

# WEBENCH® Power Architect

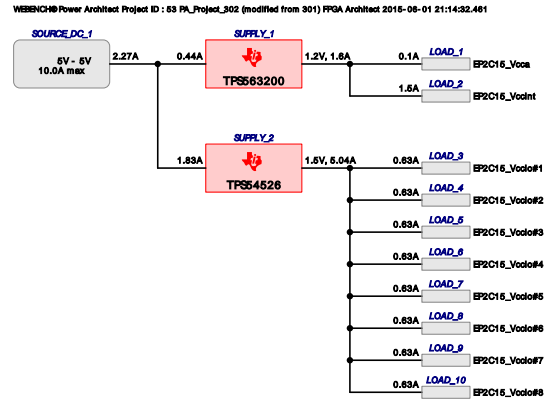
## Project Report

Project : 3456113/53 : PA\_Project\_302 (modified from 301)  
 Created : 2015-06-01 21:14:32.461  
 Optimize project optFactor=3

### Project Summary

1. Total System Efficiency	83.528 %
2. Total System BOM Count	20.0
3. Total System Footprint	271.0 mm <sup>2</sup>
4. Total System BOM Cost	\$3.42
5. Total System Power Dissipation	1.87 W

--> Launch WEBENCH Power Architect.



## Power Supplies

#	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	1.2 V	1.6 A	88.1%	73	\$1.30	677	4
2.	SUPPLY_2	TPS54526	Switcher : 5A Synchronous Buck Converter with Eco-Mode	1.5 V	5.04 A	82.4%	198	\$2.12	678	9

## Power Loads

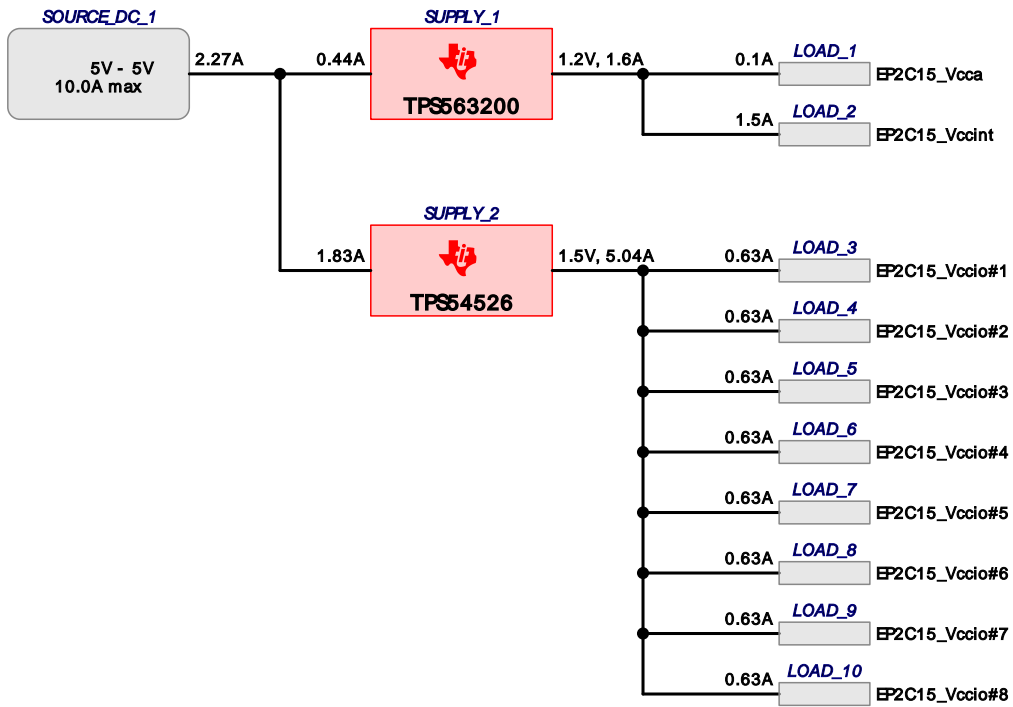
#	Name	VLoad	Iload	Description
1.	EP2C15_Vcca	1.2 V	0.1 A	VoutRipple=8%, SoftStart delay=1.0 mSec
2.	EP2C15_Vccint	1.2 V	1.5 A	VoutRipple=8%, SoftStart delay=1.0 mSec
3.	EP2C15_Vccio#1	1.5 V	0.63 A	VoutRipple=10%, SoftStart delay=1.0 mSec
4.	EP2C15_Vccio#2	1.5 V	0.63 A	VoutRipple=10%, SoftStart delay=1.0 mSec
5.	EP2C15_Vccio#3	1.5 V	0.63 A	VoutRipple=10%, SoftStart delay=1.0 mSec
6.	EP2C15_Vccio#4	1.5 V	0.63 A	VoutRipple=10%, SoftStart delay=1.0 mSec
7.	EP2C15_Vccio#5	1.5 V	0.63 A	VoutRipple=10%, SoftStart delay=1.0 mSec
8.	EP2C15_Vccio#6	1.5 V	0.63 A	VoutRipple=10%, SoftStart delay=1.0 mSec
9.	EP2C15_Vccio#7	1.5 V	0.63 A	VoutRipple=10%, SoftStart delay=1.0 mSec
10.	EP2C15_Vccio#8	1.5 V	0.63 A	VoutRipple=10%, SoftStart delay=1.0 mSec

## FPGAs, Processors

#	Manufacturer	Part Number	Name	Series	Description
1.	Altera	EP2C15	FPGA_1	Cyclone II	FPGA Altera Cyclone II EP2C15 <a href="http://www.altera.com/literature/hb/cyc2/cyc2_cii5v1_01.pdf">http://www.altera.com/literature/hb/cyc2/cyc2_cii5v1_01.pdf</a>

## Project Diagram

WEBENCH® Power Architect Project ID : 53\_PA\_Project\_302 (modified from 301) FPGA Architect 2015-06-01 21:14:32.461



