhm	1	\$0.22	 SRN8040 100 mm ²
5.	Rfbb	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
6.	Rfht	Vishay-Dale	CRCW040213K7FKED Series= CRCW..e3	Res= 13.7 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	TPS563200DDCR	Switcher	1	\$0.52	 DDC0006A 10 mm ²









Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	362.411 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	282.52 mA	Current	Output capacitor RMS ripple current
3.	Iin Avg	149.91 mA	Current	Average input current
4.	L Ipp	978.68 mA	Current	Peak-to-peak inductor ripple current
5.	BOM Count	7	General	Total Design BOM count
6.	FootPrint	149.0 mm ²	General	Total Foot Print Area of BOM components
7.	Frequency	740.836 kHz	General	Switching frequency
8.	Pout	1.852 W	General	Total output power
9.	Total BOM	\$1.06	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
12.	Duty Cycle	13.14 %	Op_point	Duty cycle
13.	Efficiency	88.253 %	Op_point	Steady state efficiency
14.	IC Tj	44.541 degC	Op_point	IC junction temperature
15.	ICThetaJA	62.9 degC/W	Op_point	IC junction-to-ambient thermal resistance
16.	IOUT_OP	1.029 A	Op_point	Iout operating point
17.	VIN_OP	14.0 V	Op_point	Vin operating point
18.	Vout p-p	4.479 mV	Op_point	Peak-to-peak output ripple voltage
19.	Cin Pd	262.683 μW	Power	Input capacitor power dissipation
20.	Cout Pd	154.846 μW	Power	Output capacitor power dissipation
21.	IC Iq Pd	2.417 mW	Power	IC Iq Pd
22.	IC Pd	231.181 mW	Power	IC power dissipation
23.	L Pd	14.803 mW	Power	Inductor power dissipation
24.	Total Pd	246.539 mW	Power	Total Power Dissipation
25.	Vout Tolerance	2.499 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	1.029	Maximum Output Current
2.	VinMax	14.0	Maximum input voltage
3.	VinMin	10.0	Minimum input voltage
4.	Vout	1.8	Output Voltage
5.	base_pn	TPS563200	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	30.0	Ambient temperature

Design Assistance

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

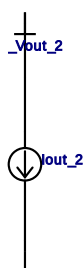
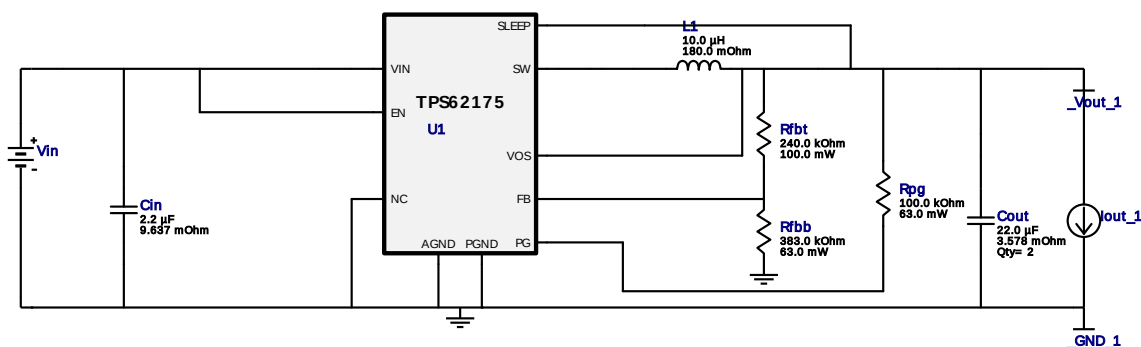


Vout = 1.3V
Iout = 0.3A

Device = TPS62175DQCR
Topology = Buck
Created = 7/24/16 7:24:38 AM
BOM Cost = \$1.08
BOM Count = 8
Total Pd = 0.11W

