

WEBENCH® Power Architect

Project Report

Project : 1194016/441 : PA_Project_304 (modified from 301)

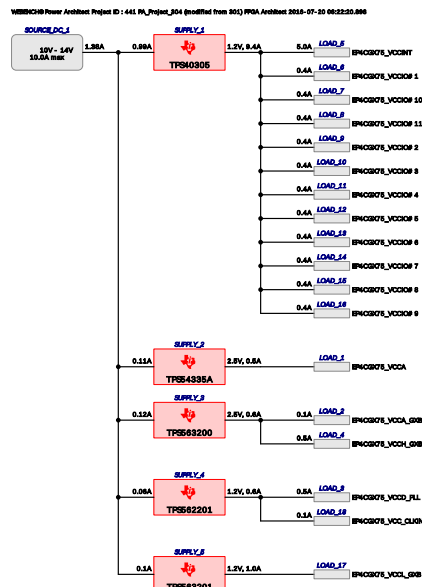
Created : 2016-07-20 06:22:20.898

Optimize project optFactor=3

Project Summary

1. Total System Efficiency	82.474 %
2. Total System BOM Count	53.0
3. Total System Footprint	850.0 mm2
4. Total System BOM Cost	\$7.60
5. Total System Power Dissipation	3.389 W

--> Launch WEBENCH Power Architect.



My Comments

No comments

Sequencer Flag Table

Supply	Sequencer Flag	Load	Load Name
SUPPLY_1	0	LOAD_5	EP4CGX75_VCCINT
SUPPLY_1	0	LOAD_6	EP4CGX75_VCCIO# 1
SUPPLY_1	0	LOAD_7	EP4CGX75_VCCIO# 10
SUPPLY_1	0	LOAD_8	EP4CGX75_VCCIO# 11
SUPPLY_1	0	LOAD_9	EP4CGX75_VCCIO# 2
SUPPLY_1	0	LOAD_10	EP4CGX75_VCCIO# 3
SUPPLY_1	0	LOAD_11	EP4CGX75_VCCIO# 4
SUPPLY_1	0	LOAD_12	EP4CGX75_VCCIO# 5
SUPPLY_1	0	LOAD_13	EP4CGX75_VCCIO# 6
SUPPLY_1	0	LOAD_14	EP4CGX75_VCCIO# 7
SUPPLY_1	0	LOAD_15	EP4CGX75_VCCIO# 8
SUPPLY_1	0	LOAD_16	EP4CGX75_VCCIO# 9
SUPPLY_2	0	LOAD_1	EP4CGX75_VCCA
SUPPLY_3	0	LOAD_2	EP4CGX75_VCCA_GXB
SUPPLY_3	0	LOAD_4	EP4CGX75_VCCD_GXB
SUPPLY_4	0	LOAD_3	EP4CGX75_VCCD_PLL
SUPPLY_4	0	LOAD_18	EP4CGX75_VCC_CLKIN
SUPPLY_5	0	LOAD_17	EP4CGX75_VCCCL_GXB

Power Supplies

#	Name	NSID	Description	Vout	Iout	Efficiency	Foot-print	Cost	Design	Page
1.	SUPPLY_1	TPS40305	Switcher : Synchronous Buck Controller	1.2 V	9.4 A	81.5%	204	\$3.03	2139	5
2.	SUPPLY_2	TPS54335A	Switcher : 28V, 3A, Low Iq, Synchronous, monolithic buck converter with Eco-mode	2.5 V	0.5 A	84.5%	173	\$1.29	2140	13
3.	SUPPLY_3	TPS563200	Switcher : 17V, 3A,6-pin, Low Iq Synchronous buck converter with Advanced Eco-mode	2.5 V	0.6 A	89.3%	149	\$1.06	2141	18
4.	SUPPLY_4	TPS562201	Switcher : 17V, 2A,6-pin, Low Iq Synchronous buck converter with Advanced Eco-mode	1.2 V	0.6 A	81.3%	162	\$1.06	2142	23
5.	SUPPLY_5	TPS563201	Switcher : 17V, 3A Synchronous buck converter with Advanced Eco-mode	1.2 V	1.0 A	82.3%	162	\$1.16	2143	29

Power Loads

#	Name	VLoad	ILoad	Description
1.	EP4CGX75_VCCINT	1.2 V	5 A	VoutRipple=8%, SoftStart delay=1.0 mSec
2.	EP4CGX75_VCCIO# 1	1.2 V	0.4 A	VoutRipple=10%, SoftStart delay=1.0 mSec

#	Name	VLoad	ILoad	Description
3.	EP4CGX75_VCCIO# 10	1.2 V	0.4 A	VoutRipple=10%, SoftStart delay=1.0 mSec
4.	EP4CGX75_VCCIO# 11	1.2 V	0.4 A	VoutRipple=10%, SoftStart delay=1.0 mSec
5.	EP4CGX75_VCCIO# 2	1.2 V	0.4 A	VoutRipple=10%, SoftStart delay=1.0 mSec
6.	EP4CGX75_VCCIO# 3	1.2 V	0.4 A	VoutRipple=10%, SoftStart delay=1.0 mSec
7.	EP4CGX75_VCCIO# 4	1.2 V	0.4 A	VoutRipple=10%, SoftStart delay=1.0 mSec
8.	EP4CGX75_VCCIO# 5	1.2 V	0.4 A	VoutRipple=10%, SoftStart delay=1.0 mSec
9.	EP4CGX75_VCCIO# 6	1.2 V	0.4 A	VoutRipple=10%, SoftStart delay=1.0 mSec
10.	EP4CGX75_VCCIO# 7	1.2 V	0.4 A	VoutRipple=10%, SoftStart delay=1.0 mSec
11.	EP4CGX75_VCCIO# 8	1.2 V	0.4 A	VoutRipple=10%, SoftStart delay=1.0 mSec
12.	EP4CGX75_VCCIO# 9	1.2 V	0.4 A	VoutRipple=10%, SoftStart delay=1.0 mSec
13.	EP4CGX75_VCCA	2.5 V	0.5 A	VoutRipple=6%, Group=analog, SoftStart delay=1.0 mSec
14.	EP4CGX75_VCCA_GXB	2.5 V	0.1 A	VoutRipple=10%, Group=tx2
15.	EP4CGX75_VCCH_GXB	2.5 V	0.5 A	VoutRipple=10%, Group=tx2
16.	EP4CGX75_VCCD_PLL	1.2 V	0.5 A	VoutRipple=8%, Group=digital1
17.	EP4CGX75_VCC_CLKIN	1.2 V	0.1 A	VoutRipple=10%, Group=digital1
18.	EP4CGX75_VCCL_GXB	1.2 V	1 A	VoutRipple=6%, Group=tx1

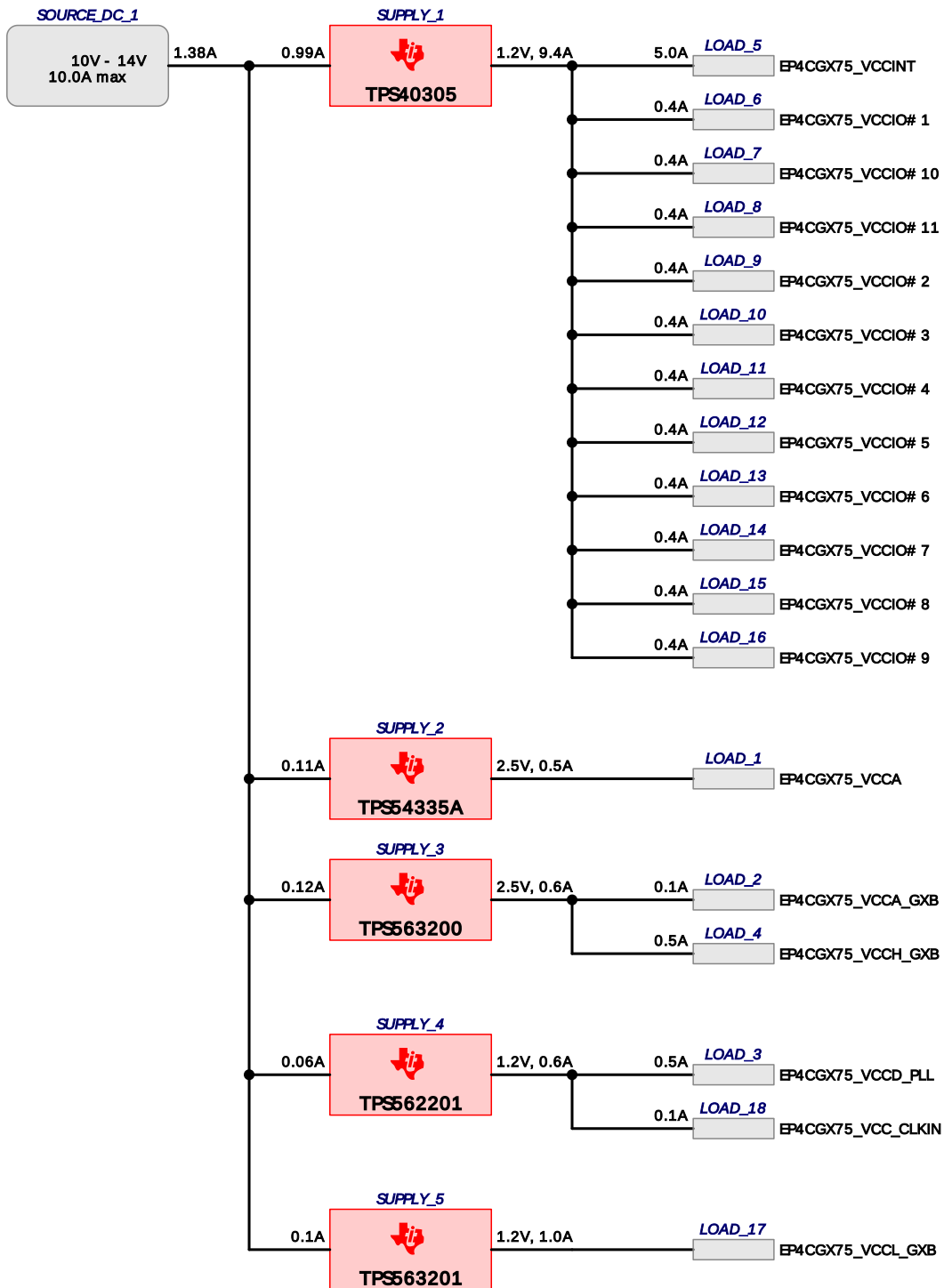
FPGAs, Processors

#	Manufacturer	Part Number	Name	Series	Description
1.	Altera	EP4CGX75	FPGA_1	Cyclone-IV GX	FPGA Altera Cyclone-IV GX EP4CGX75

<http://www.altera.com/literature/hb/cyclone-iv/cyiv-53001.pdf>

Project Diagram

WEBENCH® Power Architect Project ID : 441_PA_Project_304 (modified from 301) FPGA Architect 2016-07-20 06:22:20.898



Electrical Procurement BOM

Manufacturer	Part Number	Description	Quantity	Budgetary Price	Footprint (mm ²)
AVX	08053C104KAT2A	0805	4	\$0.01	27
Kemet	C0805C104K5RACTU	0805	2	\$0.01	14
TDK	C3216JB0J107M	1206	1	\$0.39	11
TDK	C3216X5R1E476M160AC	1206	2	\$0.35	22
TDK	C3216X6S0G476M	1206	1	\$0.13	11
Yageo America	CC0805KRX7R9BB272	0805	2	\$0.01	14
Samsung Electro-Mechanics	CL21C102JBCNFNC	0805	1	\$0.01	7
Samsung Electro-Mechanics	CL21C910JBANNNC	0805	1	\$0.01	7
Vishay-Dale	CRCW0402100KFKED	0402	2	\$0.01	6
Vishay-Dale	CRCW040210K0FKED	0402	5	\$0.01	15
Vishay-Dale	CRCW040222K6FKED	0402	1	\$0.01	3
Vishay-Dale	CRCW040222K32FKED	0402	1	\$0.01	3
Vishay-Dale	CRCW0402332RFKED	0402	1	\$0.01	3
Vishay-Dale	CRCW04023K48FKED	0402	1	\$0.01	3
Vishay-Dale	CRCW04025K62FKED	0402	1	\$0.01	3
Vishay-Dale	CRCW04025K76FKED	0402	1	\$0.01	3
Vishay-Dale	CRCW0402634RFKED	0402	1	\$0.01	3
Vishay-Dale	CRCW040295K3FKED	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	GRM155R60J154KE01D	0402	1	\$0.01	3
MuRata	GRM155R71C183KA01D	0402	1	\$0.01	3
MuRata	GRM188R61E105KA12D	0603	1	\$0.01	5
MuRata	GRM21BR61C106KE15L	0805	1	\$0.03	7
MuRata	GRM21BR61E475KA12L	0805	1	\$0.02	7
MuRata	GRM21BR61E475MA12L	0805	1	\$0.02	7
MuRata	GRM31CE70G476ME15L	1206_190	1	\$0.10	11
MuRata	GRM32ER61E226KE15L	1210	3	\$0.16	44
Yageo America	RC0603FR-0747KL	0603	1	\$0.01	5
Bourns	SDR0604-330KL	SDR0604	1	\$0.18	61
Bourns	SRN8040-2R2Y	SRN8040	1	\$0.22	100
Texas Instruments	TPS40305DRCR	S-PVSON-N10	1	\$0.95	17
Texas Instruments	TPS54335ADDAR	R-PDSO-G8	1	\$0.90	57
Texas Instruments	TPS562201DDCR	DDC0006A	1	\$0.30	10
Texas Instruments	TPS563200DDCR	DDC0006A	1	\$0.52	10
Texas Instruments	TPS563201DDCR	DDC0006A	1	\$0.40	10
TDK	VLP8040T-2R2N	VLP8040	2	\$0.22	227
Coilcraft	XAL5030-331MEB	XAL5030	1	\$0.63	54
Total			53	\$7.60	831.5369

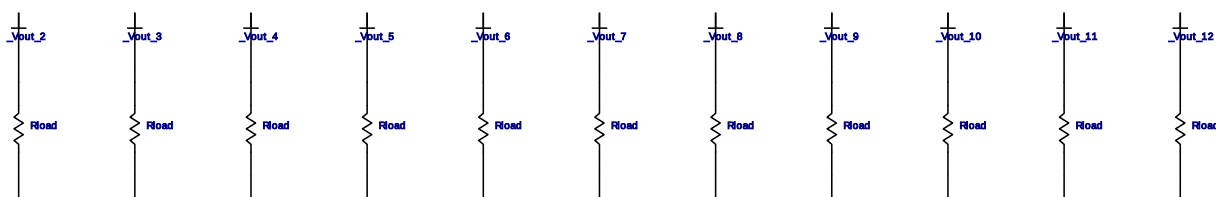
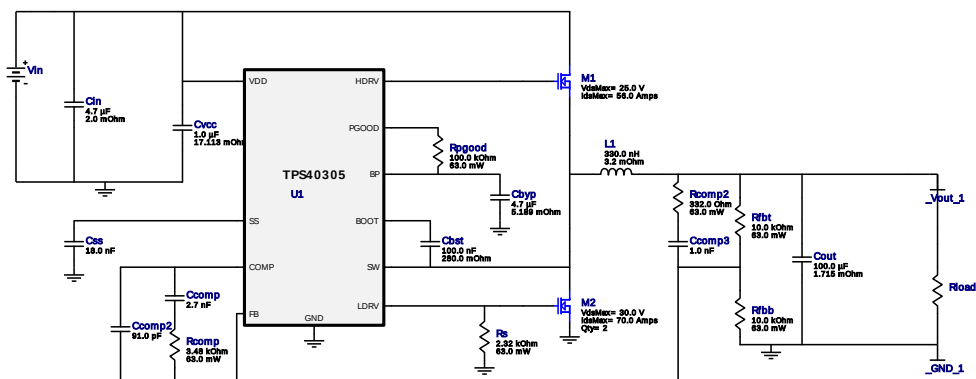


Vout = 1.2V
Iout = 9.4A

Device = TPS40305DRCR
Topology = Buck
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BOM Cost = \$3.03
BOM Count = 20
Total Pd = 2.56W