## Electrical Procurement BOM

Manufacturer	Part Number	Description	Quantity	Budgetary Price	Footprint (mm <sup>2</sup> )
AVX	08053C104KAT2A	0805	1	\$0.01	7
Kemet	C0805C103K5RACTU	0805	1	\$0.01	7
Kemet	C0805C106K8PACTU	0805	2	\$0.04	7
TDK	C1005X5R1A104K	0402	1	\$0.01	3
TDK	C1608X5R1A105K	0603	1	\$0.01	5
TDK	C3216X5R1C106KT	1206	2	\$0.08	11
Vishay-Dale	CRCW0402100KFKED	0402	1	\$0.01	3
Vishay-Dale	CRCW040210K0FKED	0402	2	\$0.01	6
Vishay-Dale	CRCW040221K0FKED	0402	1	\$0.01	3
Vishay-Dale	CRCW040222K1FKED	0402	1	\$0.01	3
Vishay-Dale	CRCW04025K76FKED	0402	1	\$0.01	3
MuRata	GRM31CR60J476ME19L	1206	2	\$0.12	22
TDK	SPM6530T-1R5M100	SPM6530	1	\$0.56	77
Texas Instruments	TPS54526PWPR	R-PDSO-G14	1	\$1.22	61
Texas Instruments	TPS563200DDCR	DDC0006A	1	\$0.52	10
Coilcraft	XFL4020-152MEB	XFL4020	1	\$0.55	25
Total			20	\$3.42	253

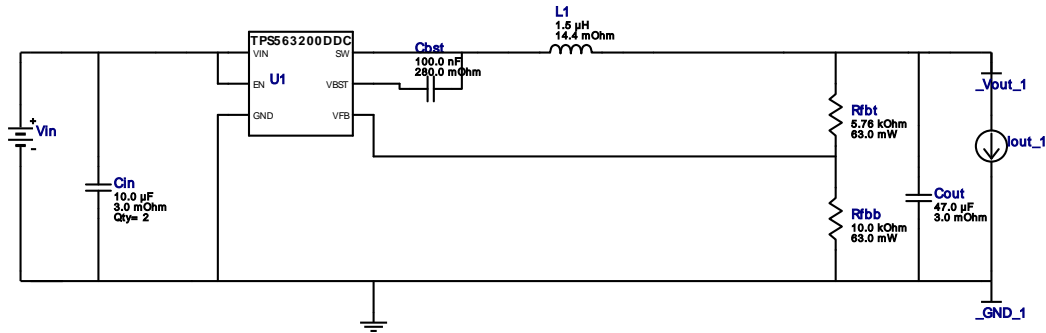


VinMin = 5.0V  
 VinMax = 5.0V  
 Vout = 1.2V  
 Iout = 1.6A

Device = TPS563200DDCR  
 Topology = Buck  
 Created = 6/1/15 9:14:31 PM  
 BOM Cost = \$1.30  
 Footprint = 73.0 mm<sup>2</sup>  
 BOM Count = 8  
 Total Pd = 0.26W

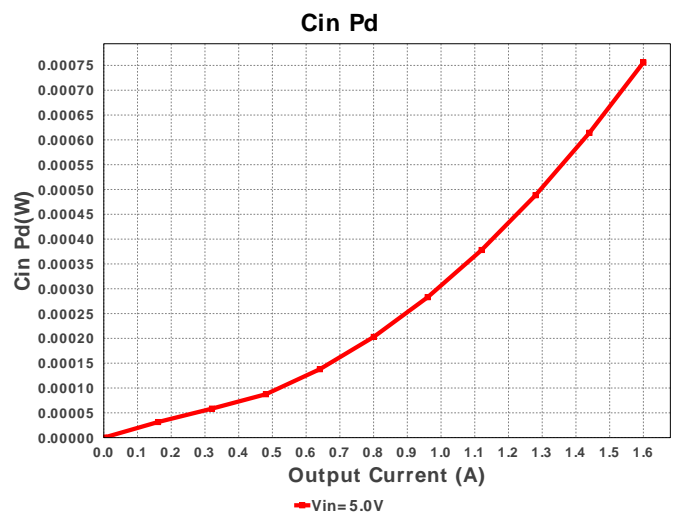
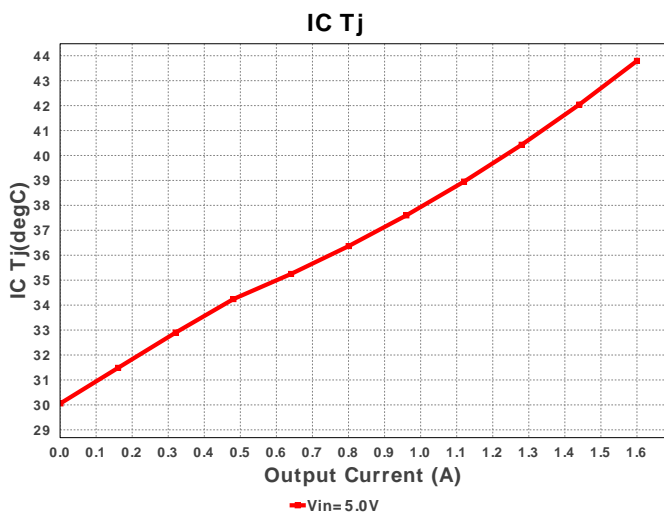
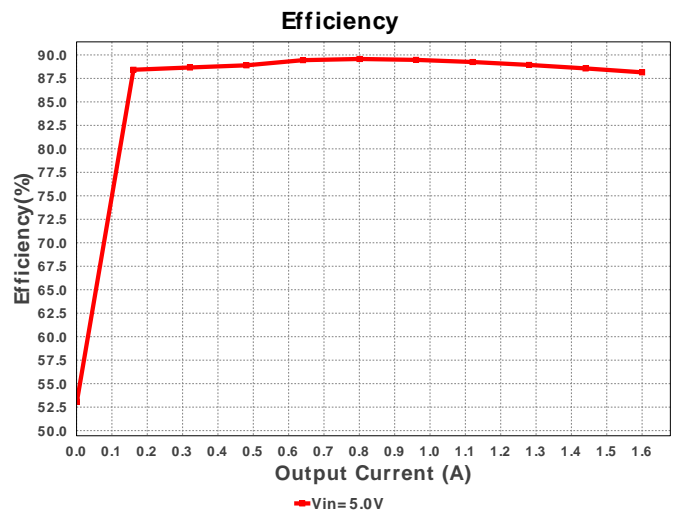
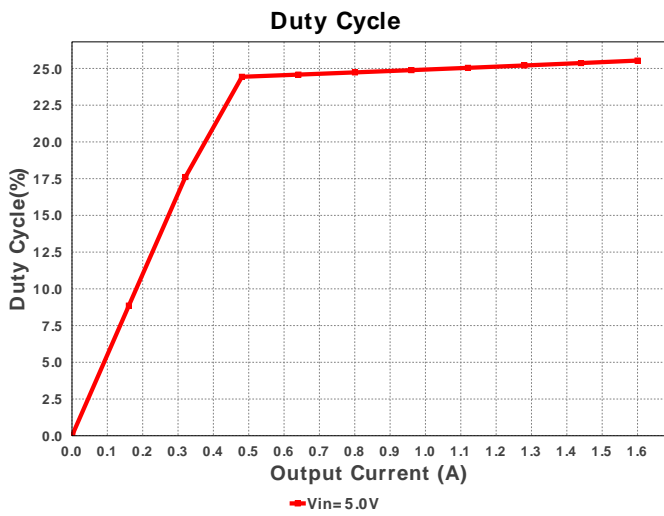
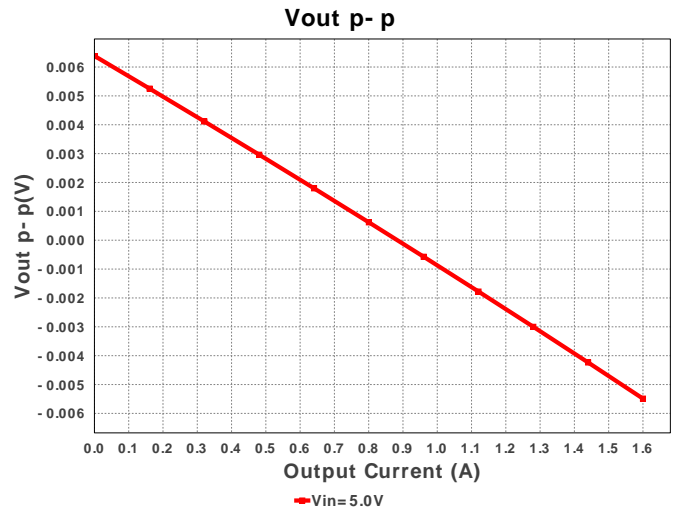
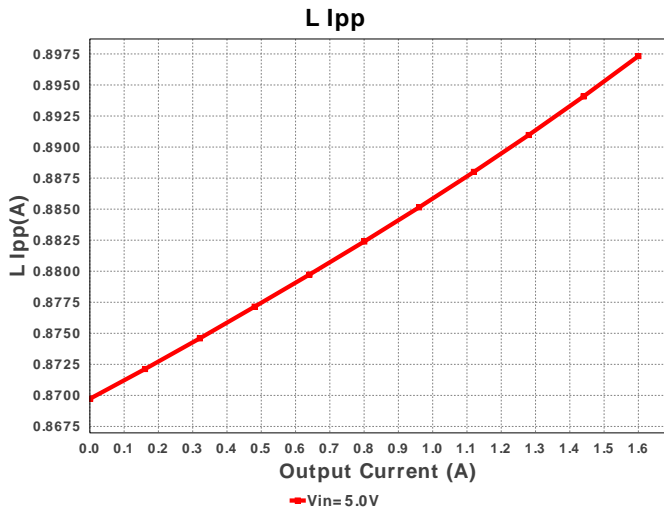
## WEBENCH® Design Report