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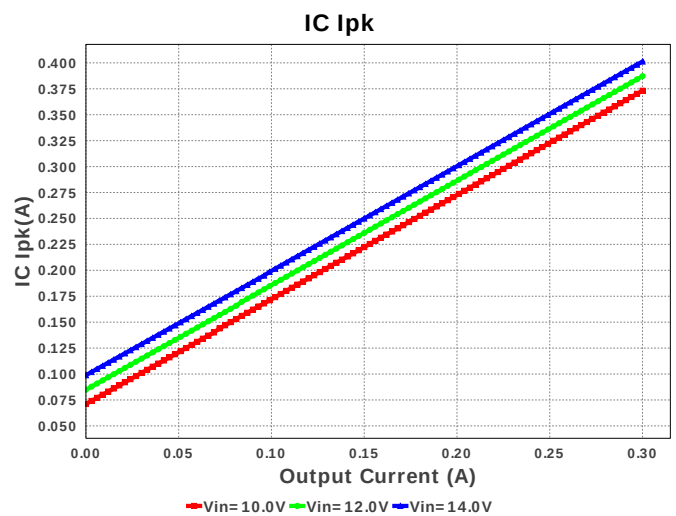
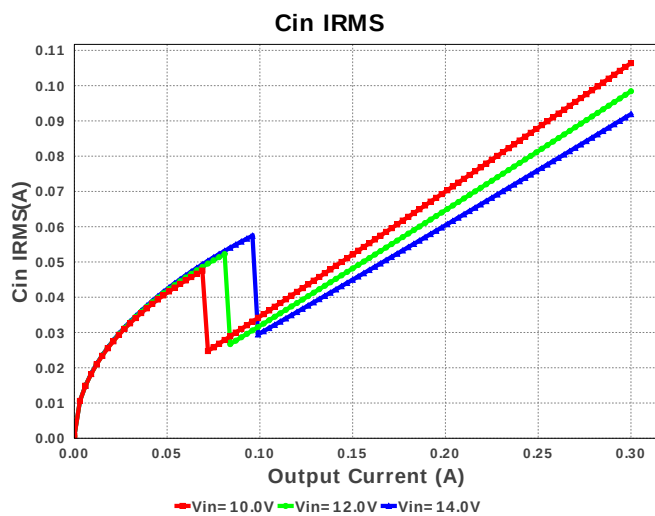
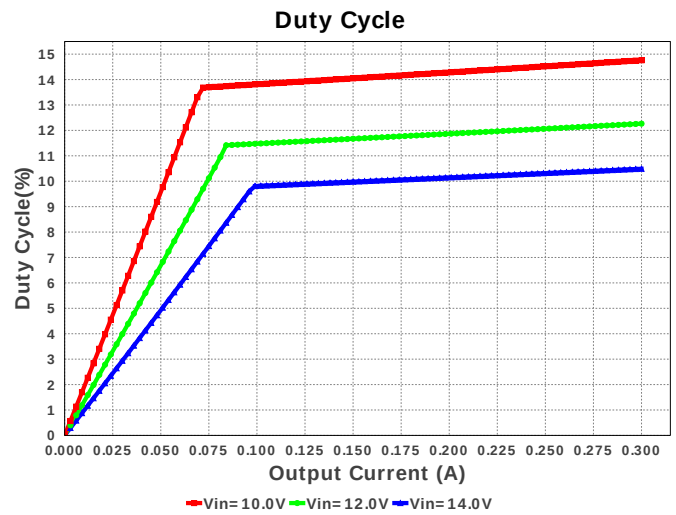
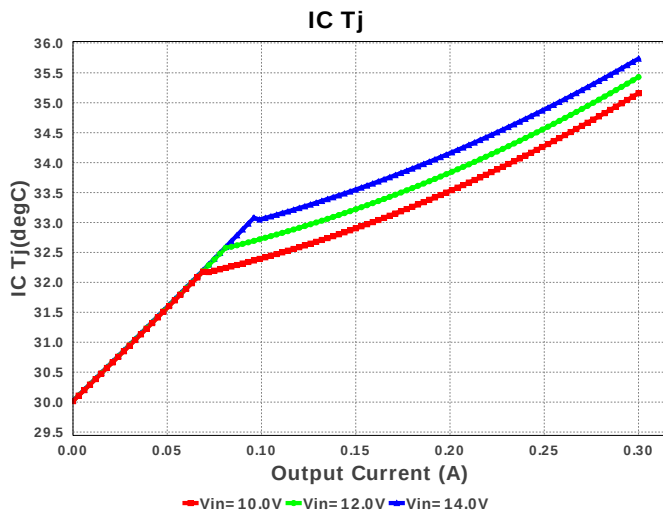
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TPS62175DQCR 10.0V-14.0V to 1.30V @ 0.3A

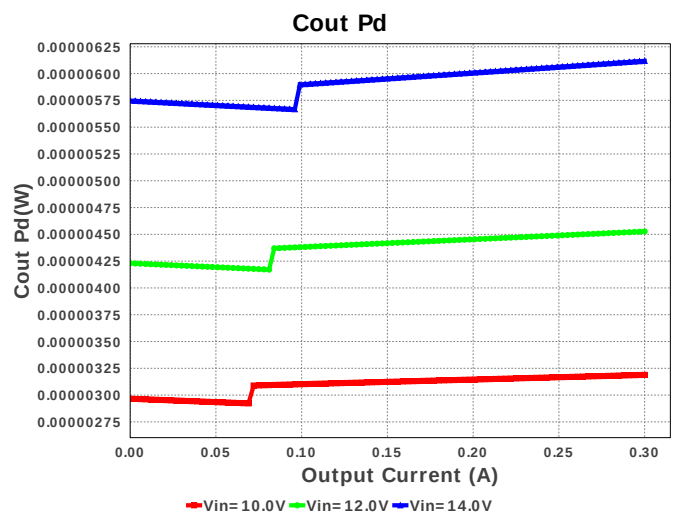
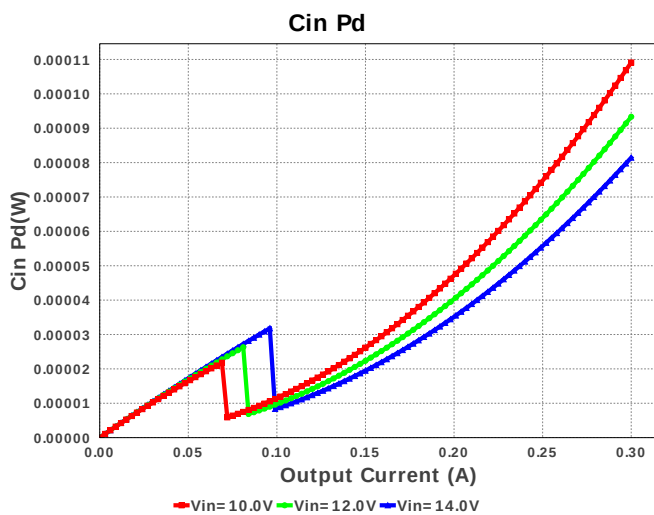
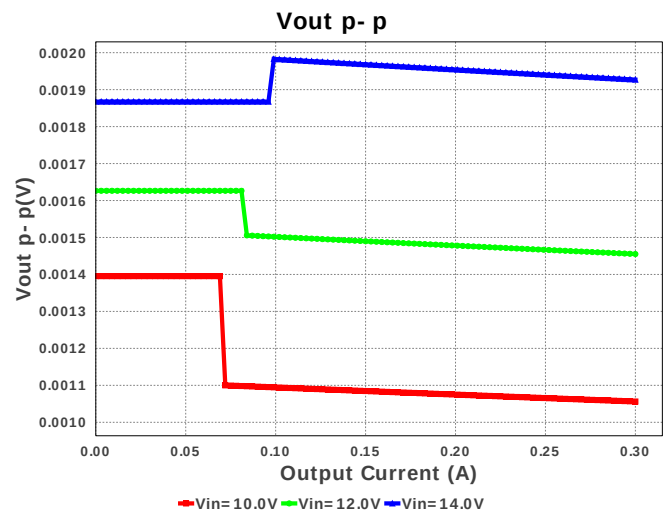
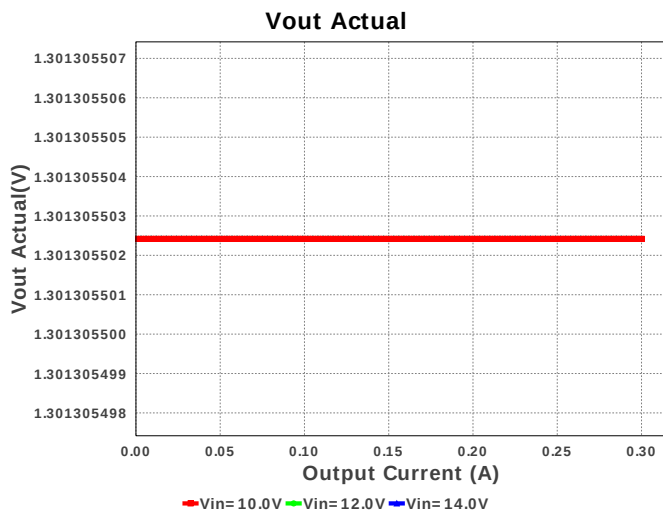
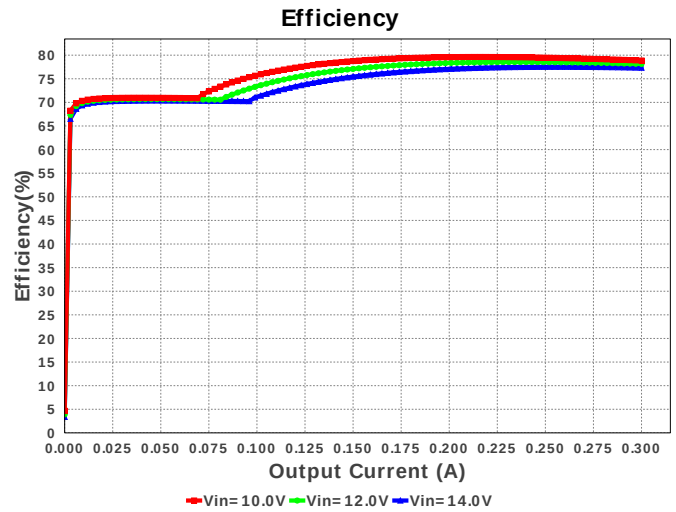
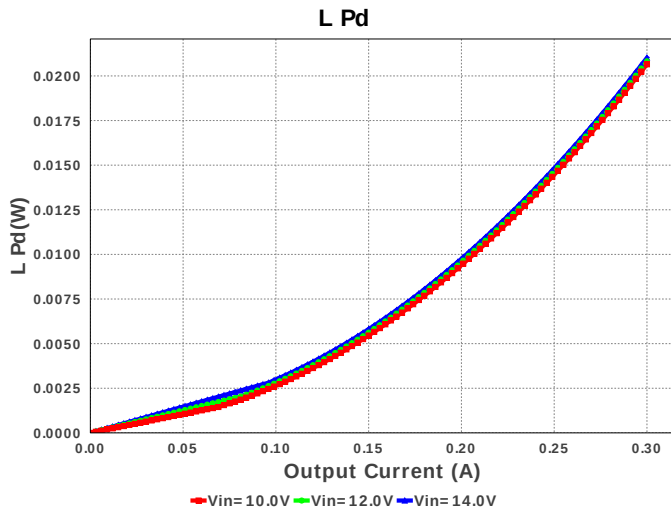