WEBENCH® Design Report

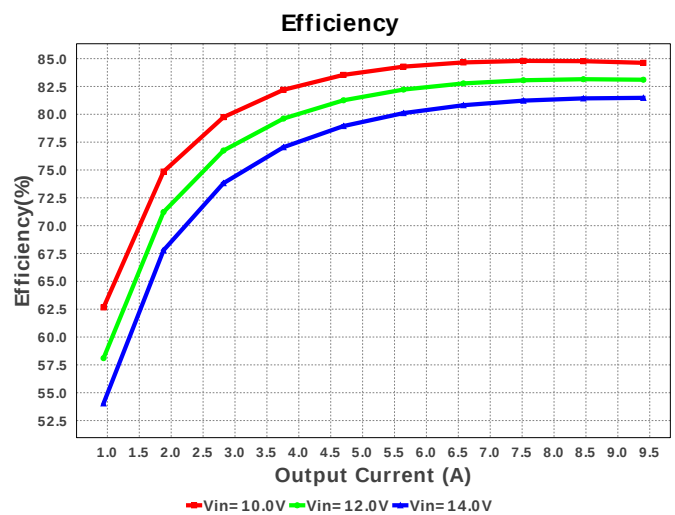
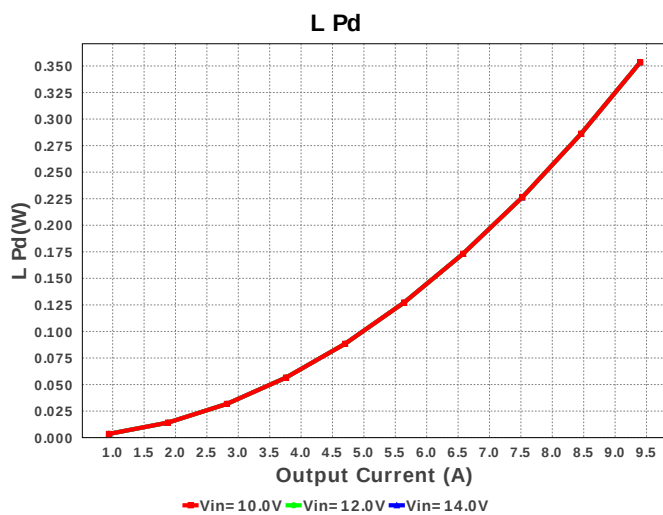
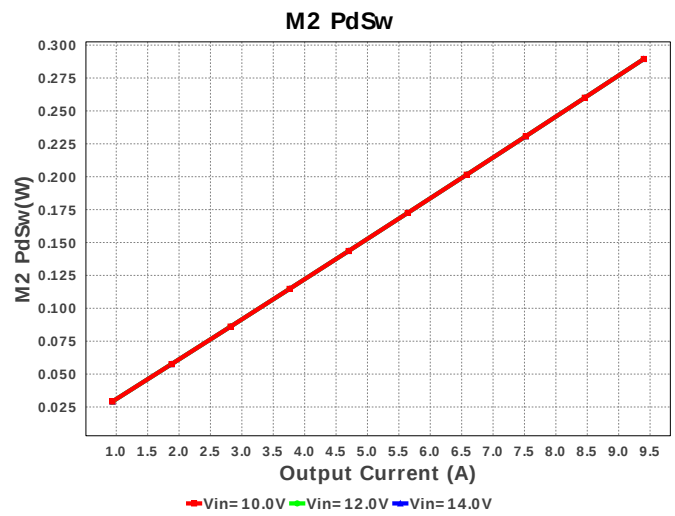
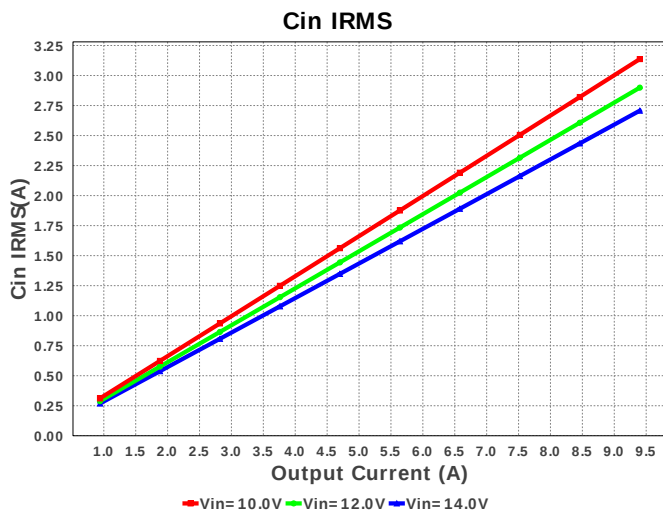
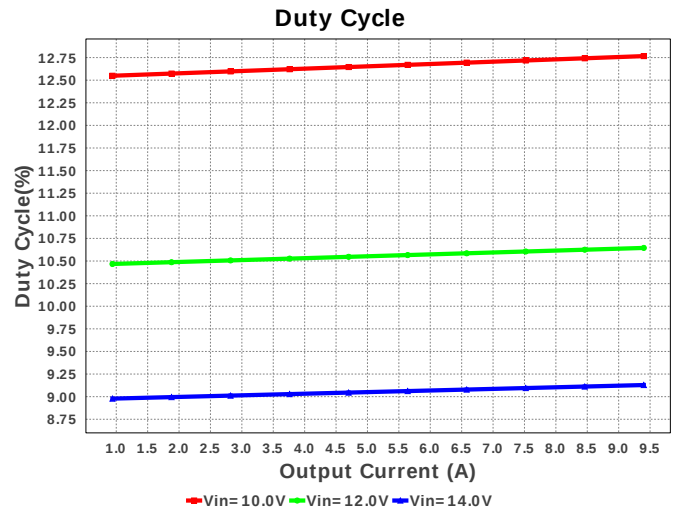
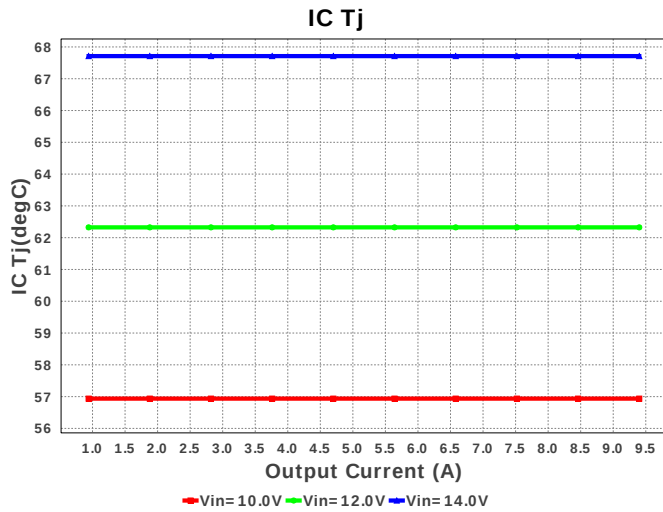
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TPS40305DRCR 10.0V-14.0V to 1.20V @ 9.4A

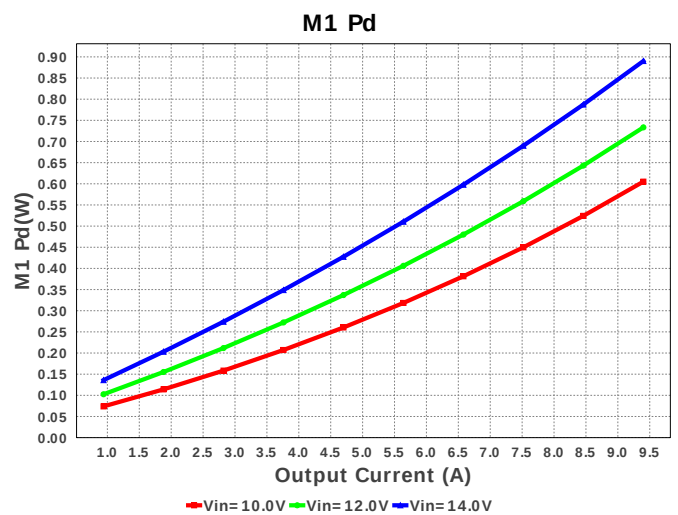
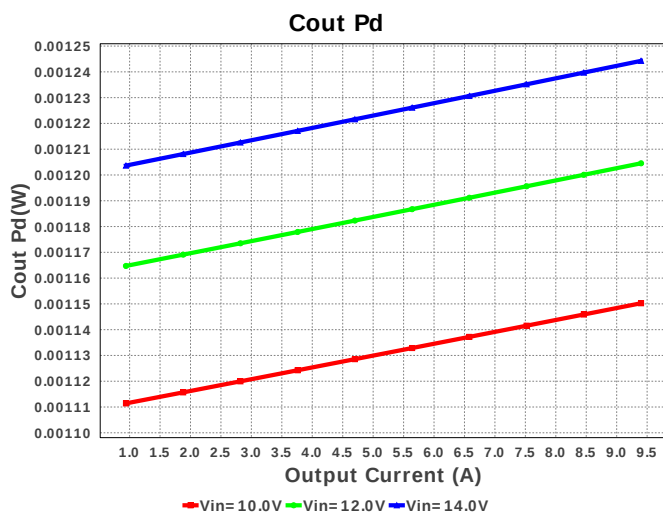
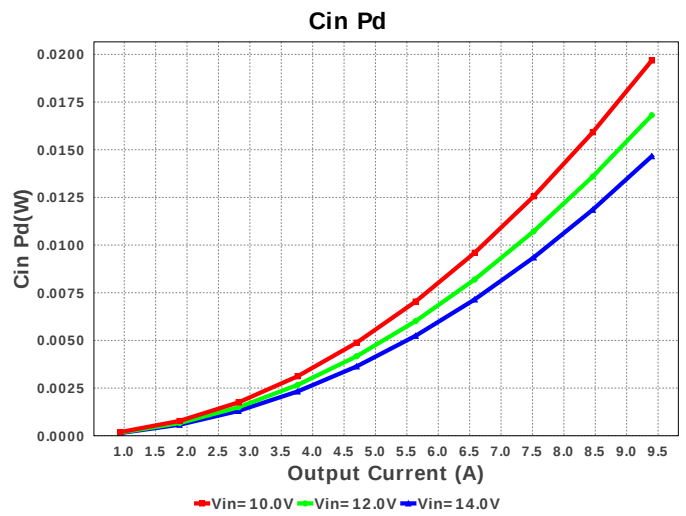
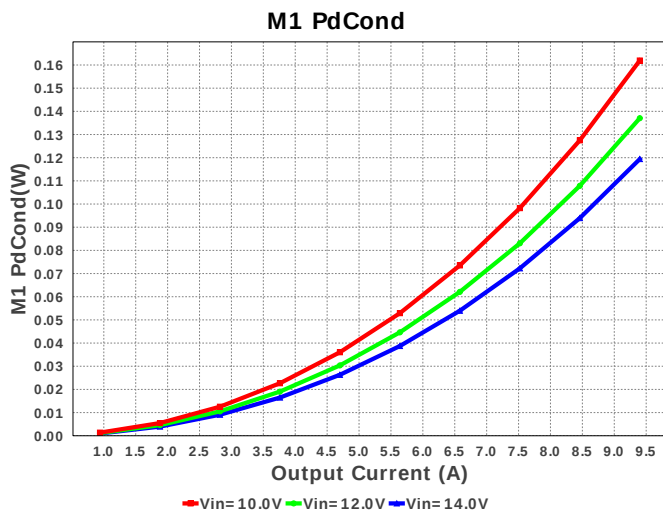
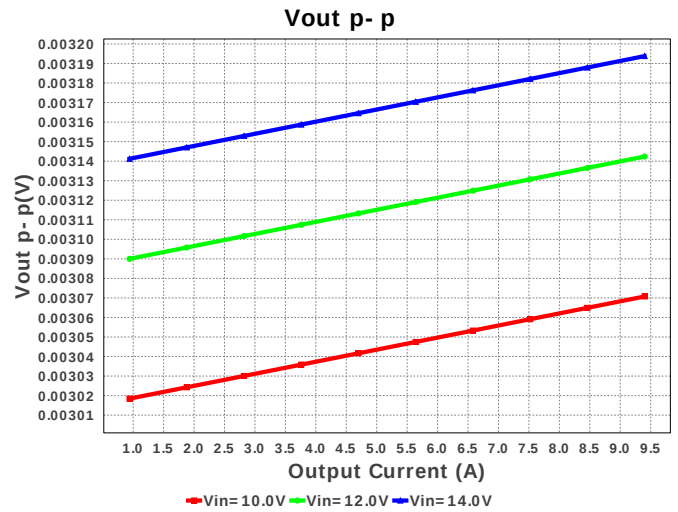
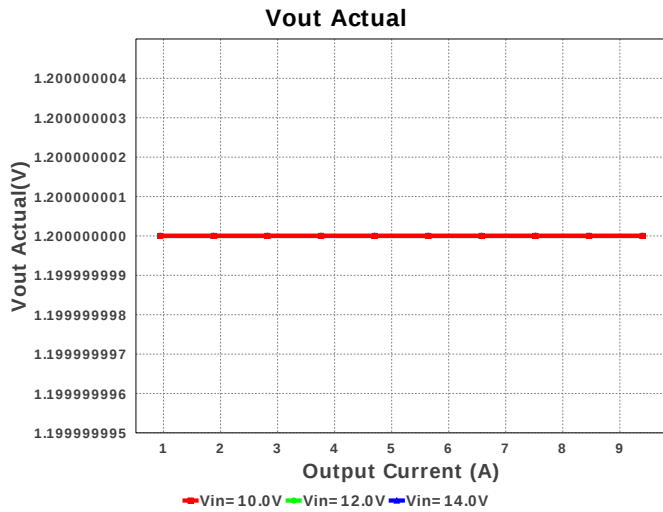