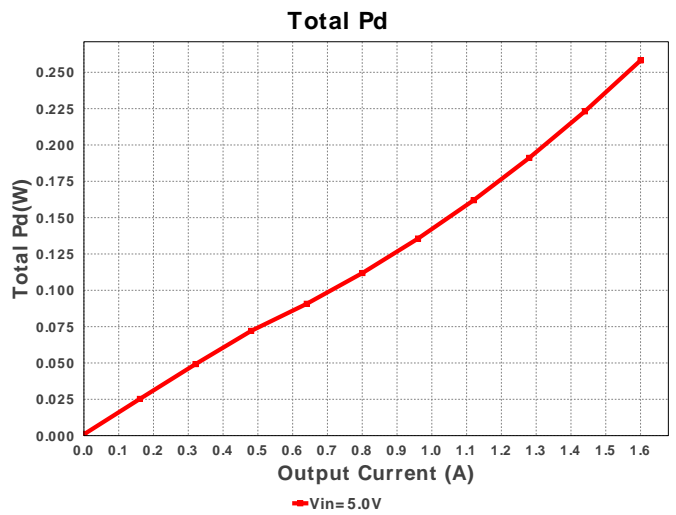
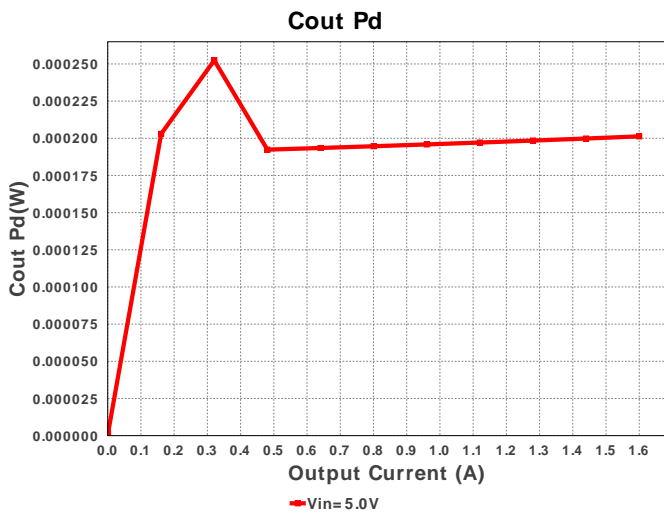
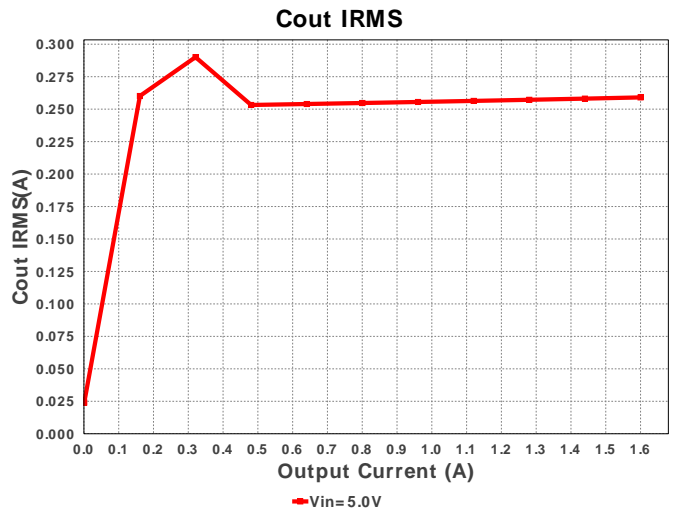
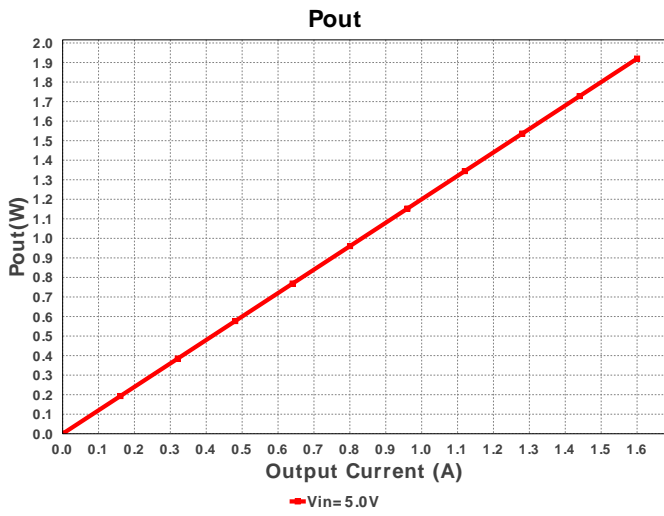
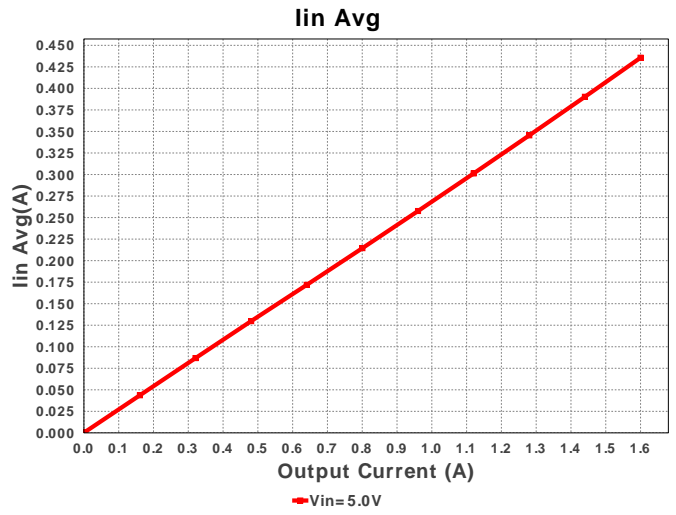
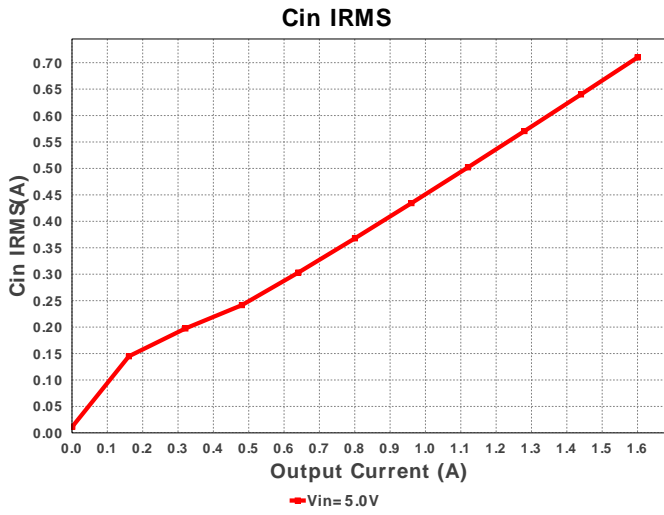
Design : 3456113/677 TPS563200DDCR  
 TPS563200DDCR 5.0V-5.0V to 1.20V @ 1.6A