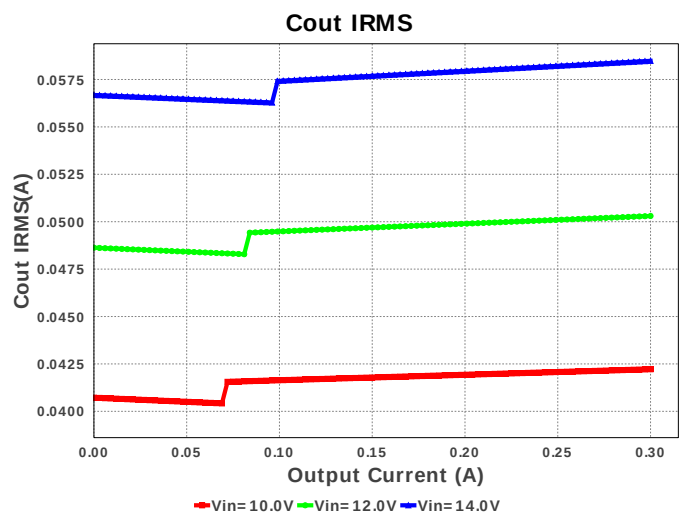
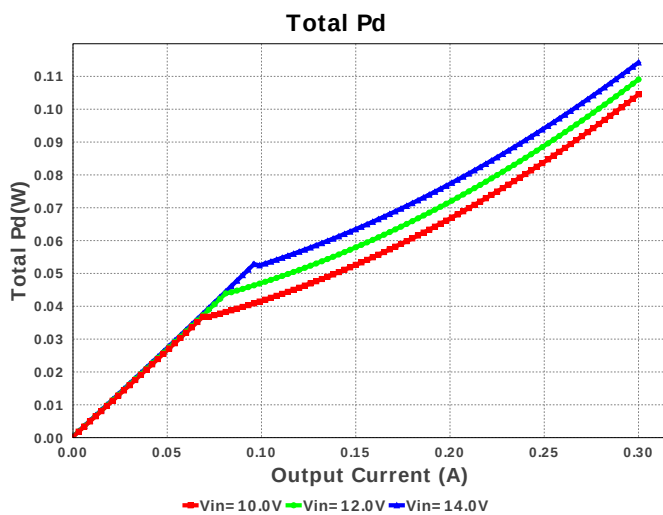
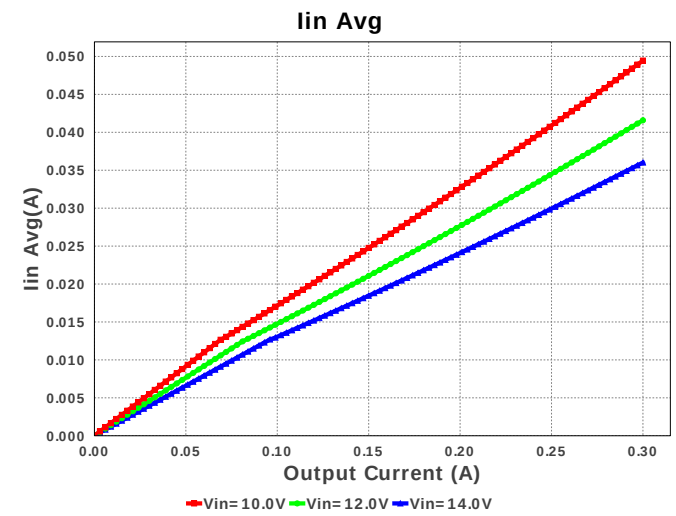
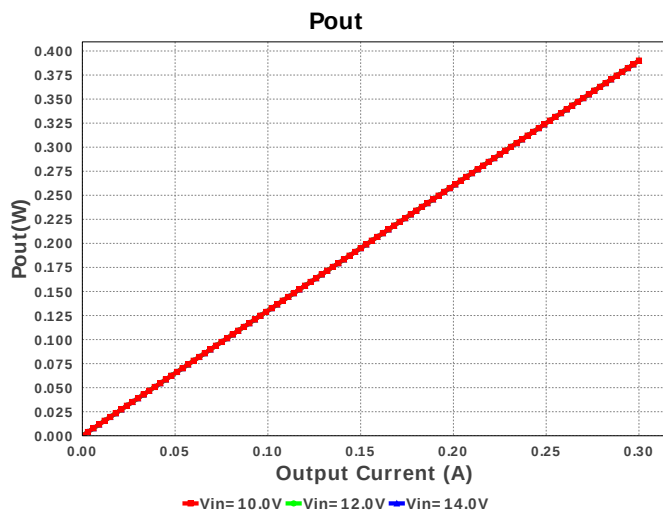
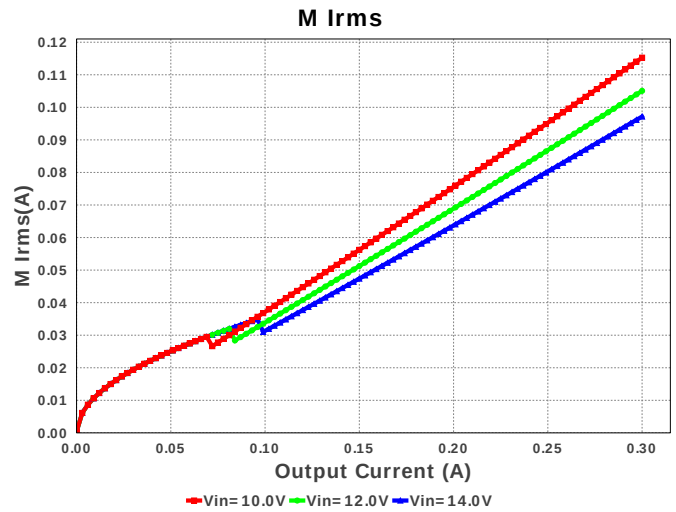
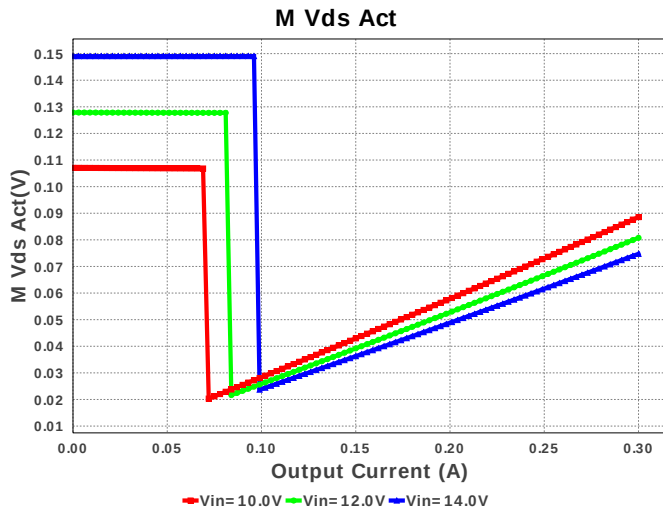
Electrical BOM