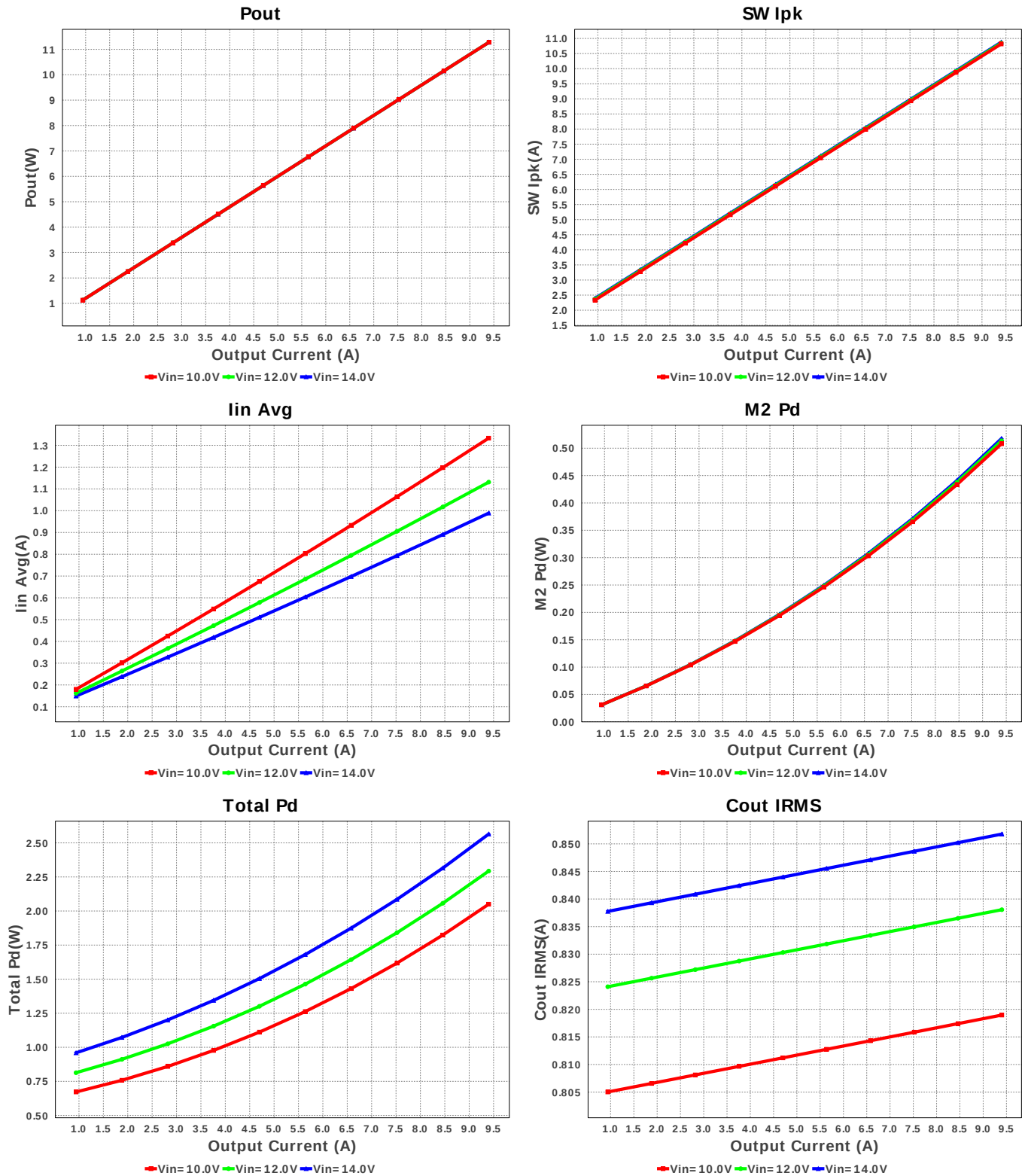
Electrical BOM

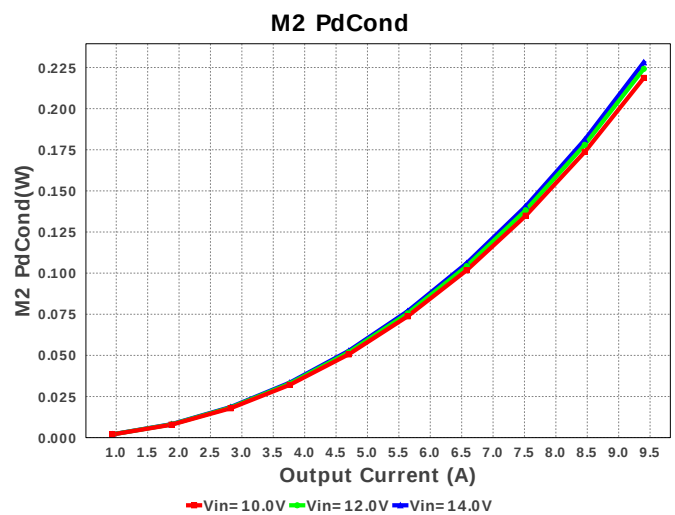
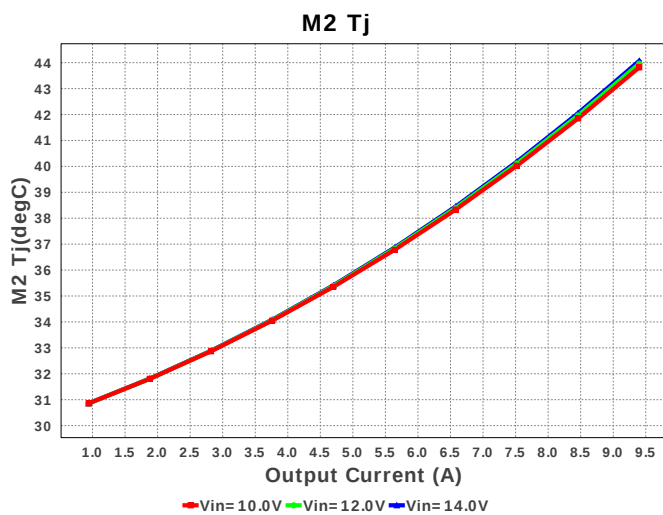
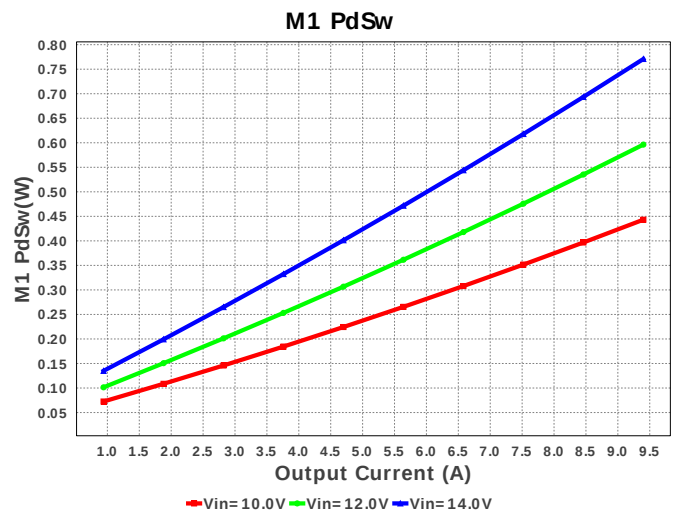
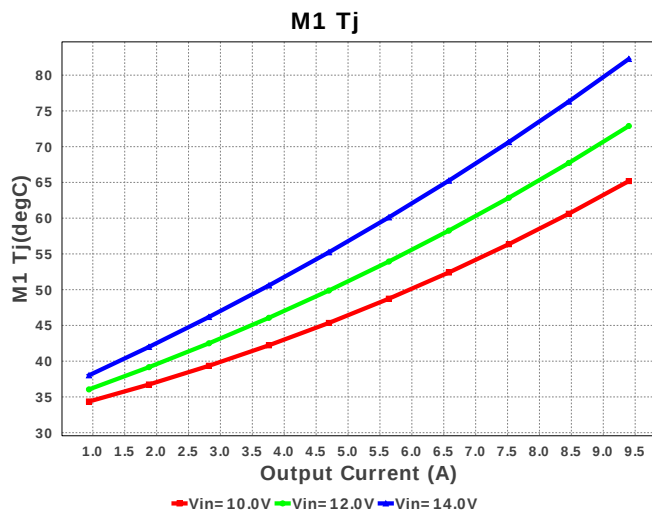
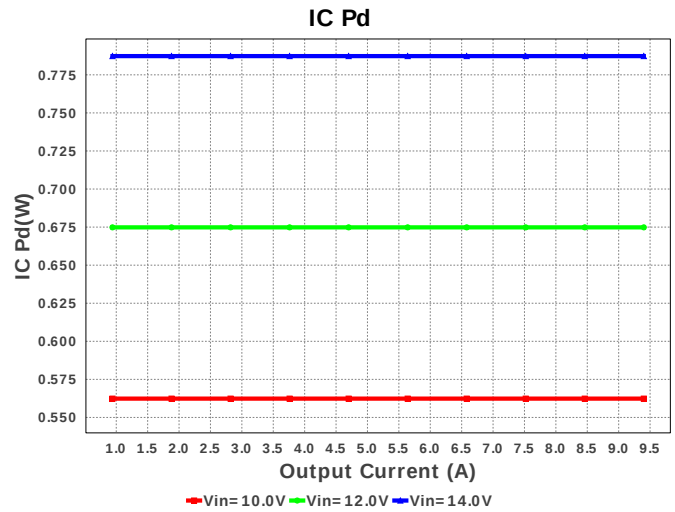
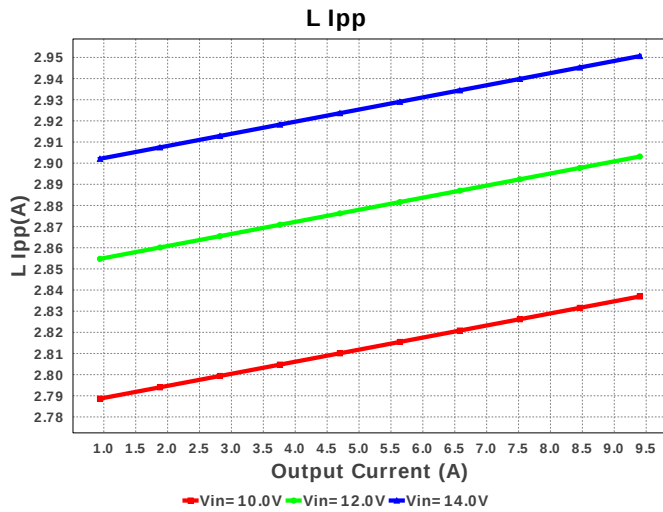
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbst	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
2.	Cbyp	MuRata	GRM21BR61E475KA12L Series= X5R	Cap= 4.7 uF ESR= 5.189 mOhm VDC= 25.0 V IRMS= 2.03531 A	1	\$0.02	0805 7 mm ²
3.	Ccomp	Yageo America	CC0805KRX7R9BB272 Series= X7R	Cap= 2.7 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
4.	Ccomp2	Samsung Electro-Mechanics	CL21C910JBANNNC Series= C0G/NP0	Cap= 91.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
5.	Ccomp3	Samsung Electro-Mechanics	CL21C102JBCNFNC Series= C0G/NP0	Cap= 1.0 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 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
7.	Cout	TDK	C3216JB0J107M Series= JB	Cap= 100.0 uF ESR= 1.715 mOhm VDC= 6.3 V IRMS= 0.0 A	1	\$0.39	1206 11 mm ²

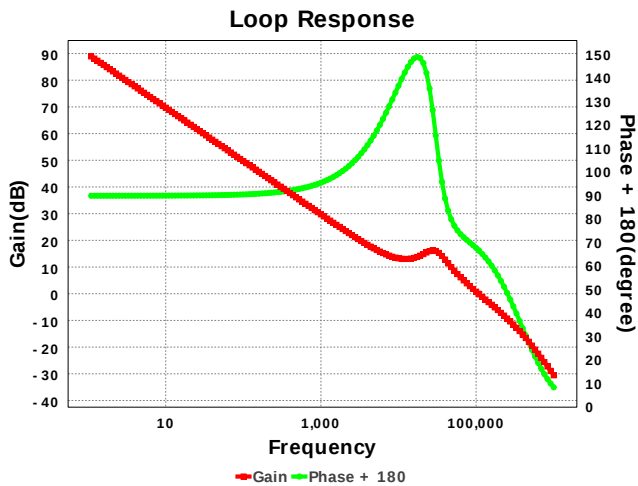
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
8.	Css	MuRata	GRM155R71C183KA01D Series= X7R	Cap= 18.0 nF VDC= 16.0 V IRMS= 0.0 A	1	\$0.01	 0402 3 mm ²
9.	Cvcc	MuRata	GRM188R61E105KA12D Series= X5R	Cap= 1.0 uF ESR= 17.113 mOhm VDC= 25.0 V IRMS= 979.39 mA	1	\$0.01	 0603 5 mm ²
10.	L1	Coilcraft	XAL5030-331MEB	L= 330.0 nH DCR= 3.2 mOhm	1	\$0.63	 XAL5030 54 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	CRCW04023K48FKED Series= CRCW..e3	Res= 3.48 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
14.	Rcomp2	Vishay-Dale	CRCW0402332RFKED Series= CRCW..e3	Res= 332.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
15.	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
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	CRCW04022K32FKED Series= CRCW..e3	Res= 2.32 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	2.707 A	Current	Input capacitor RMS ripple current
2.	Cout IRMS	851.773 mA	Current	Output capacitor RMS ripple current
3.	Iin Avg	988.32 mA	Current	Average input current
4.	L Ipp	2.951 A	Current	Peak-to-peak inductor ripple current
5.	SW Ipk	10.875 A	Current	Peak switch current
6.	BOM Count	20	General	Total Design BOM count
7.	FootPrint	204.0 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	11.28 W	General	Total output power
11.	Total BOM	\$3.03	General	Total BOM Cost
12.	Low Freq Gain	89.669 dB	Op_Point	Gain at 10Hz
13.	Vout Actual	1.2 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
14.	Cross Freq	104.511 kHz	Op_point	Bode plot crossover frequency
15.	Duty Cycle	9.129 %	Op_point	Duty cycle
16.	Efficiency	81.524 %	Op_point	Steady state efficiency
17.	Gain Marg	-38.11 dB	Op_point	Bode Plot Gain Margin
18.	IC Tj	67.712 degC	Op_point	IC junction temperature
19.	IOUT_OP	9.4 A	Op_point	Iout operating point
20.	M1 Tj	82.262 degC	Op_point	M1 MOSFET junction temperature
21.	M2 Tj	44.07 degC	Op_point	M2 MOSFET junction temperature
22.	Phase Marg	63.749 deg	Op_point	Bode Plot Phase Margin
23.	VIN_OP	14.0 V	Op_point	Vin operating point
24.	Vout p-p	3.074 mV	Op_point	Peak-to-peak output ripple voltage
25.	Cin Pd	14.659 mW	Power	Input capacitor power dissipation
26.	Cout Pd	1.244 mW	Power	Output capacitor power dissipation
27.	IC Pd	787.304 mW	Power	IC power dissipation
28.	L Pd	353.44 mW	Power	Inductor power dissipation
29.	M1 Pd	888.388 mW	Power	M1 MOSFET total power dissipation
30.	M1 PdCond	117.565 mW	Power	M1 MOSFET conduction losses
31.	M1 PdSw	770.823 mW	Power	M1 MOSFET switching losses
32.	M2 Pd	511.436 mW	Power	M2 MOSFET total power dissipation
33.	M2 PdCond	221.985 mW	Power	M2 MOSFET conduction losses
34.	M2 PdSw	289.451 mW	Power	M2 MOSFET switching losses
35.	Total Pd	2.556 W	Power	Total Power Dissipation
36.	Vout Tolerance	2.694 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	9.4	Maximum Output Current
2.	SoftStart	1.0 ms	Soft Start Time (ms)
3.	VinMax	14.0	Maximum input voltage
4.	VinMin	10.0	Minimum input voltage
5.	Vout	1.2	Output Voltage
6.	base_pn	TPS40305	Base Product Number
7.	source	DC	Input Source Type
8.	Ta	30.0	Ambient temperature

Design Assistance

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

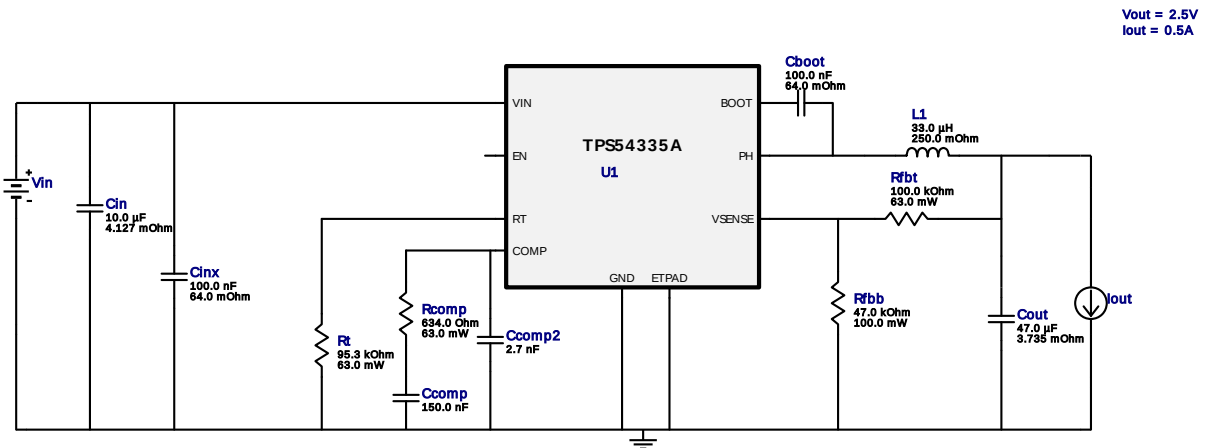


Vout = 2.5V
Iout = 0.5A

Device = TPS54335ADDAR
Topology = Buck
Created = 7/20/16 6:22:18 AM
BOM Cost = \$1.29
BOM Count = 12
Total Pd = 0.23W

WEBENCH® Design Report

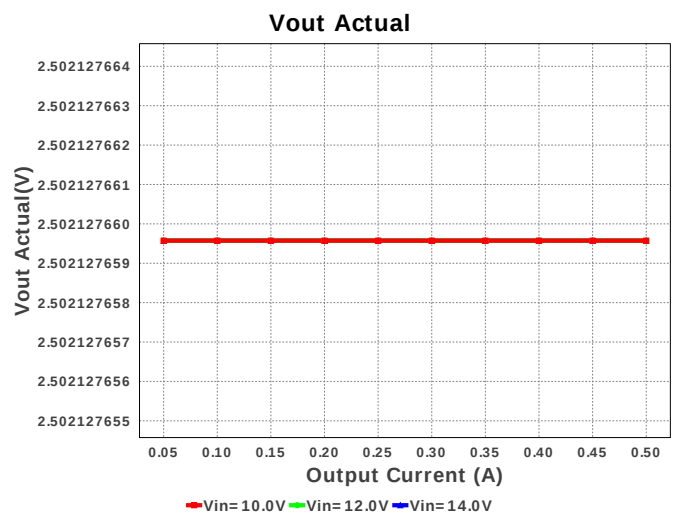
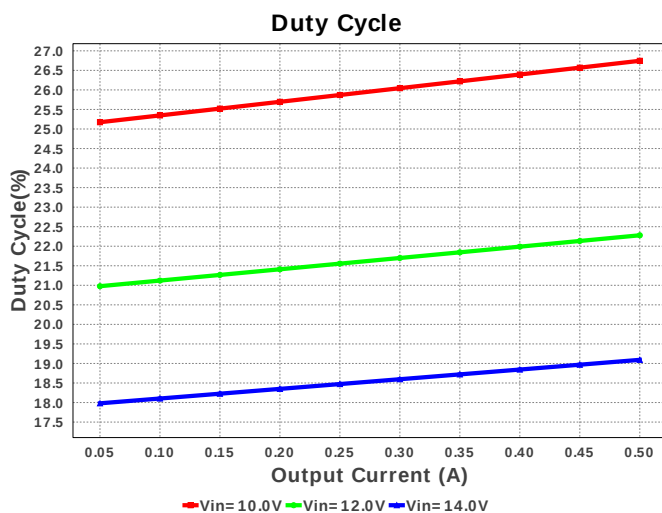
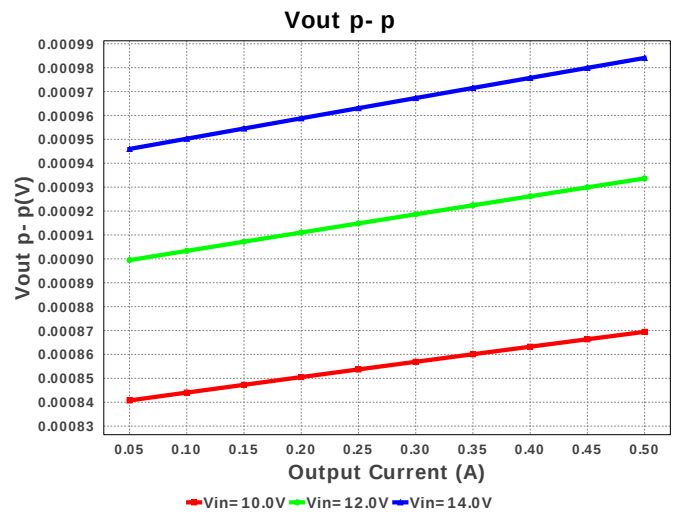
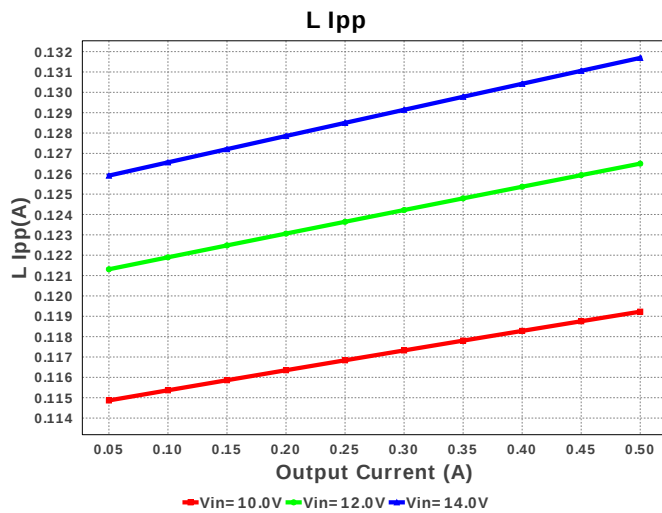
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TPS54335ADDAR 10.0V-14.0V to 2.50V @ 0.5A