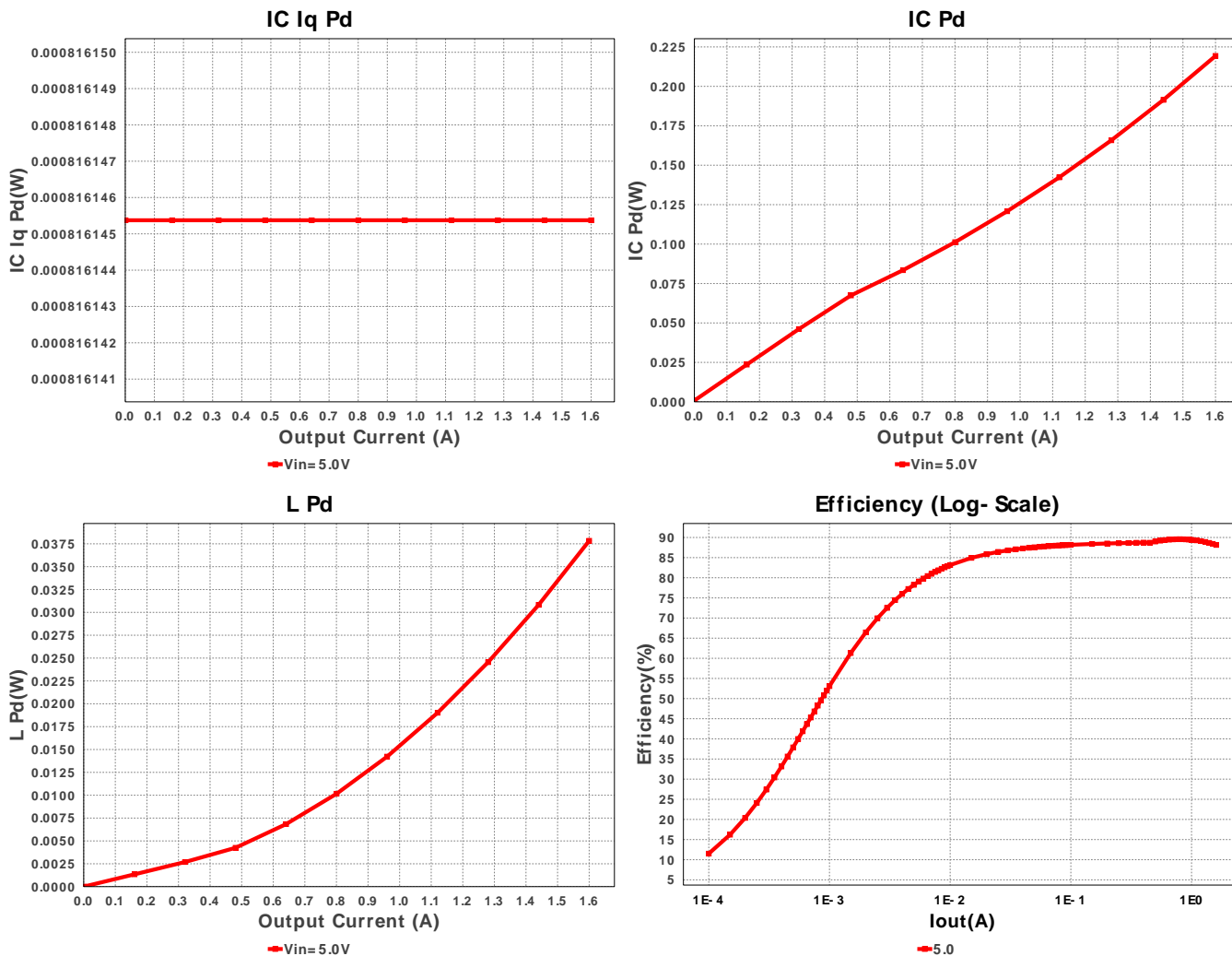


### Electrical BOM

#	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 mm <sup>2</sup>
2.	Cin	Kemet	C0805C106K8PACTU Series= X5R	Cap= 10.0 uF ESR= 3.0 mOhm VDC= 10.0 V IRMS= 11.43 A	2	\$0.04	0805 7 mm <sup>2</sup>
3.	Cout	MuRata	GRM31CR60J476ME19L Series= X5R	Cap= 47.0 uF ESR= 3.0 mOhm VDC= 6.3 V IRMS= 0.0 A	1	\$0.12	1206 11 mm <sup>2</sup>
4.	L1	Coilcraft	XFL4020-152MEB	L= 1.5 uH DCR= 14.4 mOhm	1	\$0.55	XFL4020 25 mm <sup>2</sup>
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 <sup>2</sup>
6.	Rfbt	Vishay-Dale	CRCW04025K76FKED Series= CRCW..e3	Res= 5.76 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm <sup>2</sup>
7.	U1	Texas Instruments	TPS563200DDCR	Switcher	1	\$0.52	DDC0006A 10 mm <sup>2</sup>







Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	709.878 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	259.036 mA	Current	Output capacitor RMS ripple current
3.	Iin Avg	435.63 mA	Current	Average input current
4.	L Ipp	897.33 mA	Current	Peak-to-peak inductor ripple current
5.	BOM Count	8	General	Total Design BOM count
6.	FootPrint	73.0 mm <sup>2</sup>	General	Total Foot Print Area of BOM components
7.	Frequency	699.21 kHz	General	Switching frequency
8.	Pout	1.92 W	General	Total output power
9.	Total BOM	\$1.3	General	Total BOM Cost
10.	Vout OP	1.2 V	Op_Point	Operational Output Voltage
11.	Duty Cycle	25.536 %	Op_point	Duty cycle
12.	Efficiency	88.147 %	Op_point	Steady state efficiency
13.	IC Tj	43.793 degC	Op_point	IC junction temperature
14.	ICThetaJA	62.9 degC/W	Op_point	IC junction-to-ambient thermal resistance
15.	IOUT_OP	1.6 A	Op_point	Iout operating point
16.	VIN_OP	5.0 V	Op_point	Vin operating point
17.	Vout p-p	4.125 mV	Op_point	Peak-to-peak output ripple voltage
18.	Cin Pd	755.89 μW	Power	Input capacitor power dissipation
19.	Cout Pd	201.298 μW	Power	Output capacitor power dissipation
20.	IC Iq Pd	816.145 μW	Power	IC Iq Pd
21.	IC Pd	219.292 mW	Power	IC power dissipation
22.	L Pd	37.83 mW	Power	Inductor power dissipation
23.	Total Pd	258.176 mW	Power	Total Power Dissipation

Design Inputs

#	Name	Value	Description
1.	Iout	1.6	Maximum Output Current
2.	Iout1	1.6	Output Current #1
3.	SoftStart	1.0 ms	Soft Start Time (ms)
4.	VinMax	5.0	Maximum input voltage

---

#	Name	Value	Description
5.	VinMin	5.0	Minimum input voltage
6.	Vout	1.2	Output Voltage
7.	Vout1	1.2	Output Voltage #1
8.	base_pn	TPS563200	Texas Instruments Base Part Number
9.	source	DC	Input Source Type
10.	ta	30.0	Ambient temperature

## Design Assistance

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



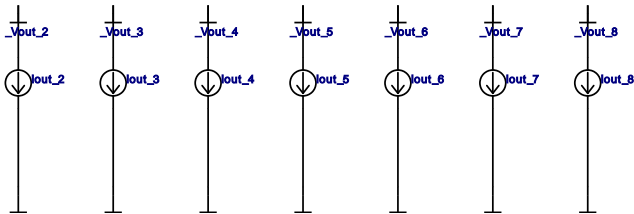
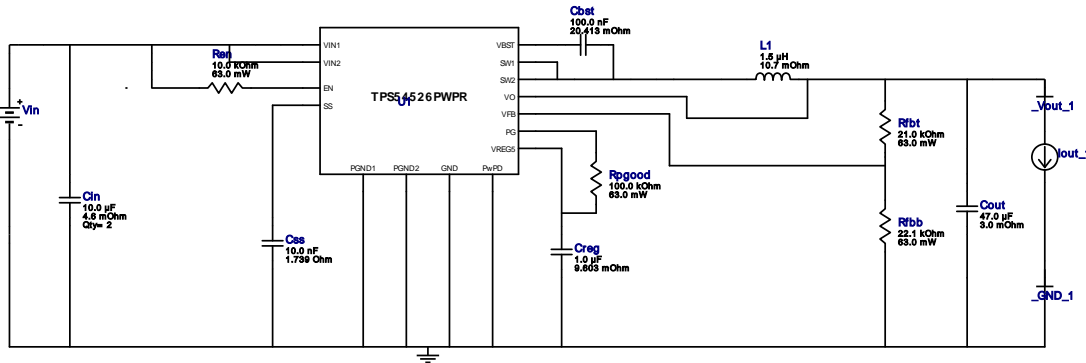