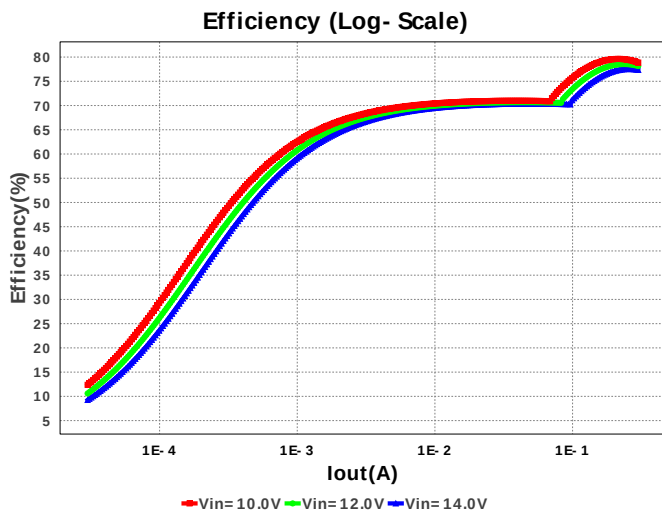
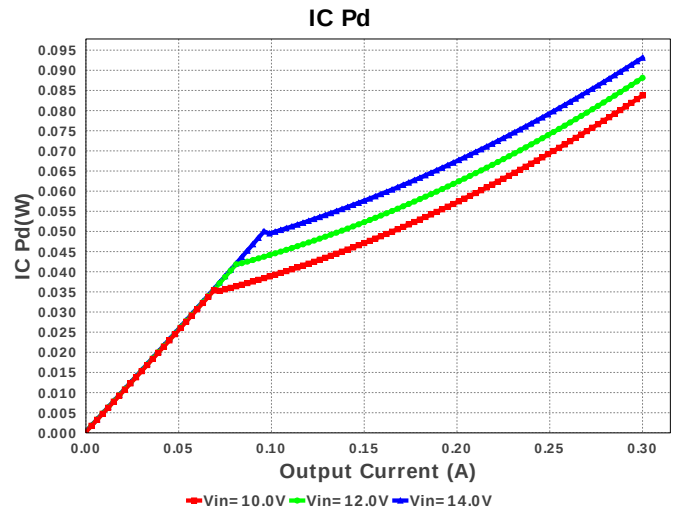
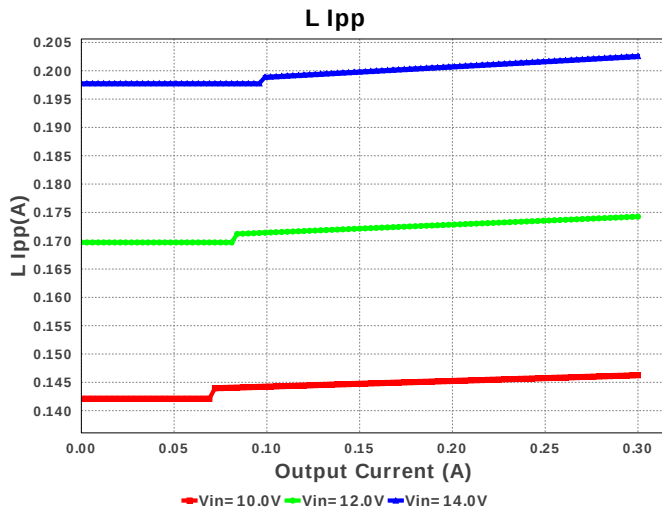
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cin	MuRata	GRM188R61C225KE15D Series= X5R	Cap= 2.2 uF ESR= 9.637 mOhm VDC= 16.0 V IRMS= 1.20373 A	1	\$0.02	0603 5 mm ²
2.	Cout	MuRata	GRM21BC80G226ME39L Series= X6S	Cap= 22.0 uF ESR= 3.578 mOhm VDC= 4.0 V IRMS= 3.29633 A	2	\$0.04	0805 7 mm ²
3.	L1	Coilcraft	LPS4018-103MRB	L= 10.0 uH DCR= 180.0 mOhm	1	\$0.35	LPS4018 24 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	Yageo America	RC0603FR-07240KL Series= ?	Res= 240.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	0603 5 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	91.927 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	58.482 mA	Current	Output capacitor RMS ripple current
3.	IC Ipk	401.294 mA	Current	Peak switch current in IC
4.	Iin Avg	36.017 mA	Current	Average input current
5.	L Ipp	202.59 mA	Current	Peak-to-peak inductor ripple current
6.	M1 Irms	97.164 mA	Current	Q lavg
7.	BOM Count	8	General	Total Design BOM count
8.	FootPrint	65.0 mm ²	General	Total Foot Print Area of BOM components
9.	Frequency	657.6 kHz	General	Switching frequency
10.	IC Tolerance	24.0 mV	General	IC Feedback Tolerance
11.	M Vds Act	74.74 mV	General	Voltage drop across the MosFET
12.	Pout	390.0 mW	General	Total output power
13.	Total BOM	\$1.08	General	Total BOM Cost
14.	Vout Actual	1.301 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
15.	Vout OP	1.3 V	Op_Point	Operational Output Voltage
16.	Duty Cycle	10.49 %	Op_point	Duty cycle
17.	Efficiency	77.344 %	Op_point	Steady state efficiency
18.	IC Tj	35.737 degC	Op_point	IC junction temperature
19.	ICThetaJA	61.6 degC/W	Op_point	IC junction-to-ambient thermal resistance
20.	IOUT_OP	300.0 mA	Op_point	Iout operating point
21.	VIN_OP	14.0 V	Op_point	Vin operating point
22.	Vout p-p	1.013 mV	Op_point	Peak-to-peak output ripple voltage
23.	Cin Pd	81.438 μW	Power	Input capacitor power dissipation
24.	Cout Pd	6.119 μW	Power	Output capacitor power dissipation
25.	IC Pd	93.133 mW	Power	IC power dissipation
26.	L Pd	21.02 mW	Power	Inductor power dissipation
27.	Total Pd	114.24 mW	Power	Total Power Dissipation
28.	Vout Tolerance	3.802 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	300.0 m	Maximum Output Current
2.	VinMax	14.0	Maximum input voltage
3.	VinMin	10.0	Minimum input voltage
4.	Vout	1.3	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.