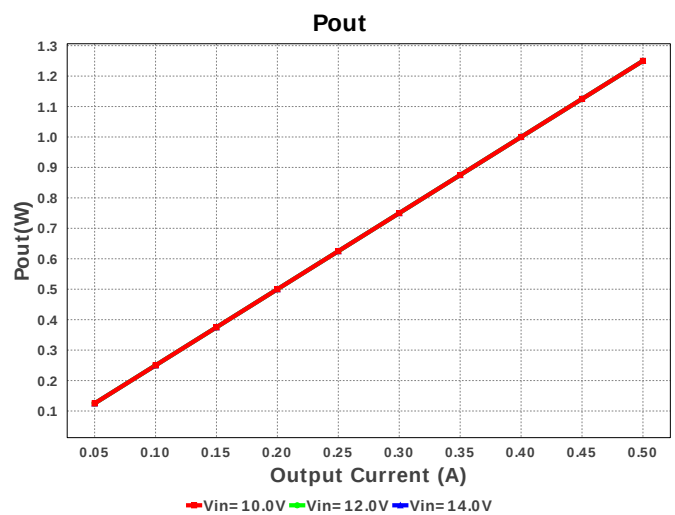
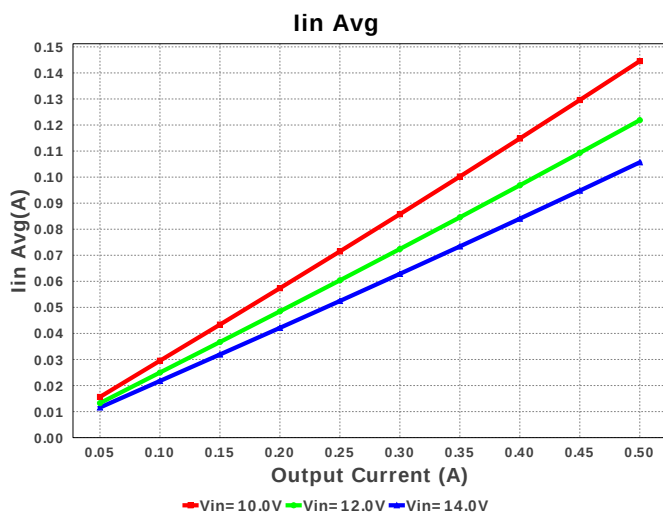
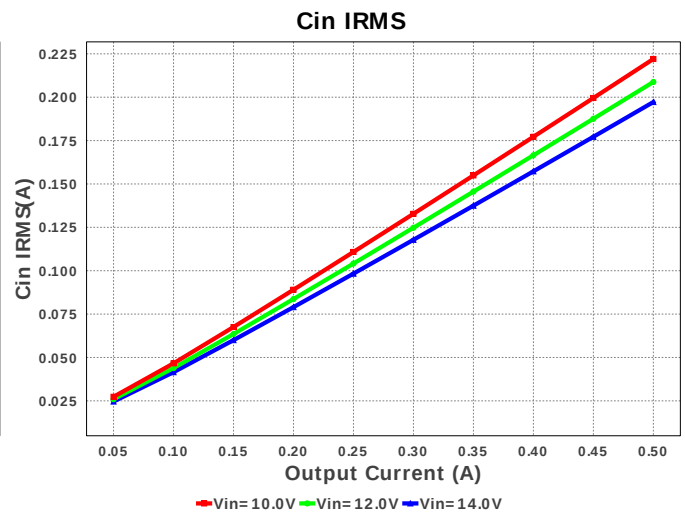
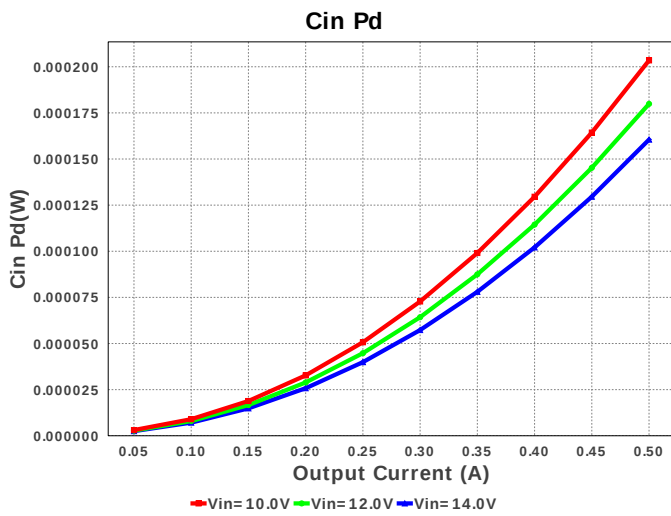
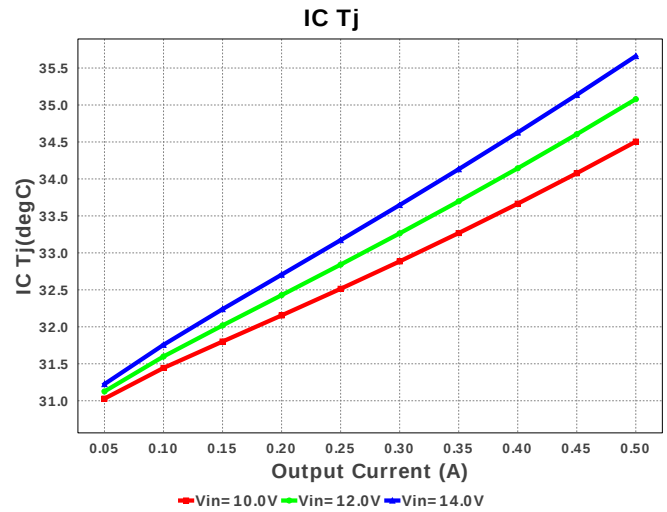
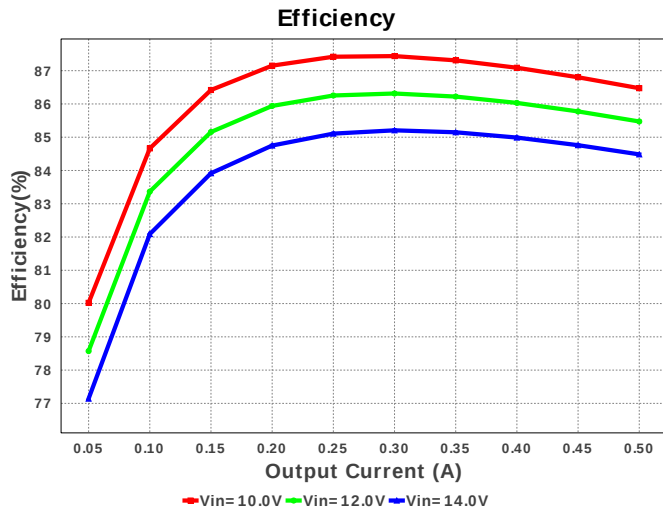


Electrical BOM

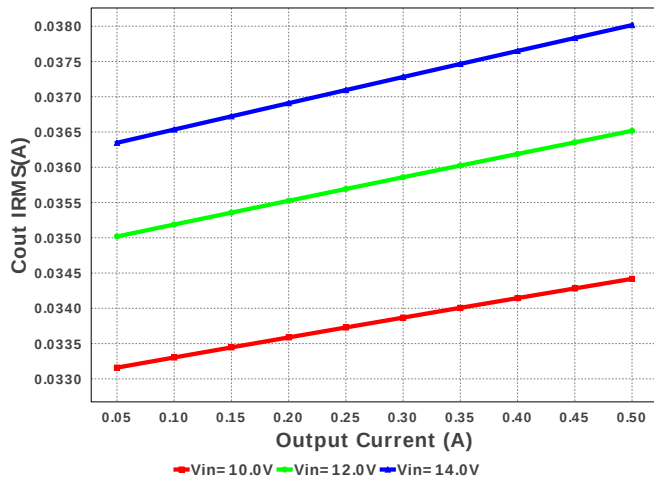
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot	Kemet	C0805C104K5RACTU Series= X7R	Cap= 100.0 nF ESR= 64.0 mOhm VDC= 50.0 V IRMS= 1.64 A	1	\$0.01	0805 7 mm ²
2.	Ccomp	MuRata	GRM155R60J154KE01D Series= X5R	Cap= 150.0 nF VDC= 6.3 V IRMS= 0.0 A	1	\$0.01	0402 3 mm ²
3.	Ccomp2	Yageo America	CC0805KRX7R9BB272 Series= X7R	Cap= 2.7 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
4.	Cin	MuRata	GRM21BR61C106KE15L Series= X5R	Cap= 10.0 uF ESR= 4.127 mOhm VDC= 16.0 V IRMS= 2.46634 A	1	\$0.03	0805 7 mm ²
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 mm ²
6.	Cout	MuRata	GRM31CE70G476ME15L Series= X7U	Cap= 47.0 uF ESR= 3.735 mOhm VDC= 4.0 V IRMS= 4.1841 A	1	\$0.10	1206_190 11 mm ²
7.	L1	Bourns	SDR0604-330KL	L= 33.0 uH DCR= 250.0 mOhm	1	\$0.18	SDR0604 61 mm ²
8.	Rcomp	Vishay-Dale	CRCW0402634RFKED Series= CRCW..e3	Res= 634.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
9.	Rfbb	Yageo America	RC0603FR-0747KL Series= ?	Res= 47.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	0603 5 mm ²
10.	Rfbt	Vishay-Dale	CRCW0402100KFKE 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
11.	Rt	Vishay-Dale	CRCW040295K3FKED Series= CRCW..e3	Res= 95.3 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
12.	U1	Texas Instruments	TPS54335ADDAR	Switcher	1	\$0.90	

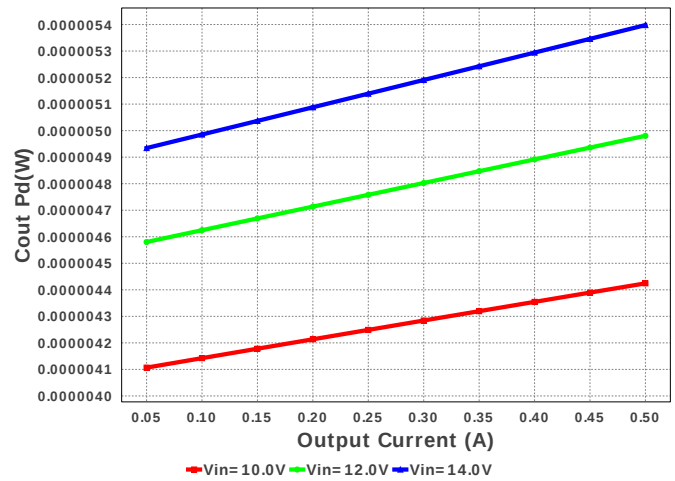
R-PDSO-G8 57 mm²



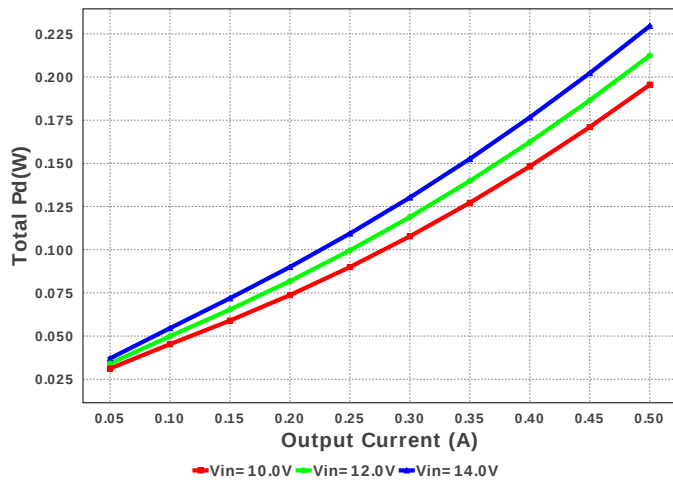
Cout IRMS



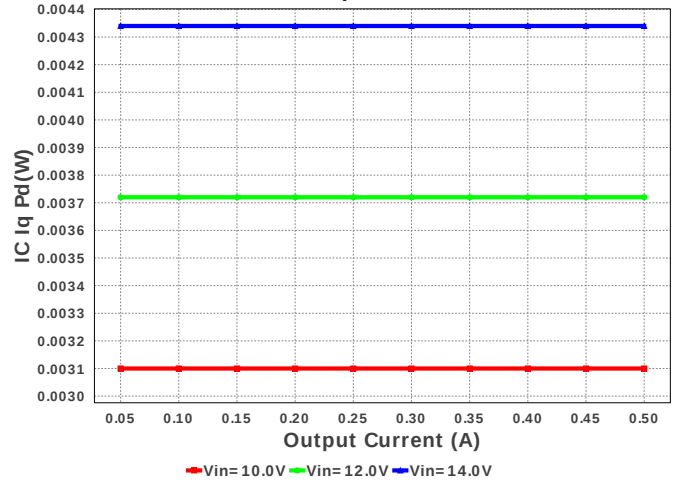
Cout Pd



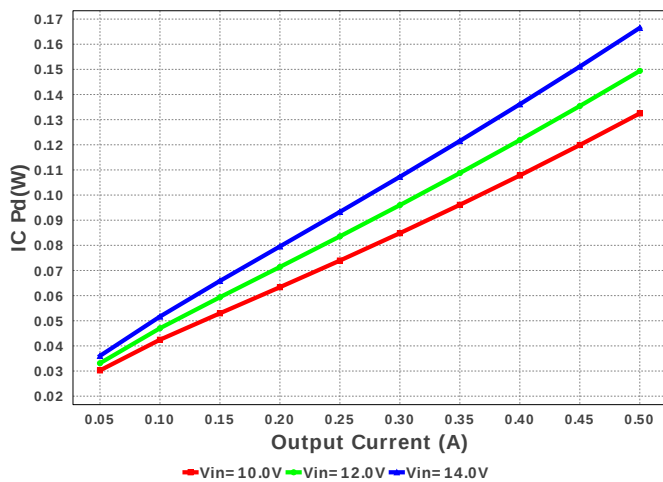
Total Pd



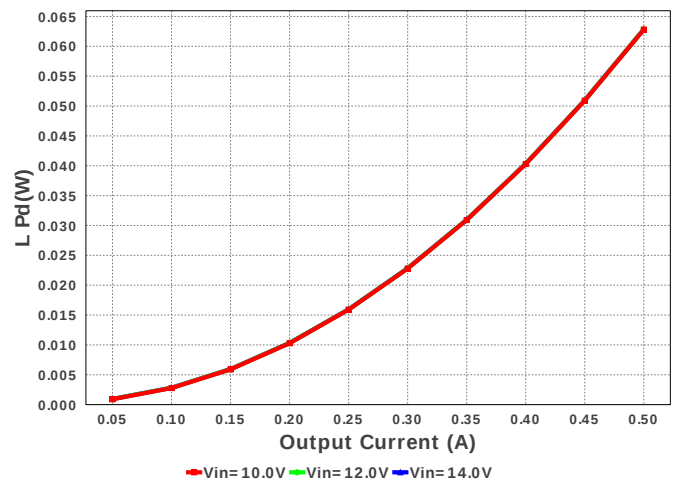
IC Iq Pd

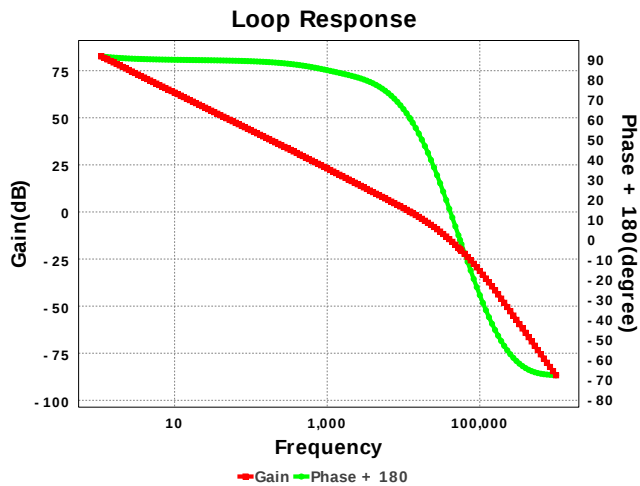


IC Pd



L Pd





Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	197.216 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	38.016 mA	Current	Output capacitor RMS ripple current
3.	Iin Avg	105.68 mA	Current	Average input current
4.	L Ipp	131.69 mA	Current	Peak-to-peak inductor ripple current
5.	BOM Count	12	General	Total Design BOM count
6.	FootPrint	173.0 mm ²	General	Total Foot Print Area of BOM components
7.	Frequency	496.814 kHz	General	Switching frequency
8.	IC Tolerance	12.0 mV	General	IC Feedback Tolerance
9.	Pout	1.25 W	General	Total output power
10.	Total BOM	\$1.29	General	Total BOM Cost
11.	ICThetaJA Effective	34.0 degC/W	Op_Point	Effective IC Junction-to-Ambient Thermal Resistance
12.	Low Freq Gain	82.566 dB	Op_Point	Gain at 10Hz
13.	Vout Actual	2.502 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
14.	Vout OP	2.5 V	Op_Point	Operational Output Voltage
15.	Cross Freq	12.304 kHz	Op_point	Bode plot crossover frequency
16.	Duty Cycle	19.092 %	Op_point	Duty cycle
17.	Efficiency	84.484 %	Op_point	Steady state efficiency
18.	Gain Marg	-19.793 dB	Op_point	Bode Plot Gain Margin
19.	IC Tj	35.661 degC	Op_point	IC junction temperature
20.	IOUT_OP	500.0 mA	Op_point	Iout operating point
21.	Phase Marg	60.519 deg	Op_point	Bode Plot Phase Margin
22.	VIN_OP	14.0 V	Op_point	Vin operating point
23.	Vout p-p	984.085 μ V	Op_point	Peak-to-peak output ripple voltage
24.	Cin Pd	160.516 μ W	Power	Input capacitor power dissipation
25.	Cout Pd	5.398 μ W	Power	Output capacitor power dissipation
26.	IC Iq Pd	4.34 mW	Power	IC Iq Pd
27.	IC Pd	166.509 mW	Power	IC power dissipation
28.	L Pd	62.861 mW	Power	Inductor power dissipation
29.	Total Pd	229.562 mW	Power	Total Power Dissipation
30.	Vout Tolerance	2.895 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	500.0 m	Maximum Output Current
2.	SoftStart	1.0 ms	Soft Start Time (ms)
3.	VinMax	14.0	Maximum input voltage
4.	VinMin	10.0	Minimum input voltage
5.	Vout	2.5	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.