VinMin = 5.0V  
 VinMax = 5.0V  
 Vout = 1.5V  
 Iout = 5.04A








Device = TPS54526PWPR  
 Topology = Buck  
 Created = 6/1/15 9:14:31 PM  
 BOM Cost = \$2.12  
 Footprint = 198.0 mm<sup>2</sup>  
 BOM Count = 12  
 Total Pd = 1.61W


## WEBENCH® Design Report

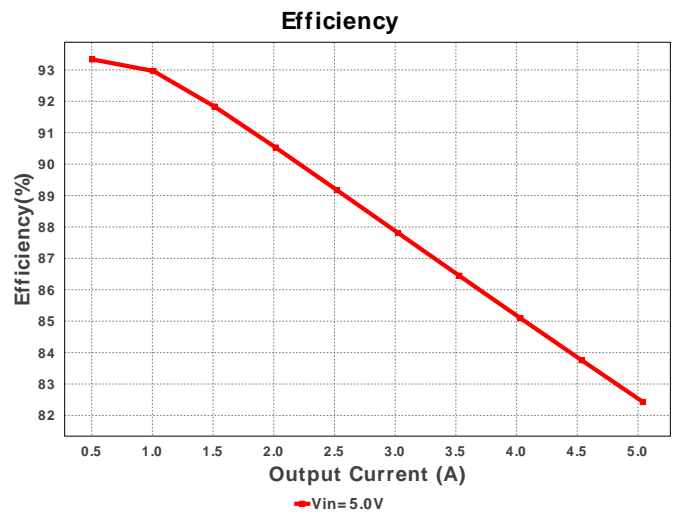
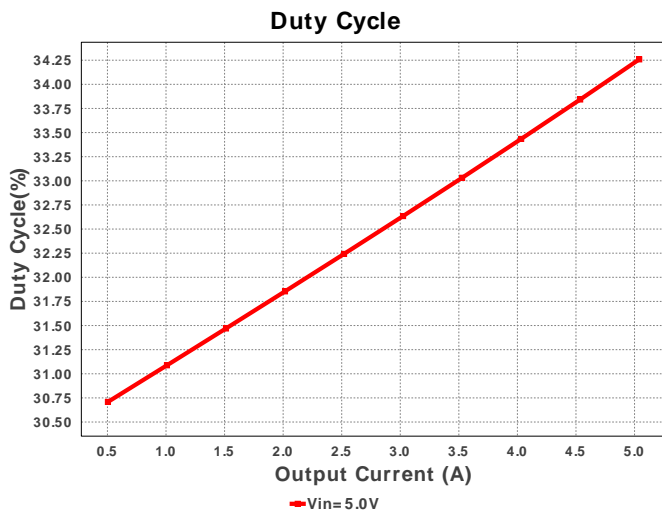
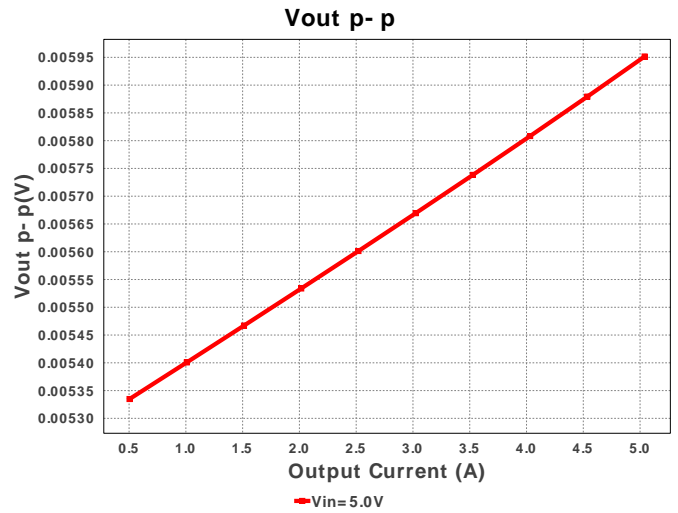
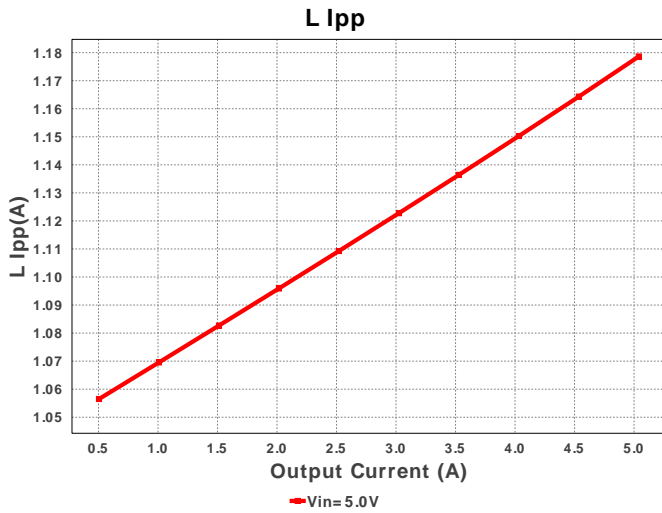
Design : 3456113/678 TPS54526PWPR  
 TPS54526PWPR 5.0V-5.0V to 1.50V @ 5.04A