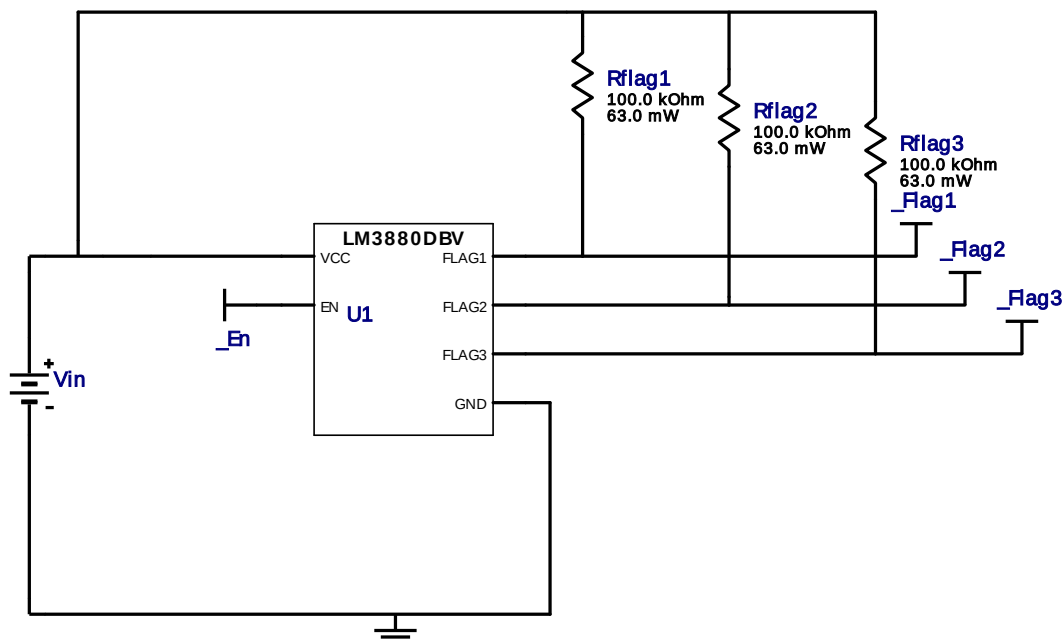


Vout = 3.3V
Iout = 0.0A

Device = LM3880MF-1AE/NOPB
Topology = SEQUENCER
Created = 7/24/16 7:24:39 AM
BOM Cost = \$0.48
BOM Count = 4
Total Pd = 0.0W