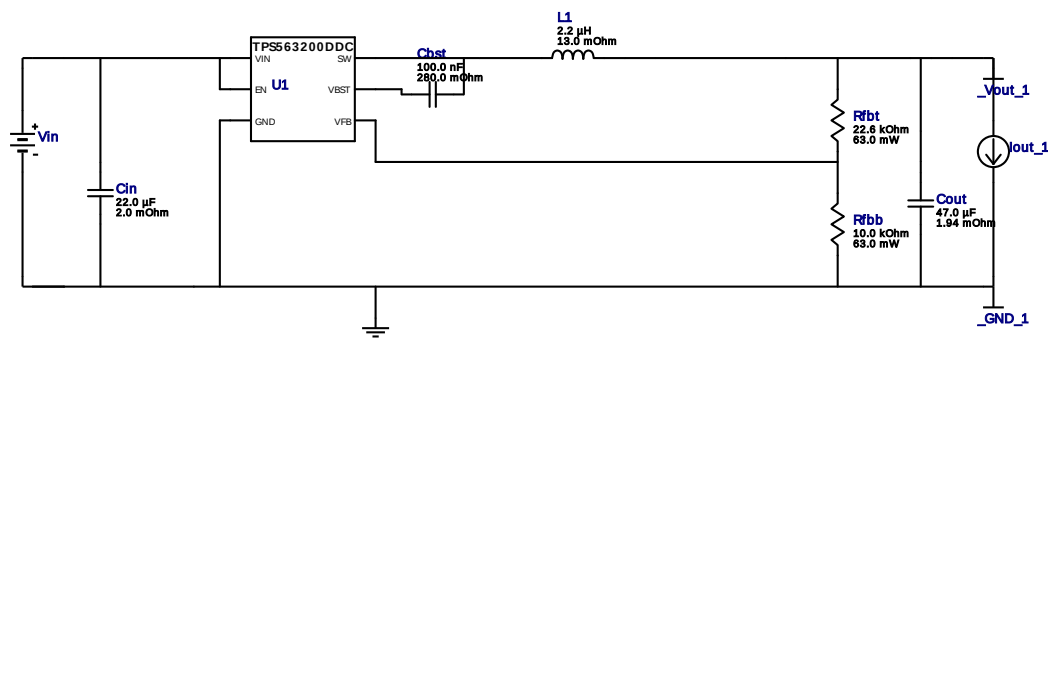


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Iout = 0.6A

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Topology = Buck
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BOM Cost = \$1.06
BOM Count = 7
Total Pd = 0.18W

WEBENCH® Design Report

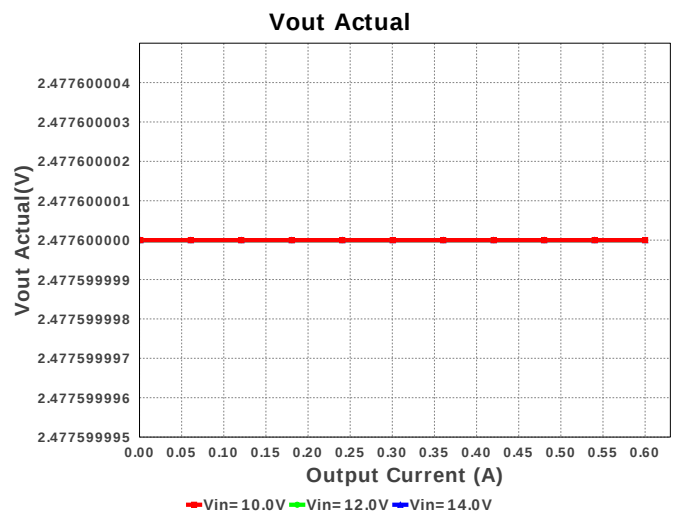
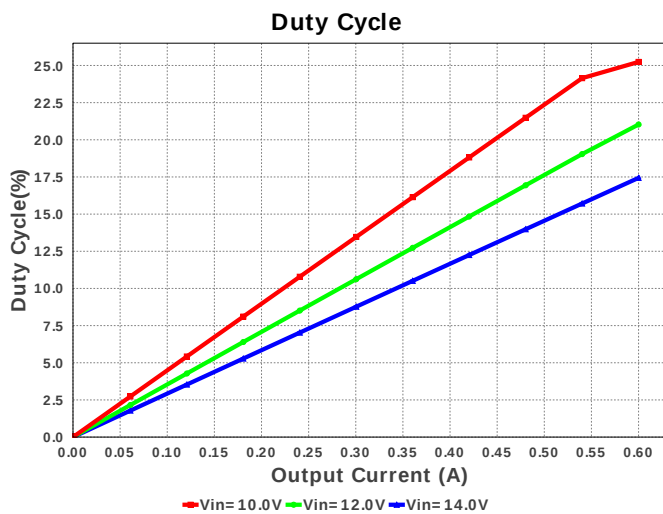
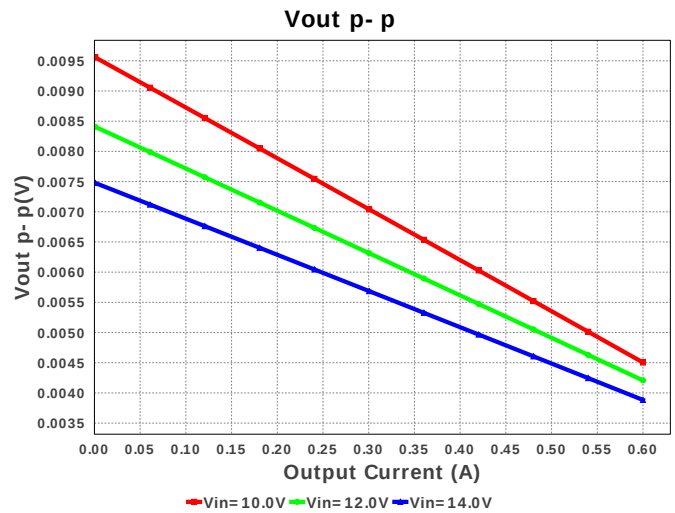
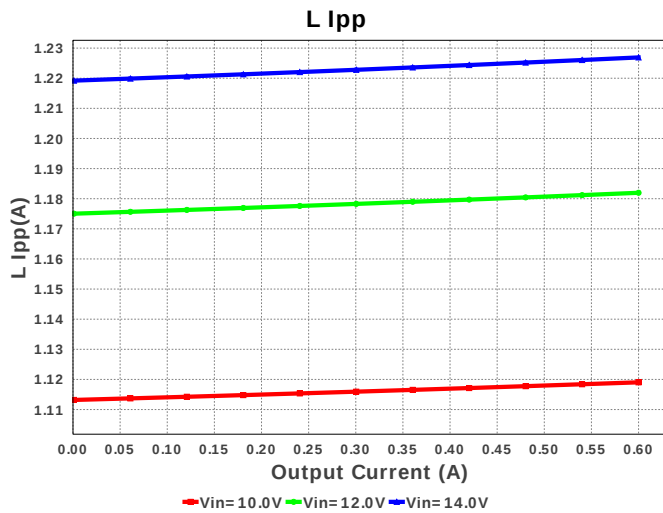
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TPS563200DDCR 10.0V-14.0V to 2.50V @ 0.6A

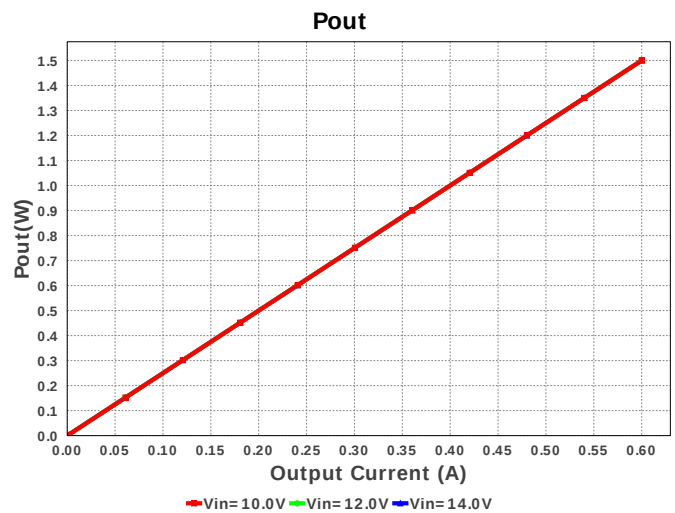
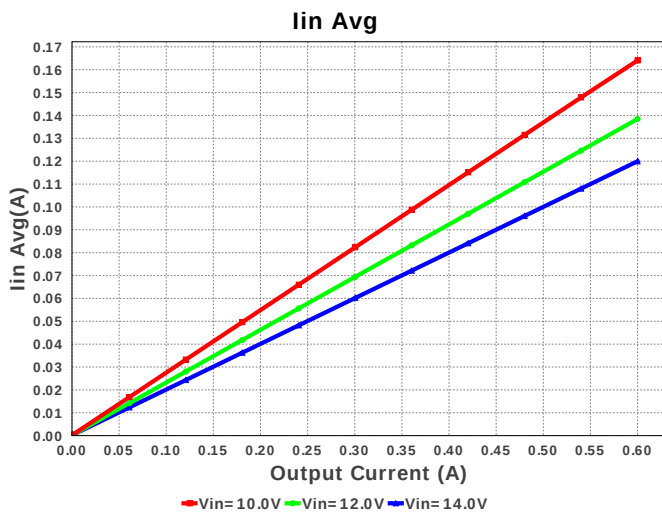
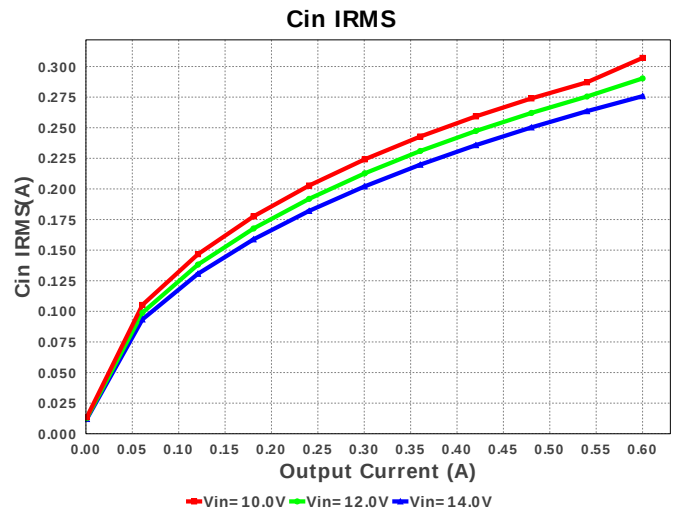
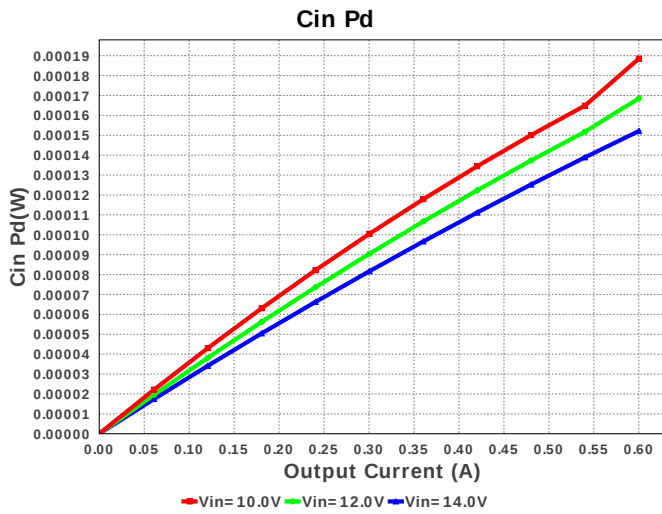
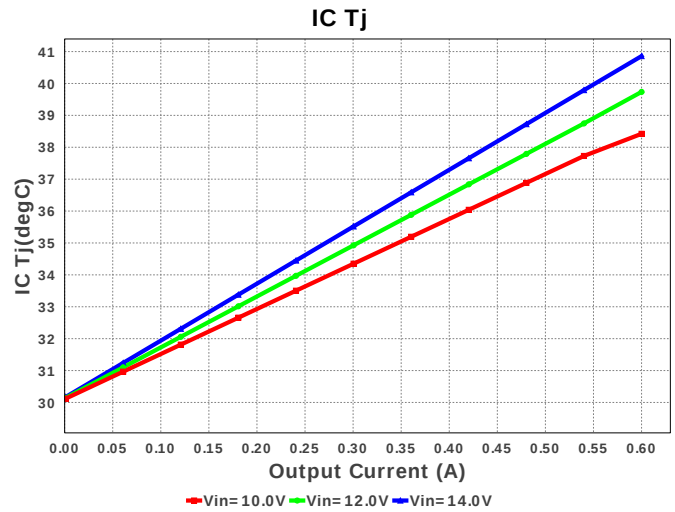
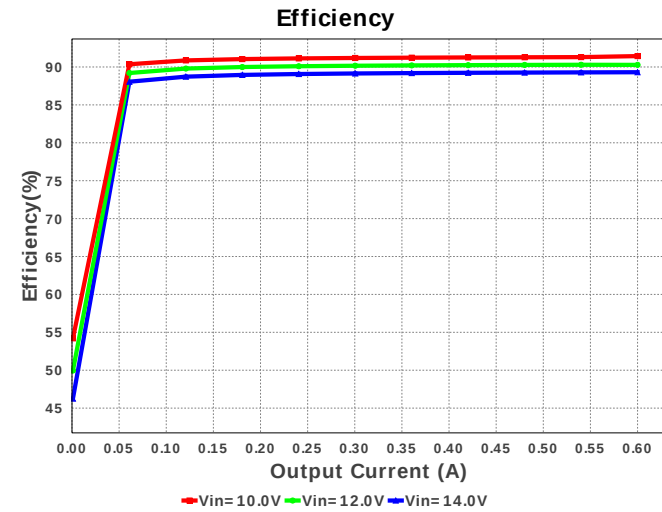


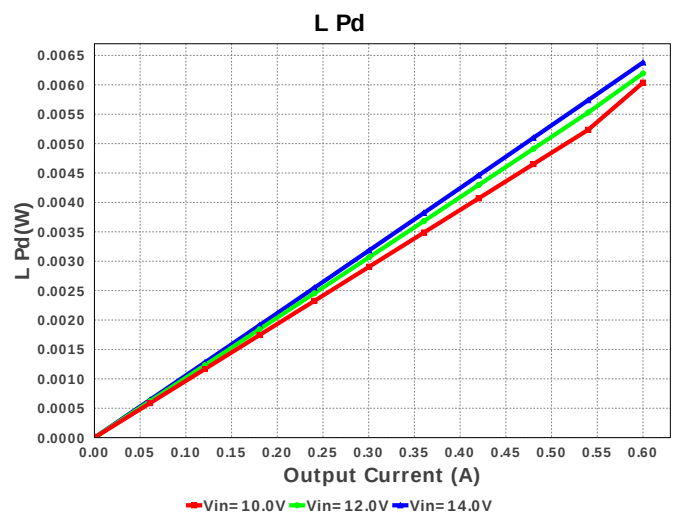
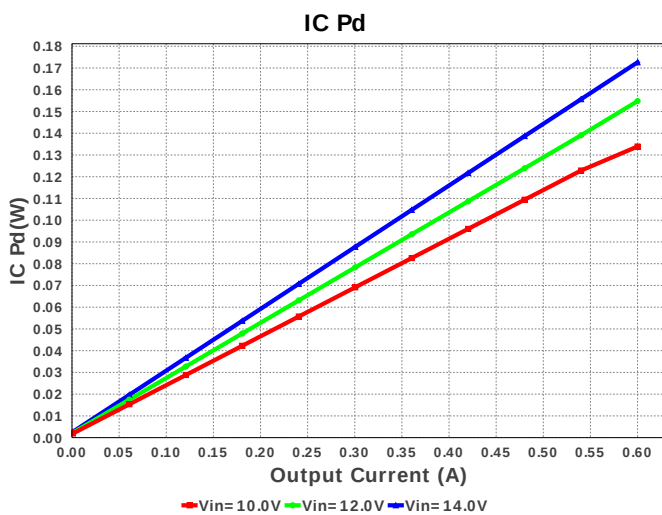
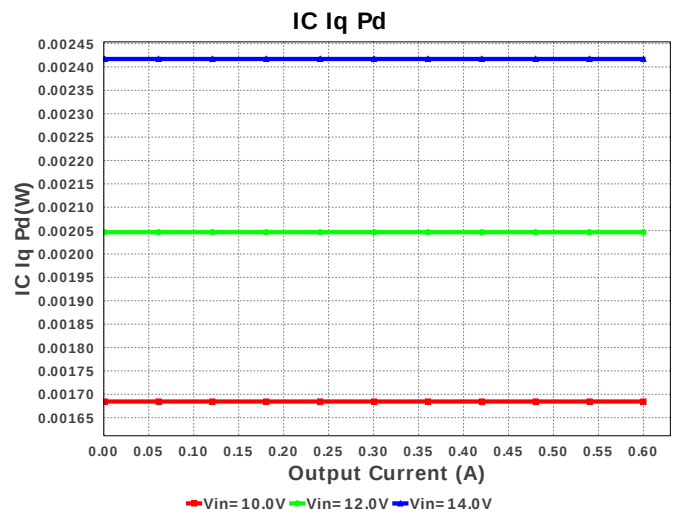
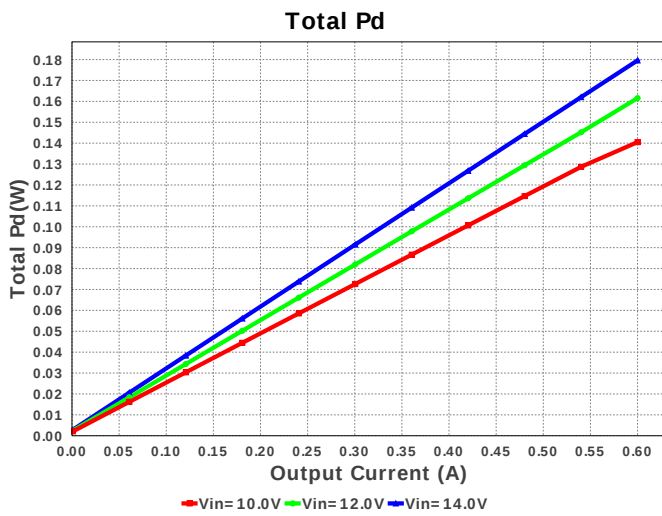
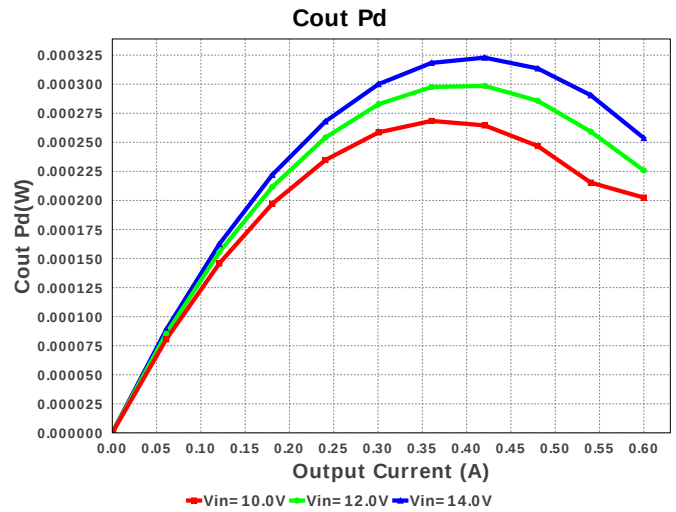
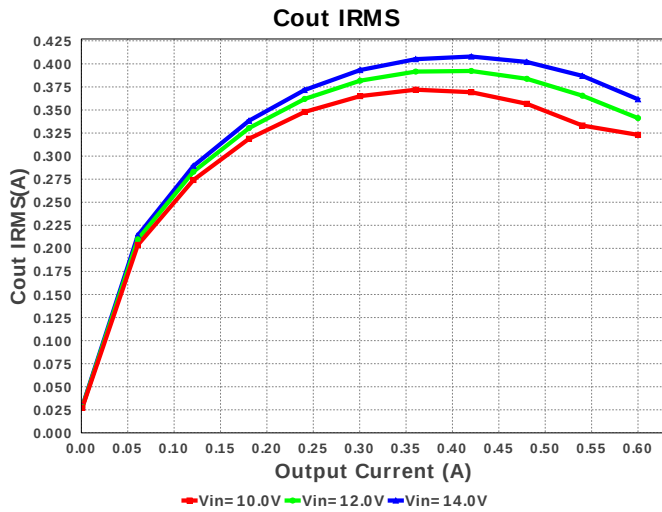
Electrical BOM