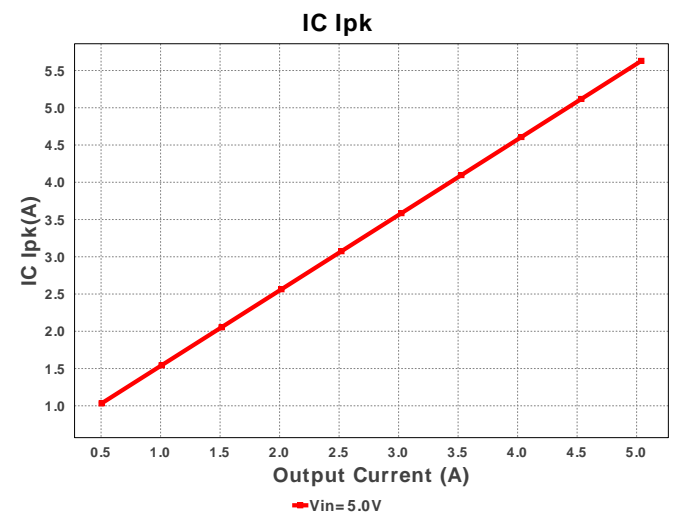
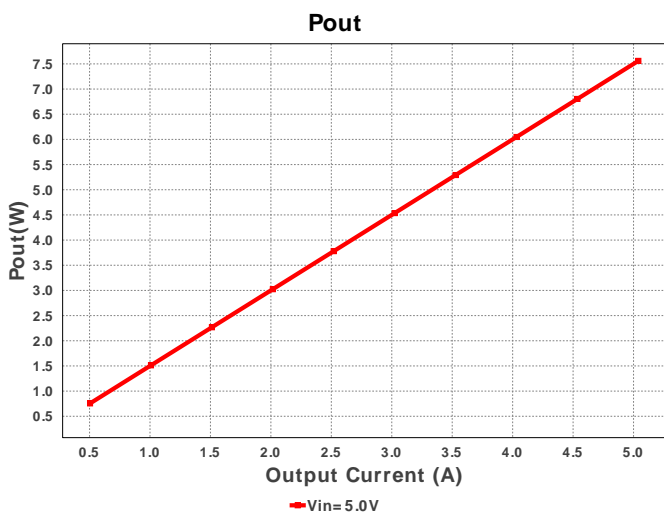
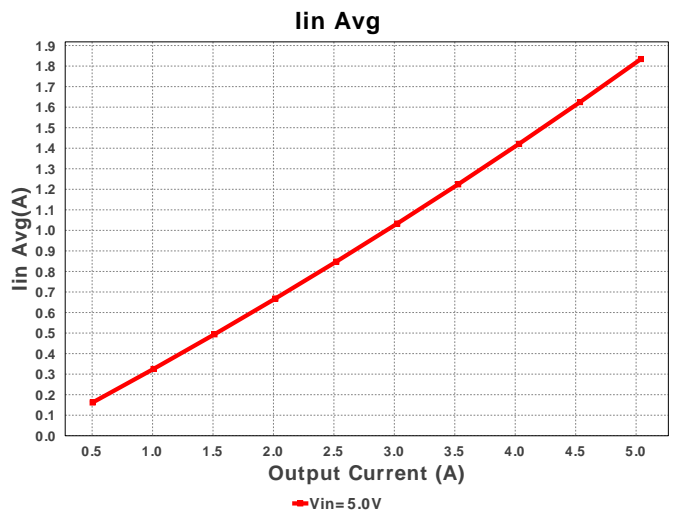
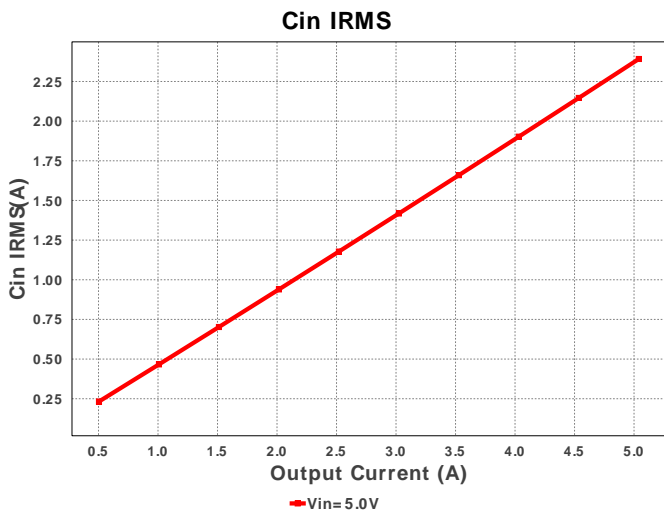
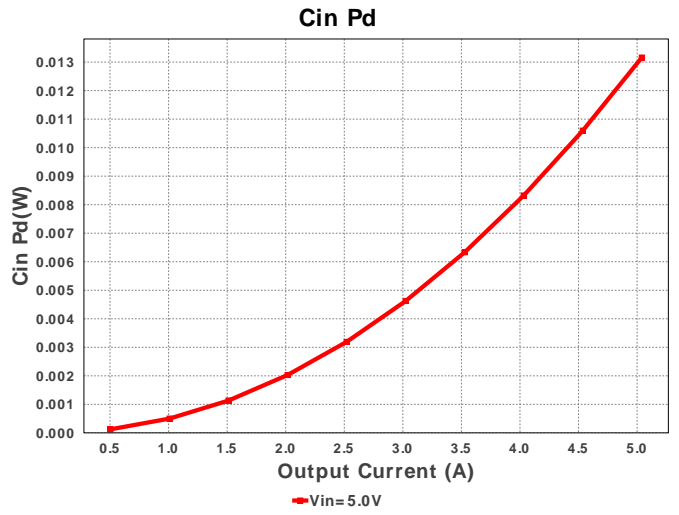
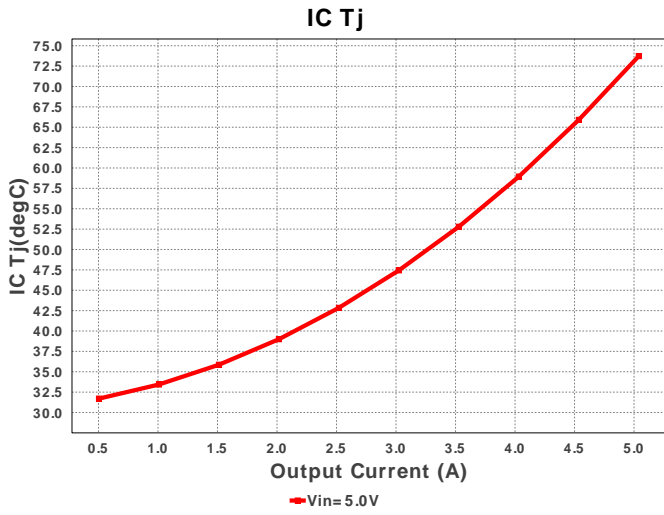