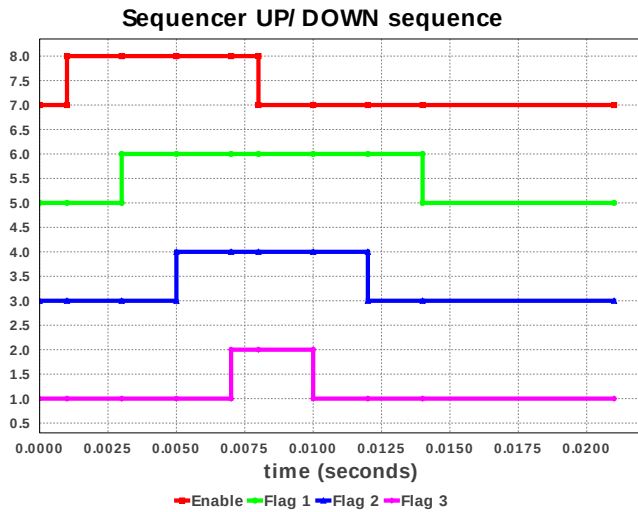
WEBENCH® Design Report

Design : 1194016/2192 LM3880MF-1AE/NOPB
Design 2192 - 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.

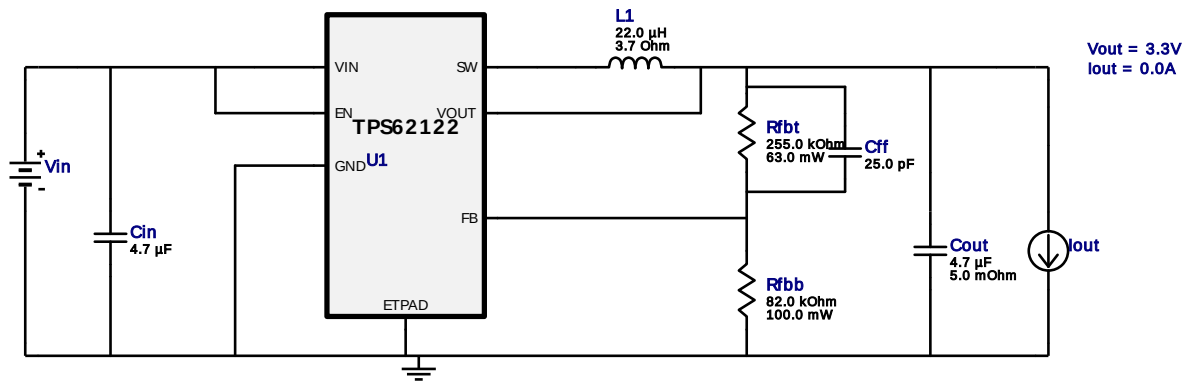


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Iout = 0.0A

Device = TPS62122DRVR
Topology = Buck
Created = 7/24/16 7:24:39 AM
BOM Cost = \$0.67
BOM Count = 7
Total Pd = 0.0W