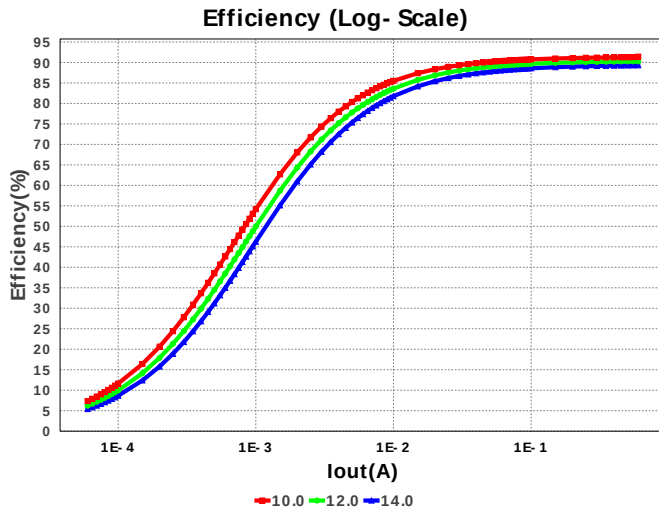
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbst	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm²
2.	Cin	MuRata	GRM32ER61E226KE15L Series= X5R	Cap= 22.0 uF ESR= 2.0 mOhm VDC= 25.0 V IRMS= 3.67 A	1	\$0.16	 1210 15 mm²
3.	Cout	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	SRN8040-2R2Y	L= 2.2 uH DCR= 13.0 mOhm	1	\$0.22	 SRN8040 100 mm²
5.	Rfbb	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
6.	Rfbb	Vishay-Dale	CRCW040222K6FKED Series= CRCW..e3	Res= 22.6 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²

#	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	275.777 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	361.611 mA	Current	Output capacitor RMS ripple current
3.	Iin Avg	119.97 mA	Current	Average input current
4.	L Ipp	1.227 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	740.627 kHz	General	Switching frequency
8.	Pout	1.5 W	General	Total output power
9.	Total BOM	\$1.06	General	Total BOM Cost
10.	Vout Actual	2.478 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
11.	Vout OP	2.5 V	Op_Point	Operational Output Voltage
12.	Duty Cycle	17.438 %	Op_point	Duty cycle
13.	Efficiency	89.307 %	Op_point	Steady state efficiency
14.	IC Tj	40.858 degC	Op_point	IC junction temperature
15.	ICThetaJA	62.9 degC/W	Op_point	IC junction-to-ambient thermal resistance
16.	IOUT_OP	600.0 mA	Op_point	Iout operating point
17.	VIN_OP	14.0 V	Op_point	Vin operating point
18.	Vout p-p	7.601 mV	Op_point	Peak-to-peak output ripple voltage
19.	Cin Pd	152.106 μ W	Power	Input capacitor power dissipation
20.	Cout Pd	253.679 μ W	Power	Output capacitor power dissipation
21.	IC Iq Pd	2.417 mW	Power	IC Iq Pd
22.	IC Pd	172.625 mW	Power	IC power dissipation
23.	L Pd	6.38 mW	Power	Inductor power dissipation
24.	Total Pd	179.597 mW	Power	Total Power Dissipation
25.	Vout Tolerance	2.735 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	600.0 m	Maximum Output Current
2.	VinMax	14.0	Maximum input voltage
3.	VinMin	10.0	Minimum input voltage
4.	Vout	2.5	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.

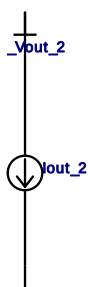
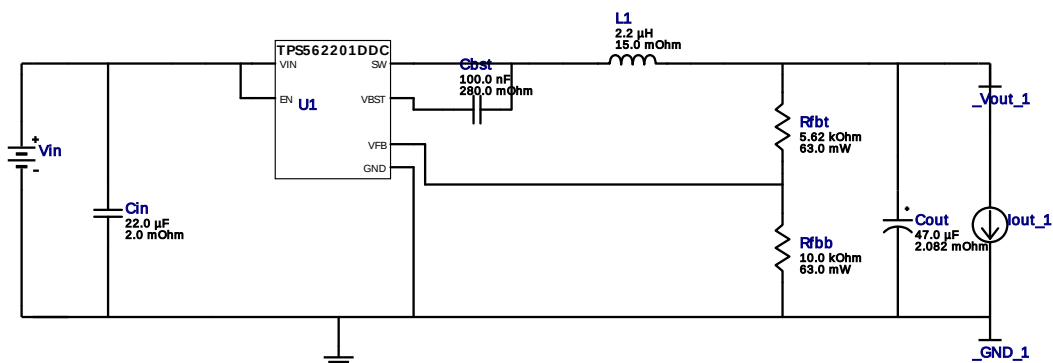


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Iout = 0.6A

Device = TPS562201DDCR
Topology = Buck
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BOM Count = 7
Total Pd = 0.17W

WEBENCH® Design Report

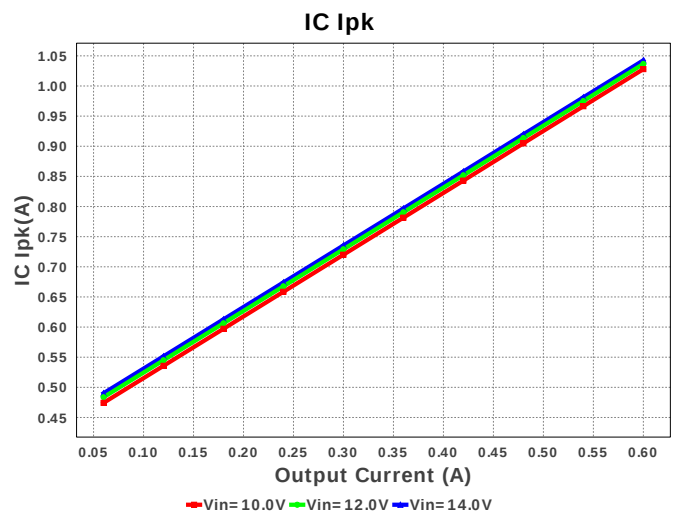
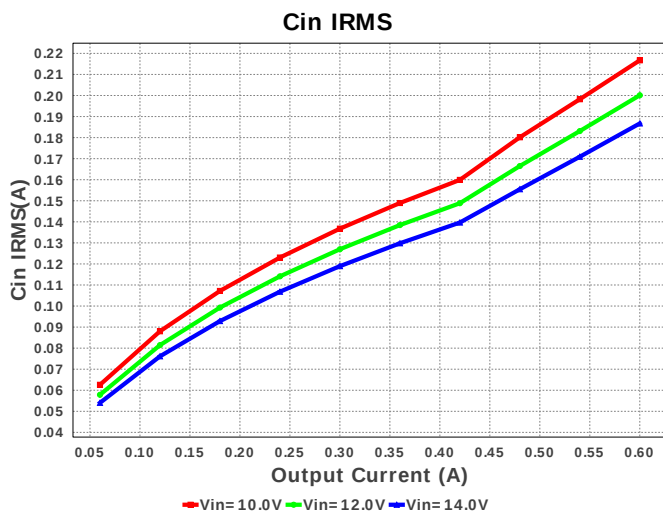
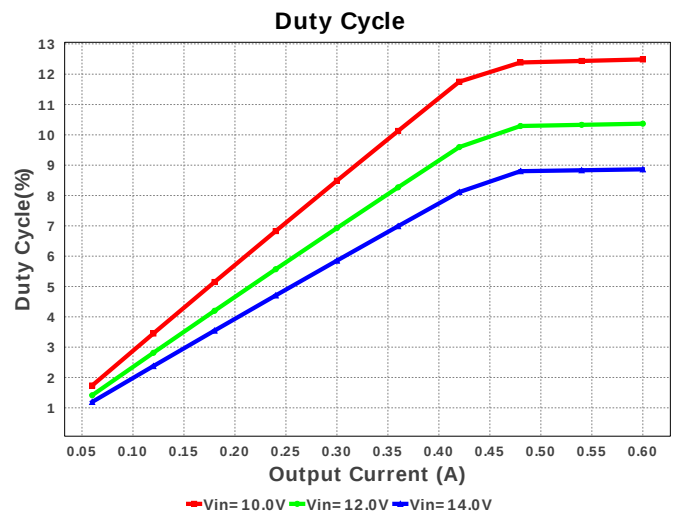
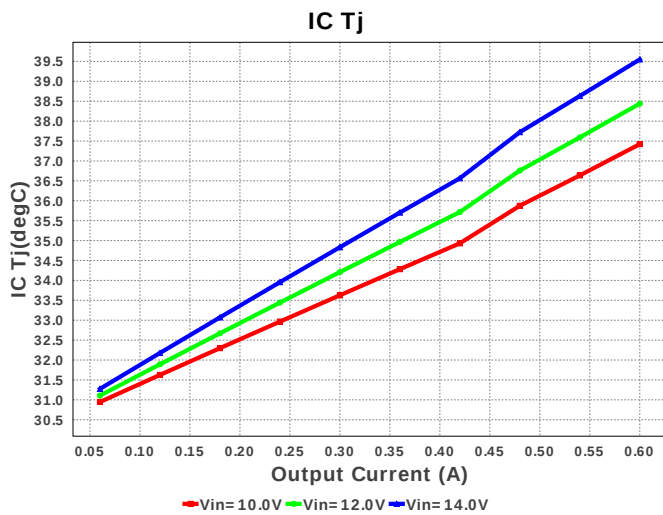
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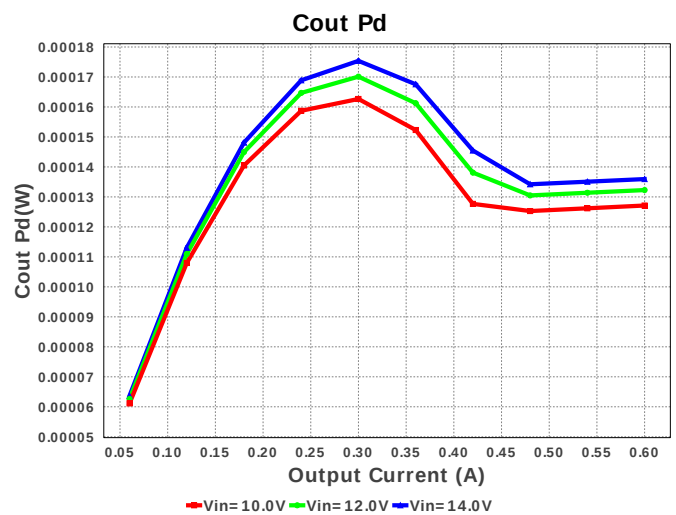
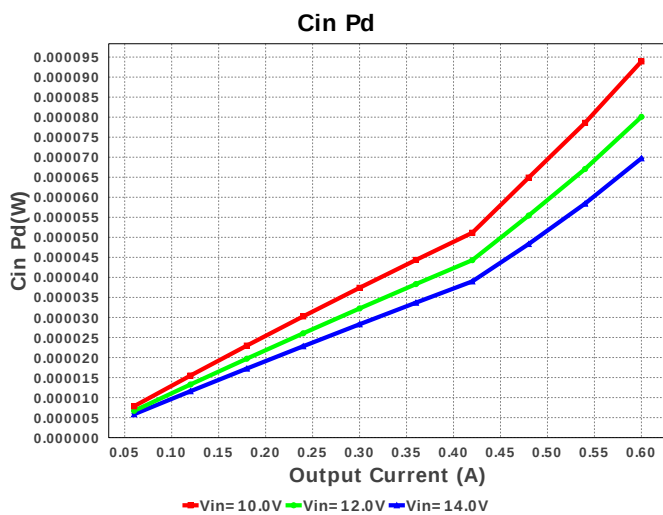
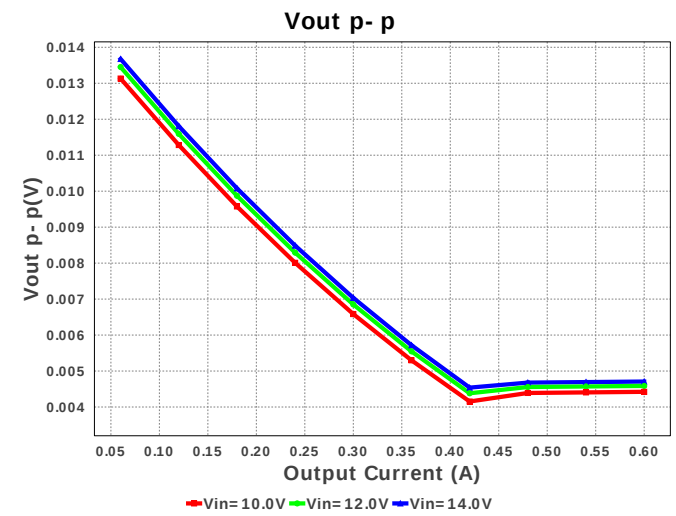
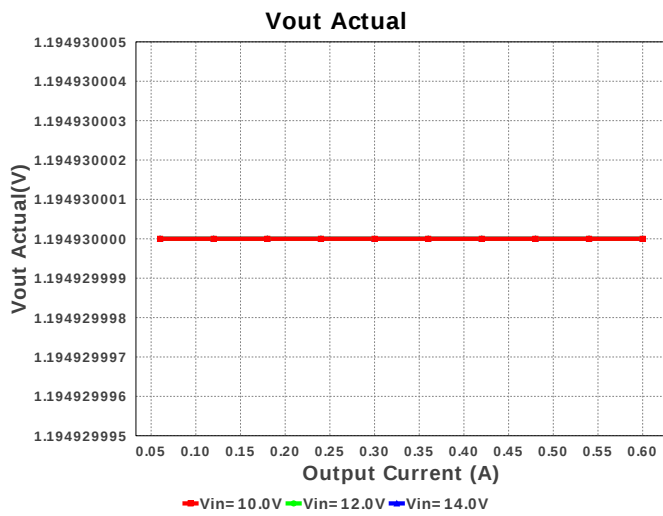
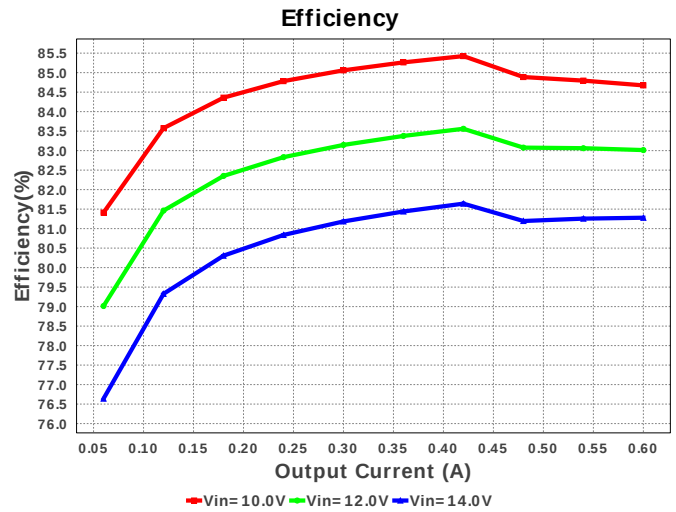
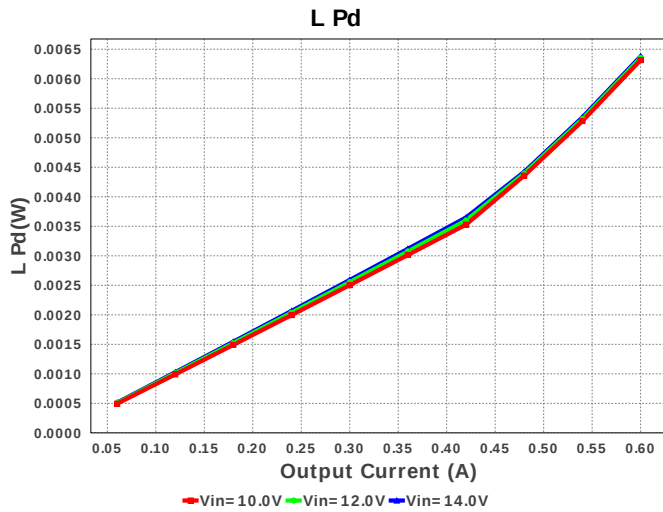


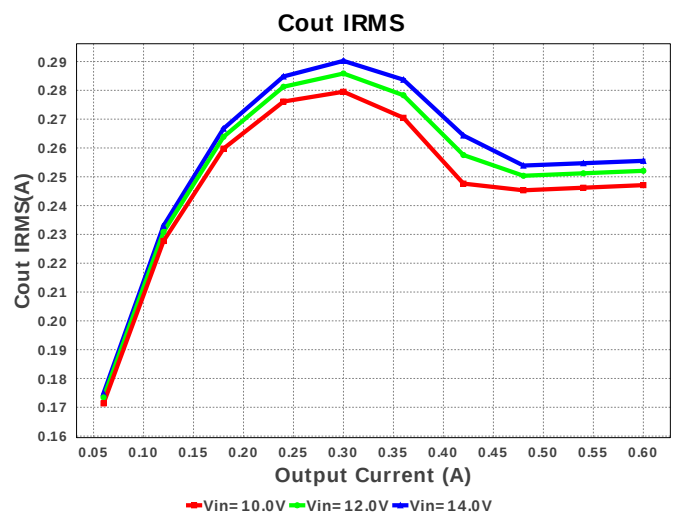
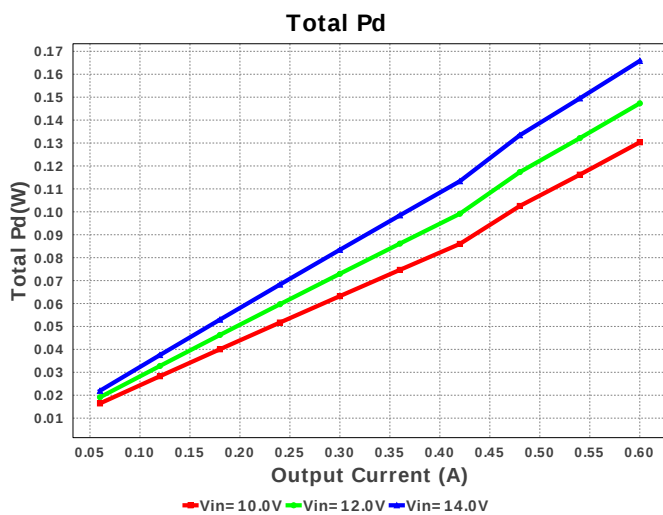
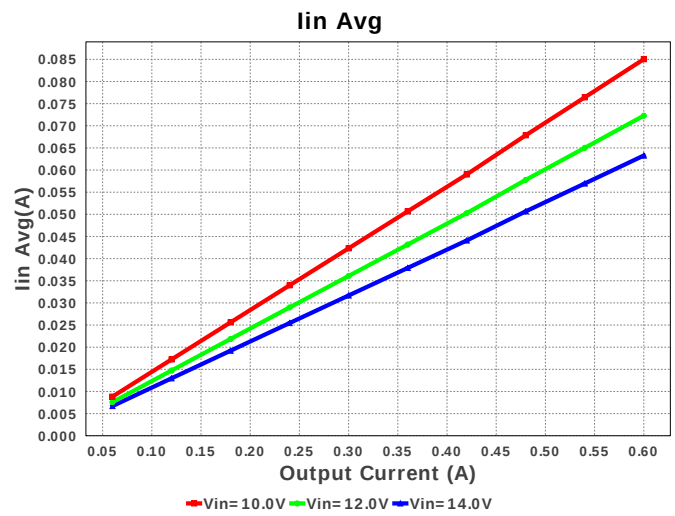
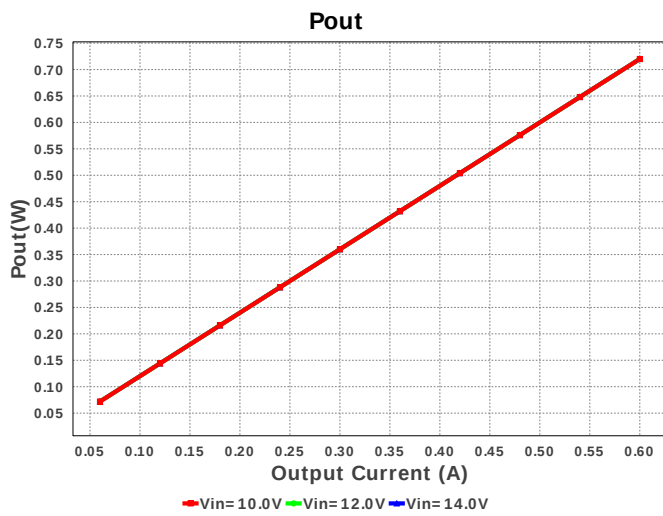
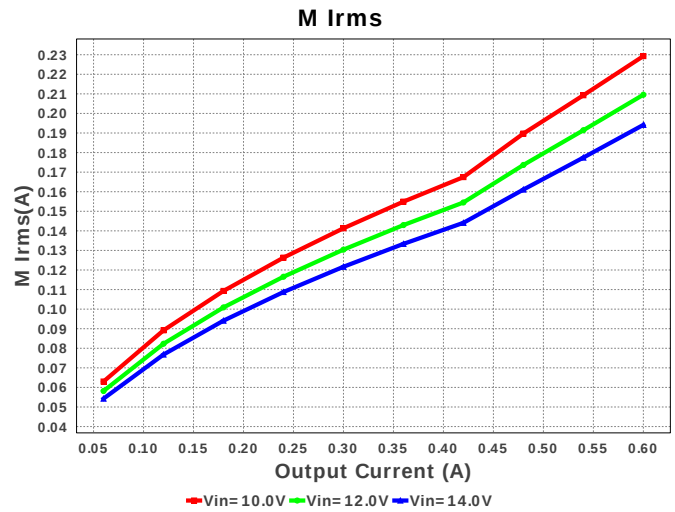
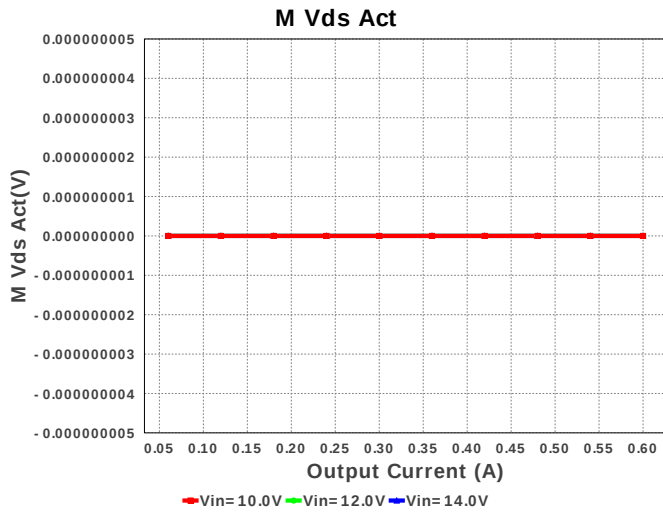
Electrical BOM

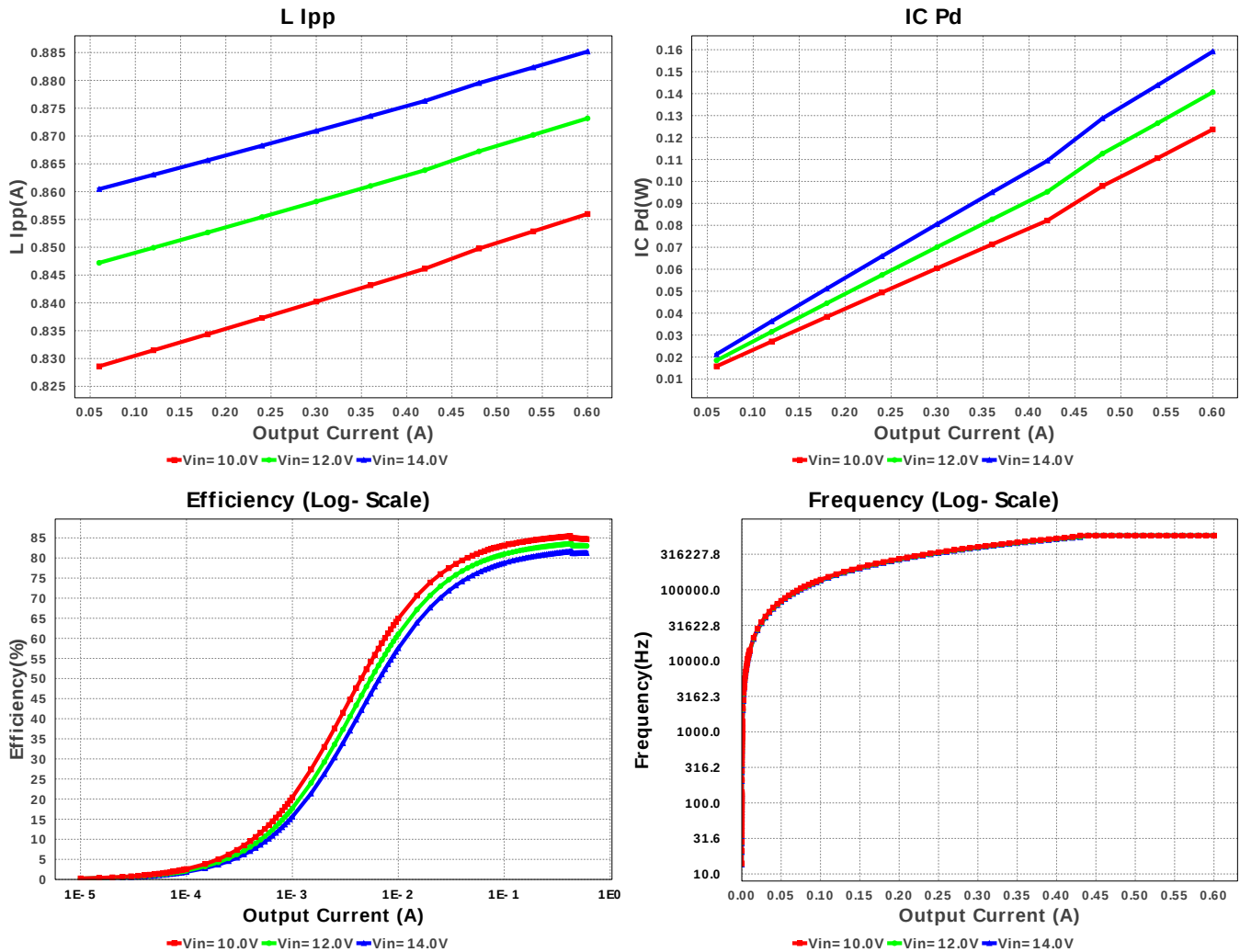
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1.	Cbst	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
2.	Cin	MuRata	GRM32ER61E226KE15L Series= X5R	Cap= 22.0 uF ESR= 2.0 mOhm VDC= 25.0 V IRMS= 3.67 A	1	\$0.16	1210 15 mm ²
3.	Cout	TDK	C3216X5R1E476M160AC 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 µH 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.	Rfbb	Vishay-Dale	CRCW04025K62FKED Series= CRCW..e3	Res= 5.62 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	TPS562201DDCR	Switcher	1	\$0.30	 DDC0006A 10 mm ²









Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	186.724 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	255.531 mA	Current	Output capacitor RMS ripple current
3.	IC Ipk	1.043 A	Current	Peak switch current in IC
4.	Iin Avg	63.274 mA	Current	Average input current
5.	L Ipp	885.18 mA	Current	Peak-to-peak inductor ripple current
6.	M1 Irms	194.148 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	579.824 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	720.0 mW	General	Total output power
13.	Total BOM	\$1.06	General	Total BOM Cost
14.	Vout Actual	1.195 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
15.	Vout OP	1.2 V	Op_Point	Operational Output Voltage
16.	Duty Cycle	8.863 %	Op_point	Duty cycle
17.	Efficiency	81.279 %	Op_point	Steady state efficiency
18.	IC Tj	39.55 degC	Op_point	IC junction temperature
19.	ICThetaJA	60.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
20.	IOUT_OP	600.0 mA	Op_point	Iout operating point
21.	VIN_OP	14.0 V	Op_point	Vin operating point
22.	Vout p-p	4.708 mV	Op_point	Peak-to-peak output ripple voltage
23.	Cin Pd	69.731 μW	Power	Input capacitor power dissipation
24.	Cout Pd	135.946 μW	Power	Output capacitor power dissipation
25.	IC Pd	159.163 mW	Power	IC power dissipation
26.	L Pd	6.379 mW	Power	Inductor power dissipation
27.	Total Pd	165.837 mW	Power	Total Power Dissipation
28.	Vout Tolerance	3.229 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	600.0 m	Maximum Output Current
2.	VinMax	14.0	Maximum input voltage
3.	VinMin	10.0	Minimum input voltage
4.	Vout	1.2	Output Voltage
5.	base_pn	TPS562201	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	30.0	Ambient temperature

Design Assistance

1. **TPS562201** Product Folder : <http://www.ti.com/product/TPS562201> : contains the data sheet and other resources.

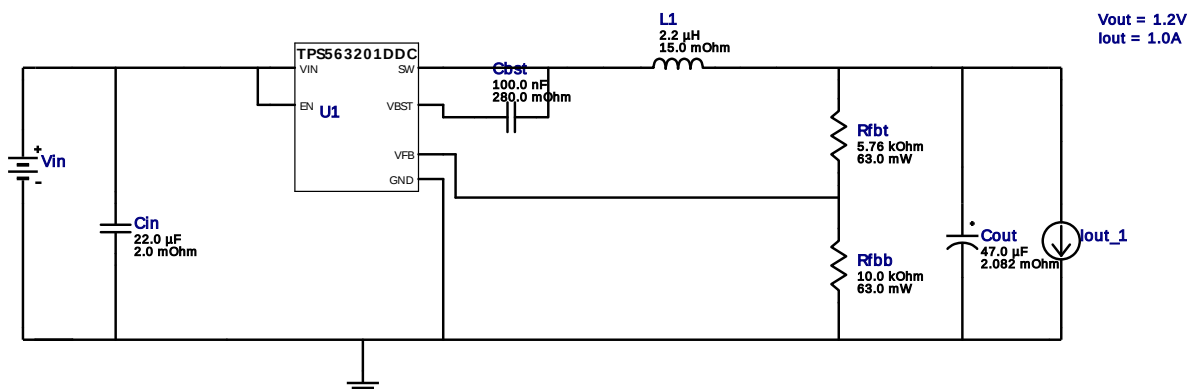


Vout = 1.2V
Iout = 1.0A

Device = TPS563201DDCR
Topology = Buck
Created = 7/20/16 6:22:19 AM
BOM Cost = \$1.16
BOM Count = 7
Total Pd = 0.26W

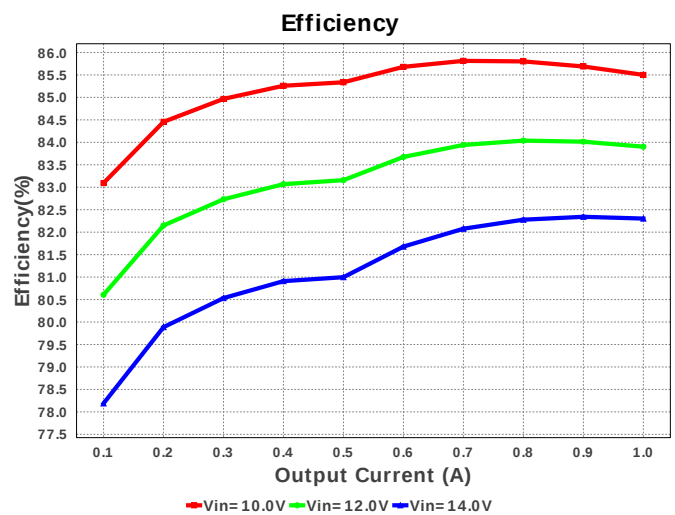
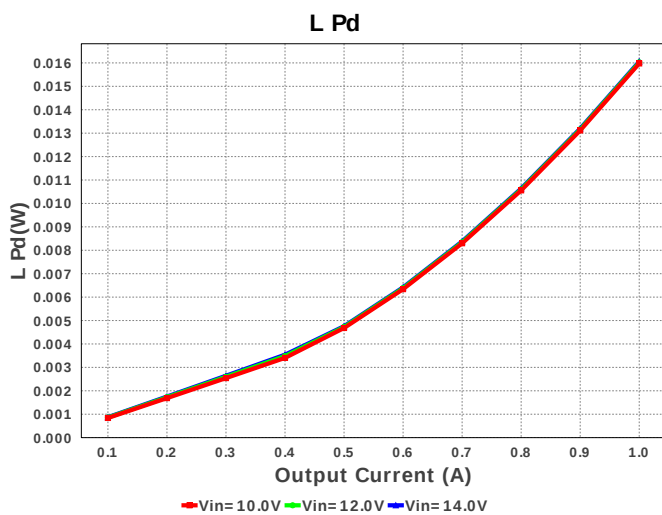
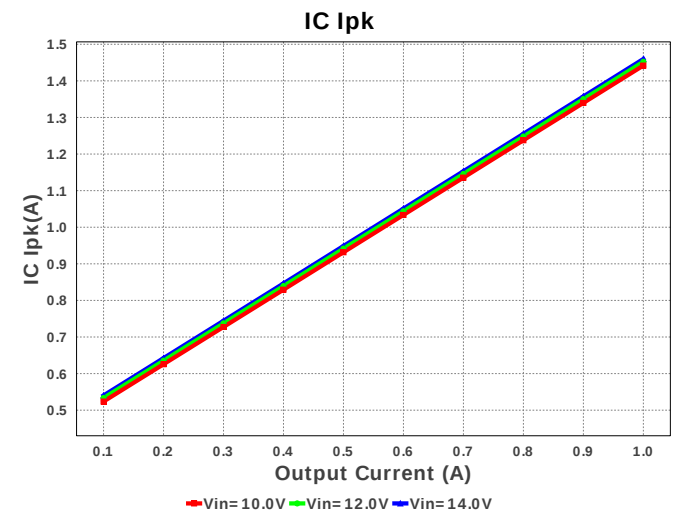
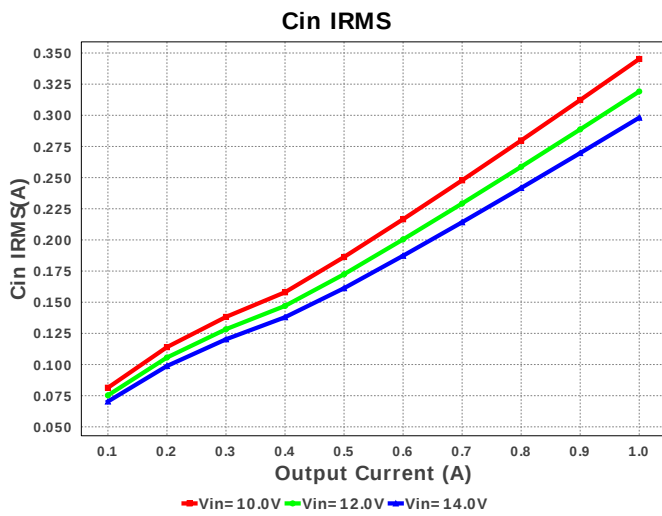
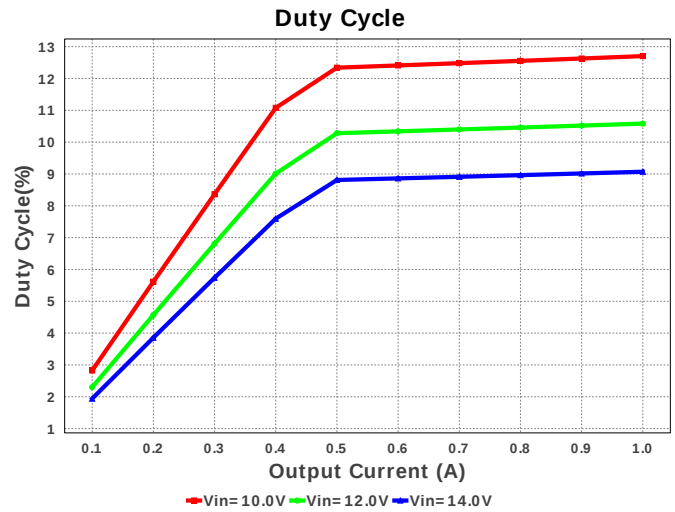
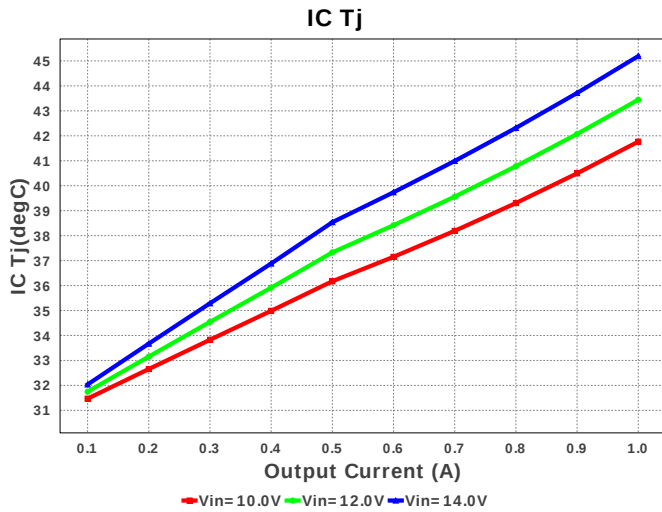
WEBENCH® Design Report