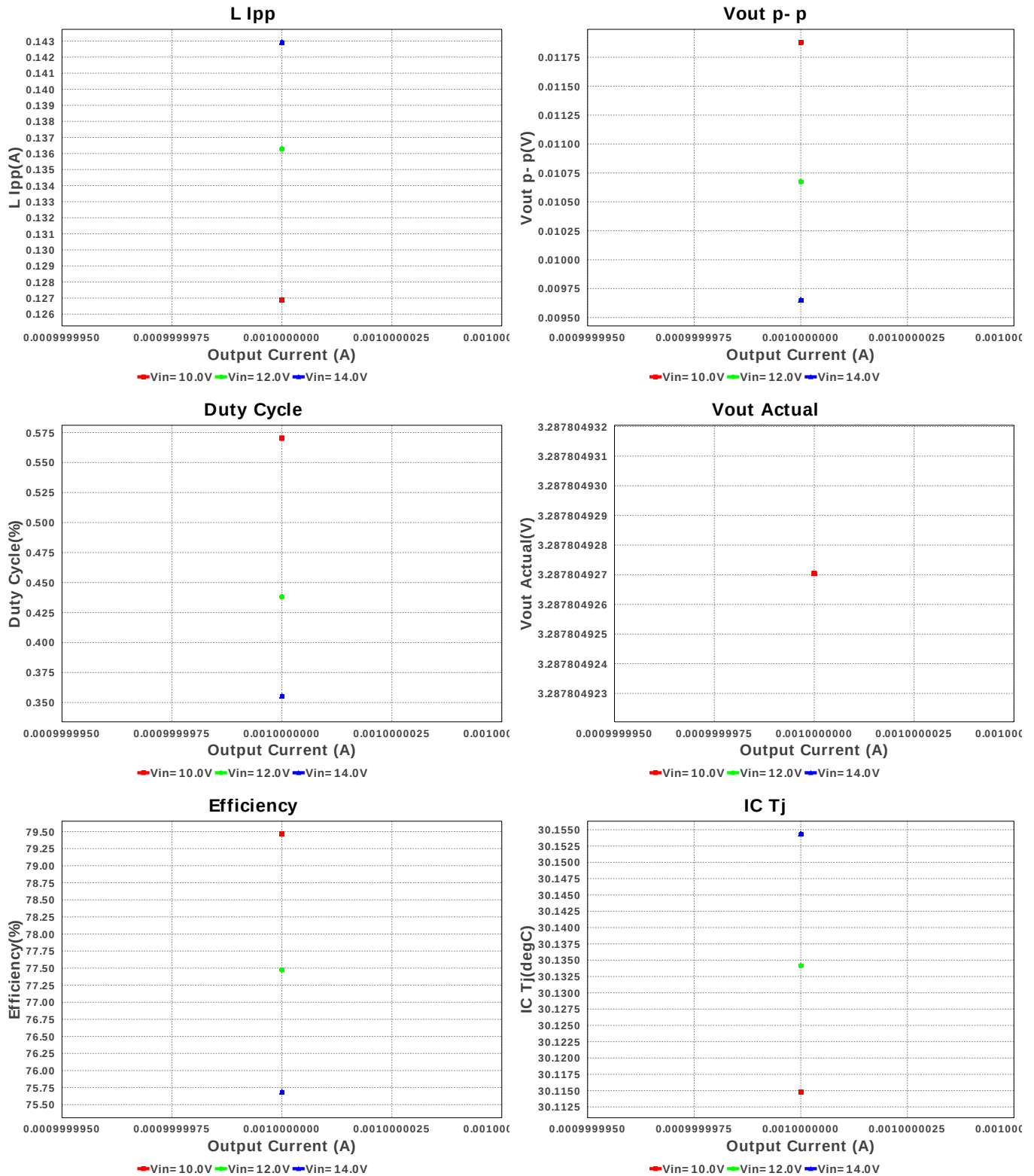
WEBENCH® Design Report

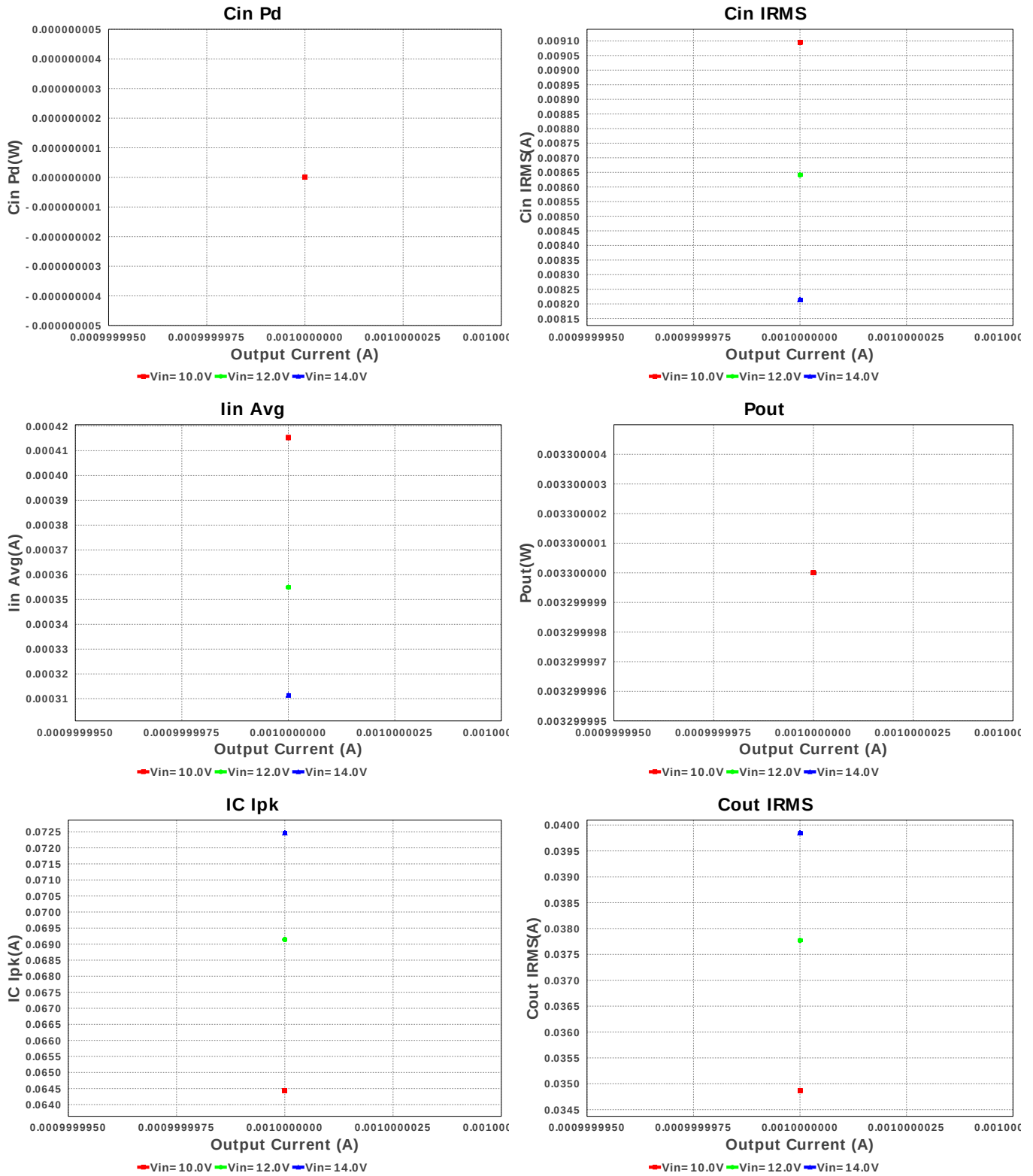
Design : 1194016/2193 TPS62122DRVR
TPS62122DRVR 10.0V-14.0V to 3.30V @ 0.001A