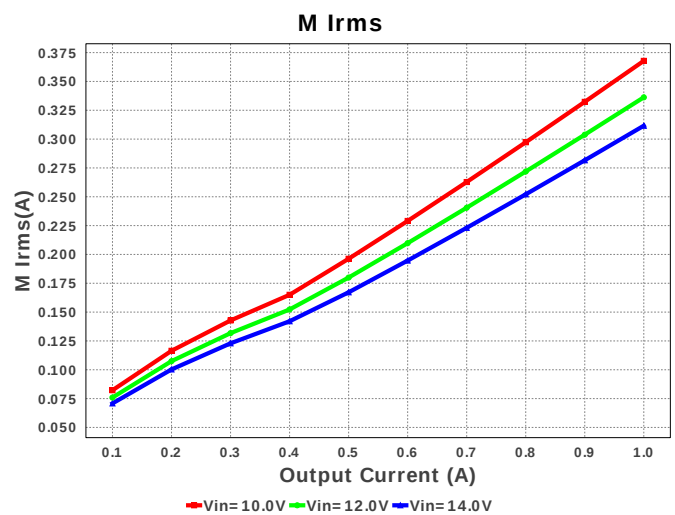
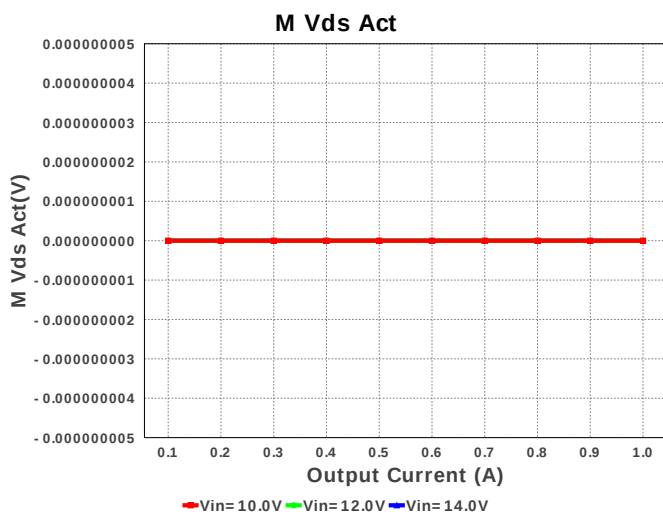
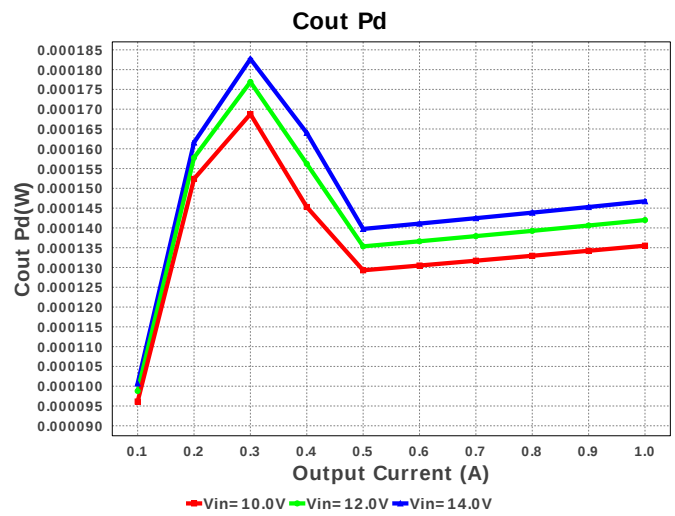
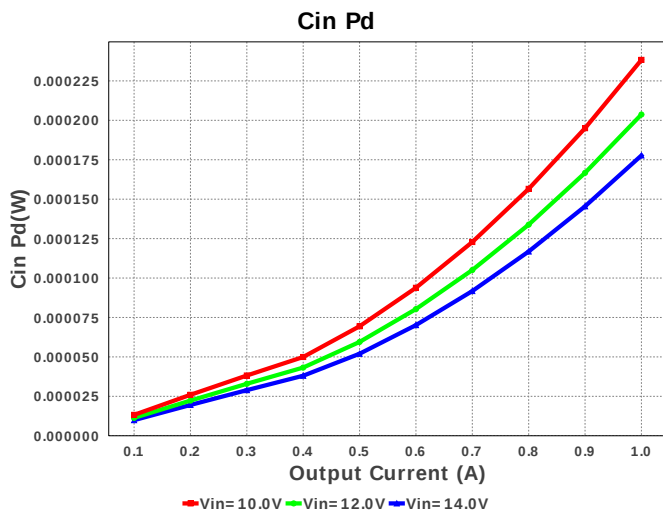
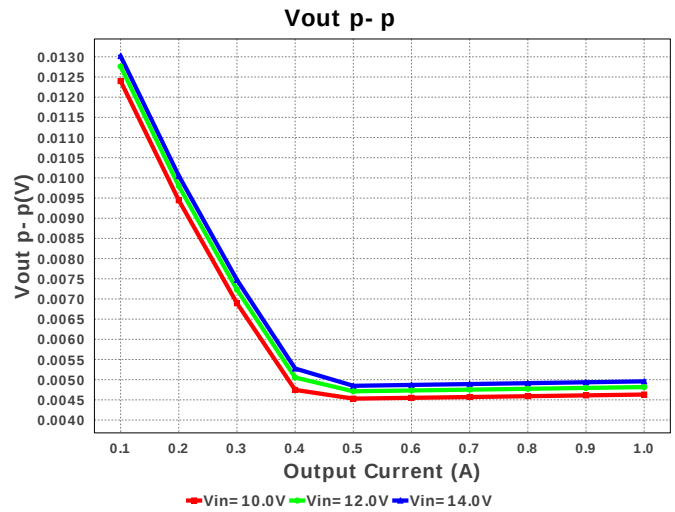
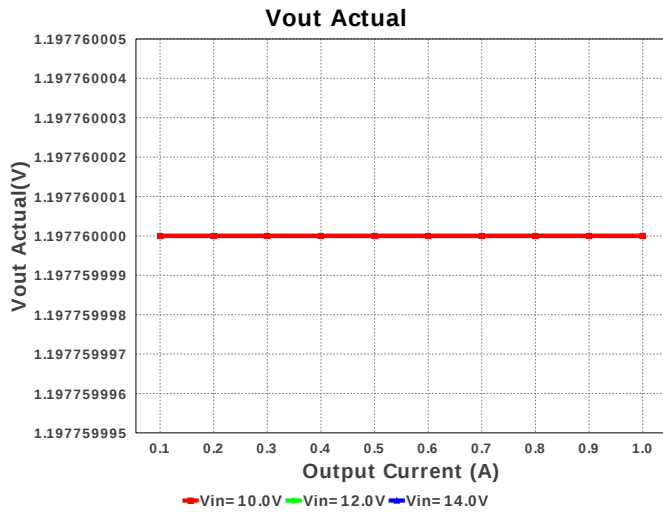
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TPS563201DDCR 10.0V-14.0V to 1.20V @ 1.0A

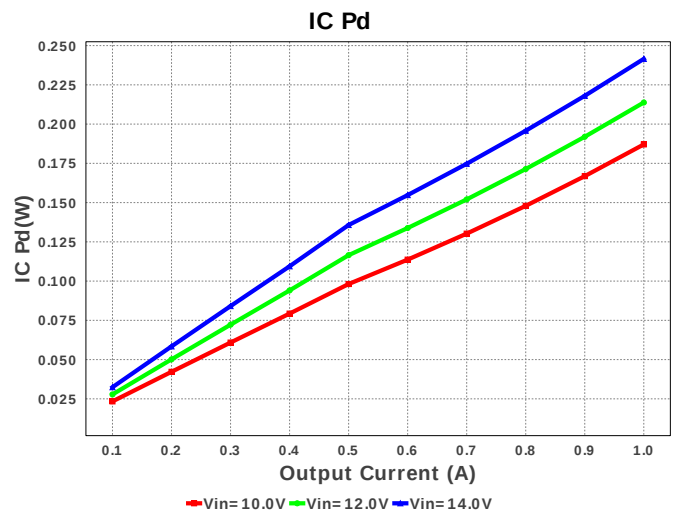
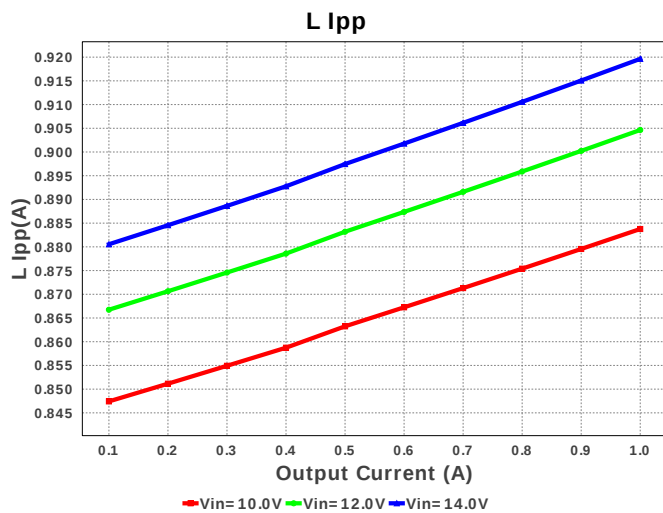
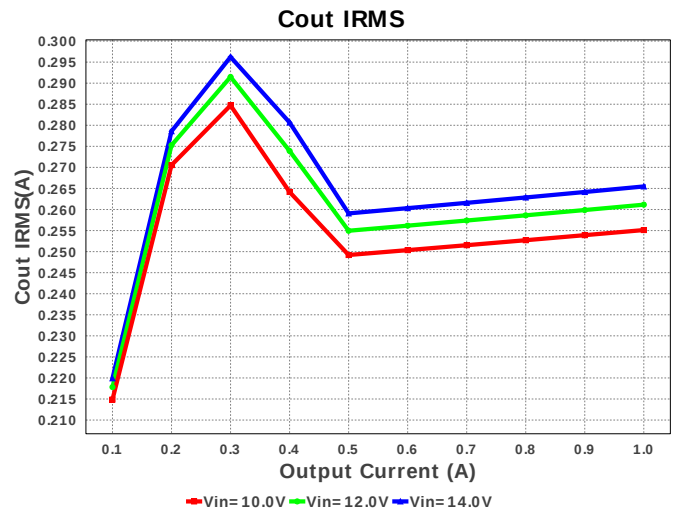
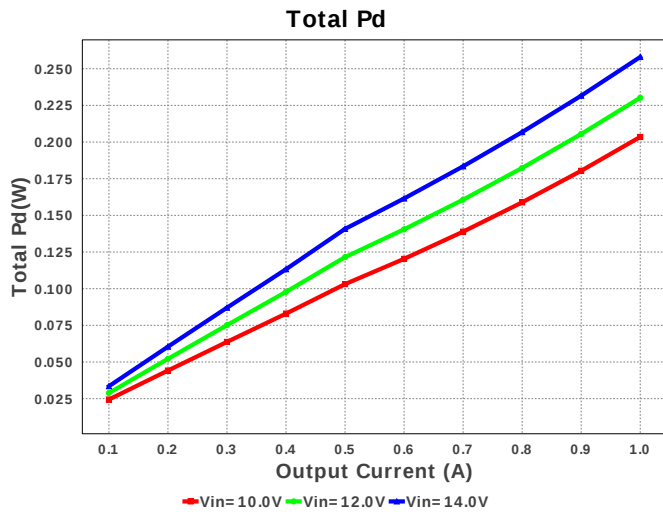
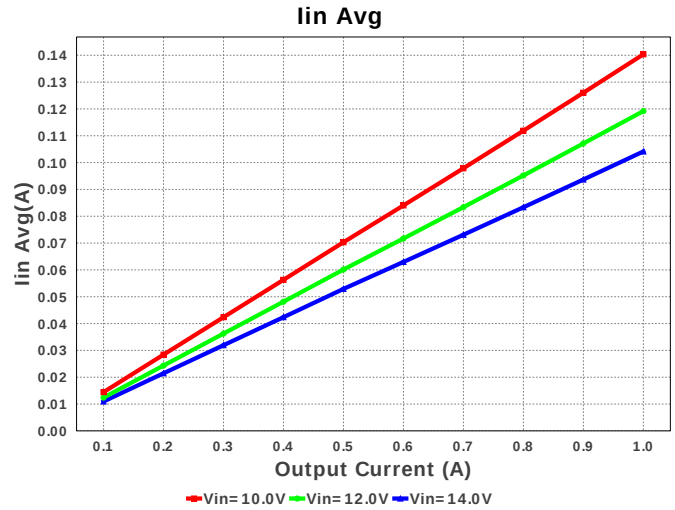
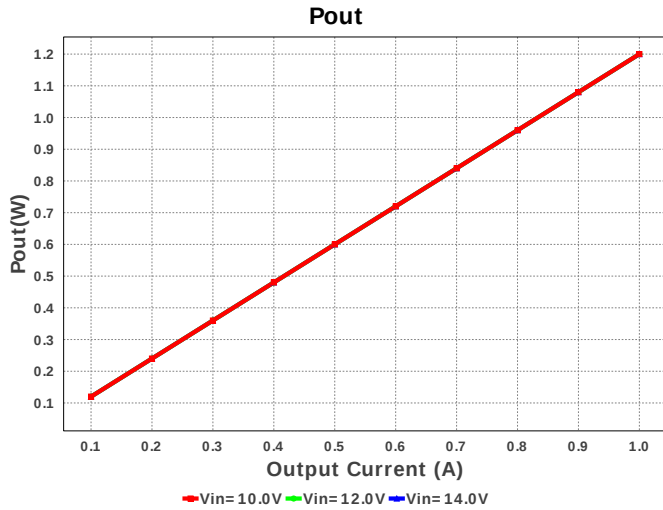


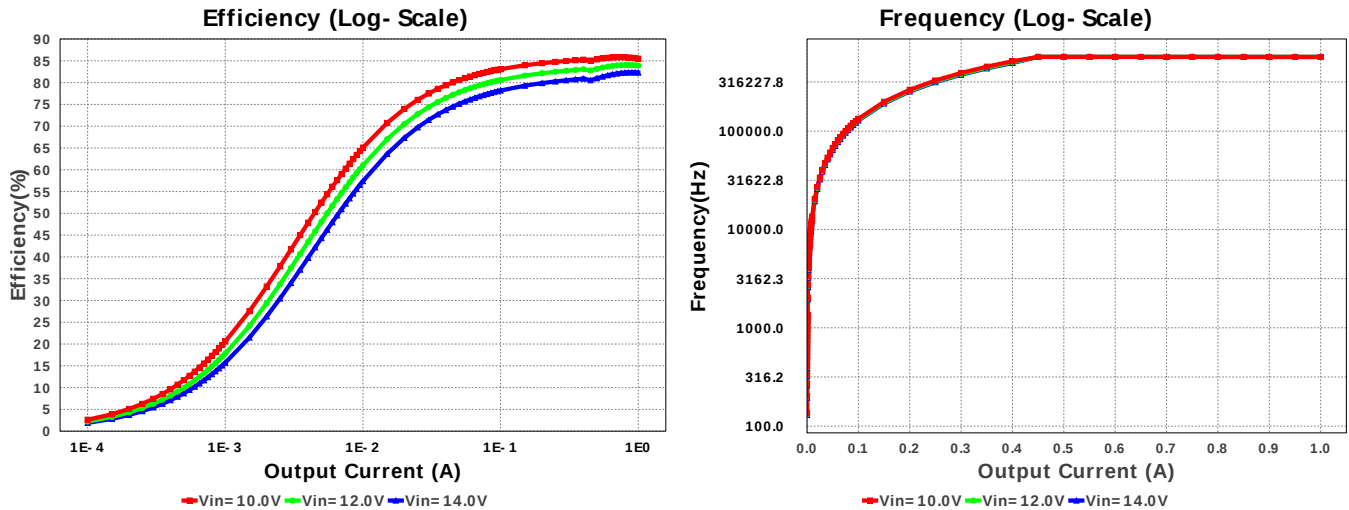
Electrical BOM

#	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	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 µH 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.	Rfbs	Vishay-Dale	CRCW04025K76FKED Series= CRCW..e3	Res= 5.76 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
7.	U1	Texas Instruments	TPS563201DDCR	Switcher	1	\$0.40	DDC0006A 10 mm ²









Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	298.099 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	265.476 mA	Current	Output capacitor RMS ripple current
3.	IC Ipk	1.46 A	Current	Peak switch current in IC
4.	Iin Avg	104.14 mA	Current	Average input current
5.	L Ipp	919.64 mA	Current	Peak-to-peak inductor ripple current
6.	M1 Irms	311.591 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	568.45 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	1.2 W	General	Total output power
13.	Total BOM	\$1.16	General	Total BOM Cost
14.	Vout Actual	1.198 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
15.	Vout OP	1.2 V	Op_Point	Operational Output Voltage
16.	Duty Cycle	9.07 %	Op_point	Duty cycle
17.	Efficiency	82.303 %	Op_point	Steady state efficiency
18.	IC Tj	45.193 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	4.959 mV	Op_point	Peak-to-peak output ripple voltage
23.	Cin Pd	177.726 μW	Power	Input capacitor power dissipation
24.	Cout Pd	146.734 μW	Power	Output capacitor power dissipation
25.	IC Pd	241.548 mW	Power	IC power dissipation
26.	L Pd	16.057 mW	Power	Inductor power dissipation
27.	Total Pd	258.015 mW	Power	Total Power Dissipation
28.	Vout Tolerance	3.257 %		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	1.2	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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