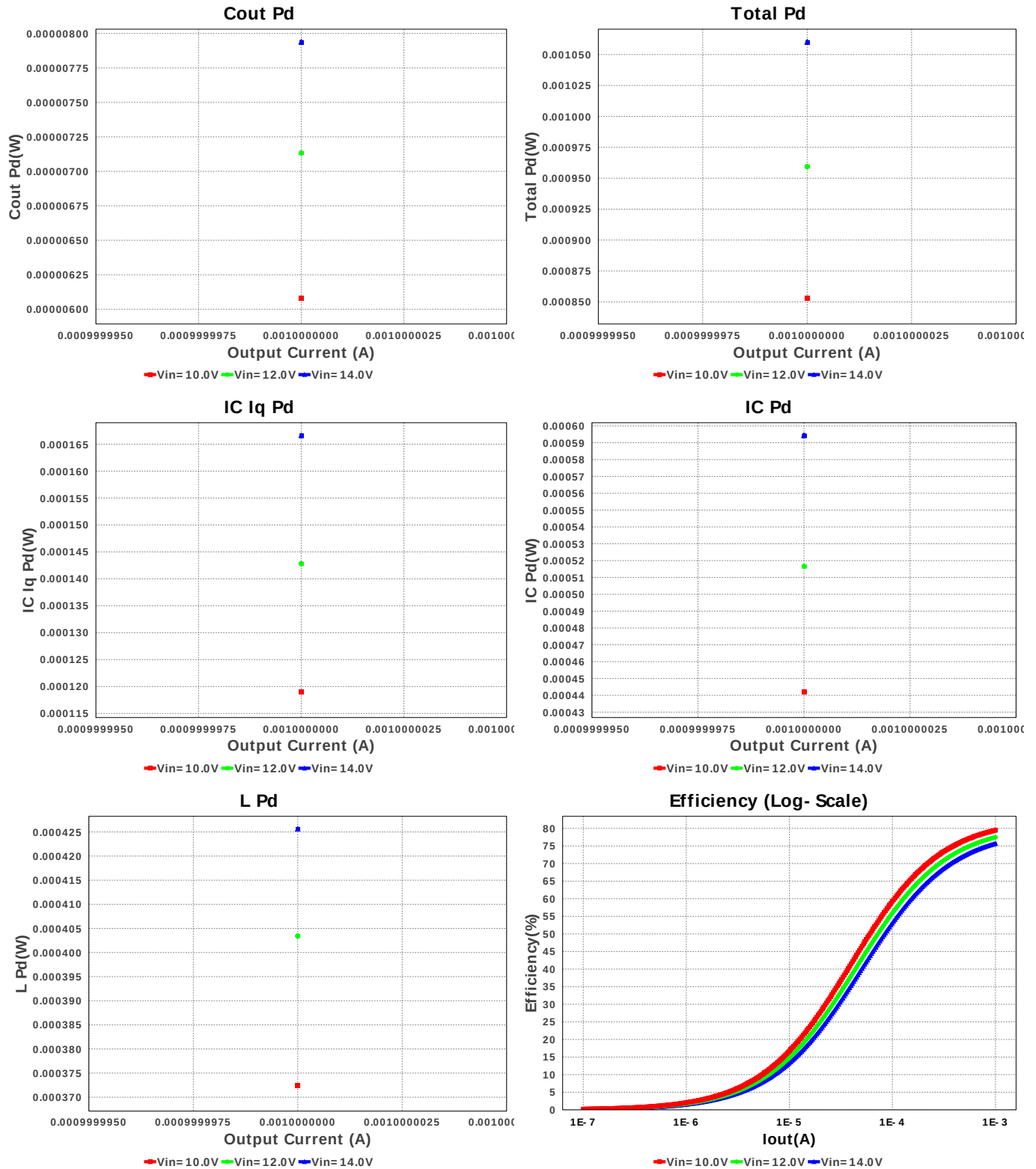


Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cff	Samsung Electro-Mechanics	CL21C250JBANNNC Series= C0G/NP0	Cap= 25.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
2.	Cin	Taiyo Yuden	TMK212BJ475KG-T Series= X5R	Cap= 4.7 uF VDC= 25.0 V IRMS= 0.0 A	1	\$0.05	0805 7 mm ²
3.	Cout	MuRata	GRM188R60J475KE19D Series= X5R	Cap= 4.7 uF ESR= 5.0 mOhm VDC= 6.3 V IRMS= 2.0 A	1	\$0.01	0603 5 mm ²
4.	L1	Taiyo Yuden	CBC2012T220M	L= 22.0 µH DCR= 3.7 Ohm	1	\$0.08	CBC2012 8 mm ²
5.	Rfbb	Yageo America	RC0603FR-0782KL Series= ?	Res= 82.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	0603 5 mm ²
6.	Rfbb	Vishay-Dale	CRCW0402255KFKED Series= CRCW..e3	Res= 255.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
7.	U1	Texas Instruments	TPS62122DRVR	Switcher	1	\$0.50	S-PWSON-N6 9 mm ²







Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	8.214 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	39.845 mA	Current	Output capacitor RMS ripple current
3.	IC Ipk	72.462 mA	Current	Peak switch current in IC
4.	Iin Avg	311.44 μ A	Current	Average input current
5.	L Ipp	142.92 mA	Current	Peak-to-peak inductor ripple current
6.	BOM Count	7	General	Total Design BOM count
7.	FootPrint	43.0 mm ²	General	Total Foot Print Area of BOM components
8.	Frequency	12.095 kHz	General	Switching frequency
9.	Pout	3.3 mW	General	Total output power
10.	Total BOM	\$0.67	General	Total BOM Cost
11.	Vout Actual	3.288 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors

#	Name	Value	Category	Description
12.	Vout OP	3.3 V	Op_Point	Operational Output Voltage
13.	Duty Cycle	355.416 m%	Op_point	Duty cycle
14.	Efficiency	75.686 %	Op_point	Steady state efficiency
15.	IC Tj	30.154 degC	Op_point	IC junction temperature
16.	ICThetaJA	259.7 degC/W	Op_point	IC junction-to-ambient thermal resistance
17.	IOUT_OP	1.0 mA	Op_point	Iout operating point
18.	VIN_OP	14.0 V	Op_point	Vin operating point
19.	Vout p-p	9.651 mV	Op_point	Peak-to-peak output ripple voltage
20.	Cin Pd	0.0 W	Power	Input capacitor power dissipation
21.	Cout Pd	7.938 μ W	Power	Output capacitor power dissipation
22.	IC Iq Pd	166.6 μ W	Power	IC Iq Pd
23.	IC Pd	594.262 μ W	Power	IC power dissipation
24.	L Pd	425.589 μ W	Power	Inductor power dissipation
25.	Total Pd	1.06 mW	Power	Total Power Dissipation
26.	Vout Tolerance	4.067 %		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	TPS62122	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	30.0	Ambient temperature

Design Assistance

1. **TPS62122** Product Folder : <http://www.ti.com/product/TPS62122> : contains the data sheet and other resources.

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