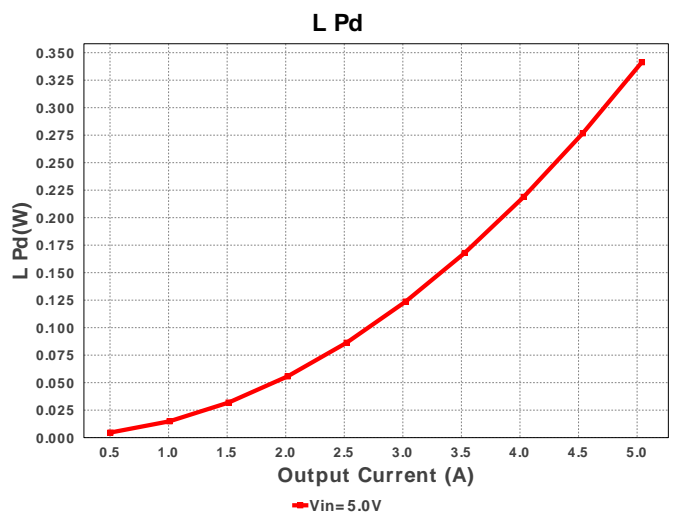
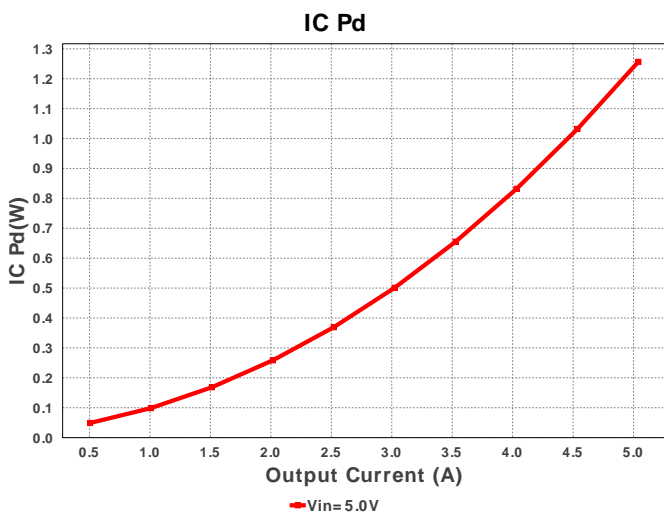
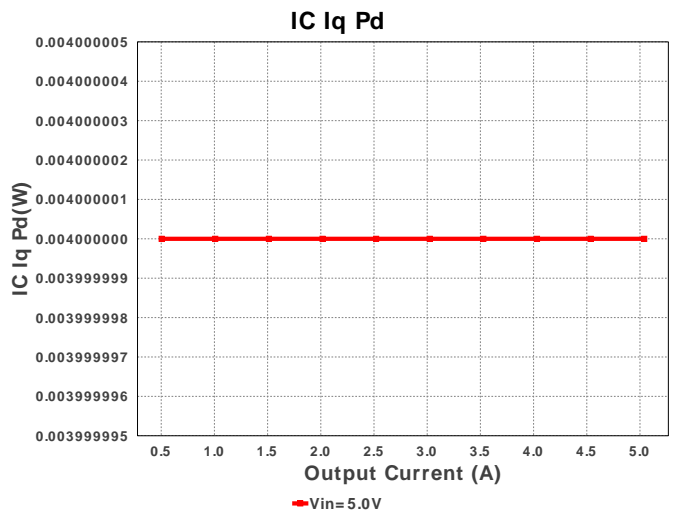
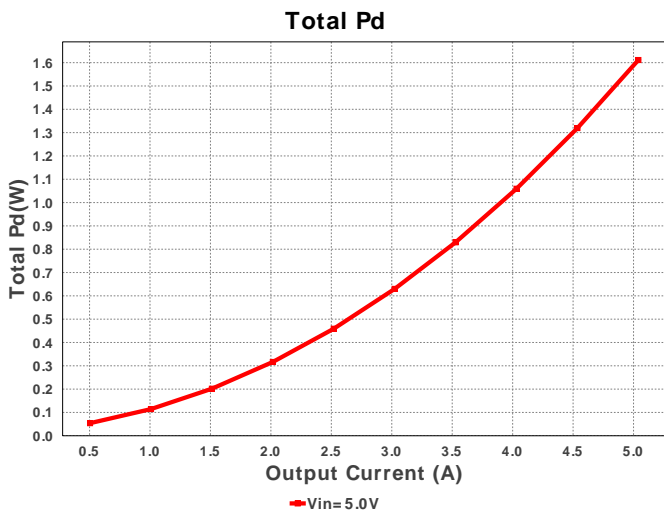
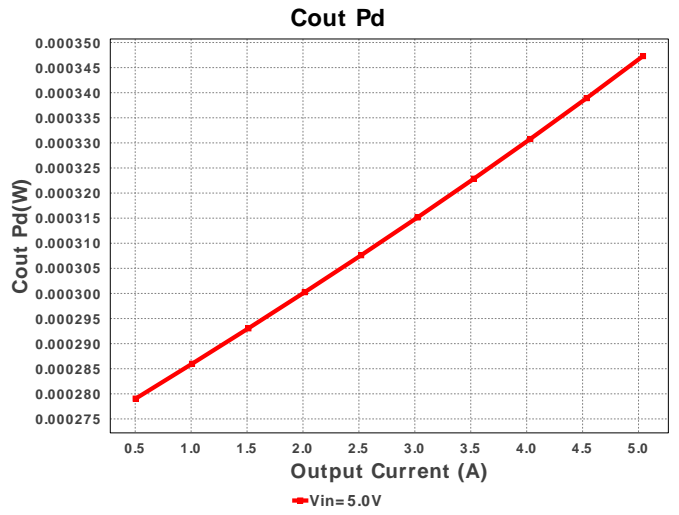
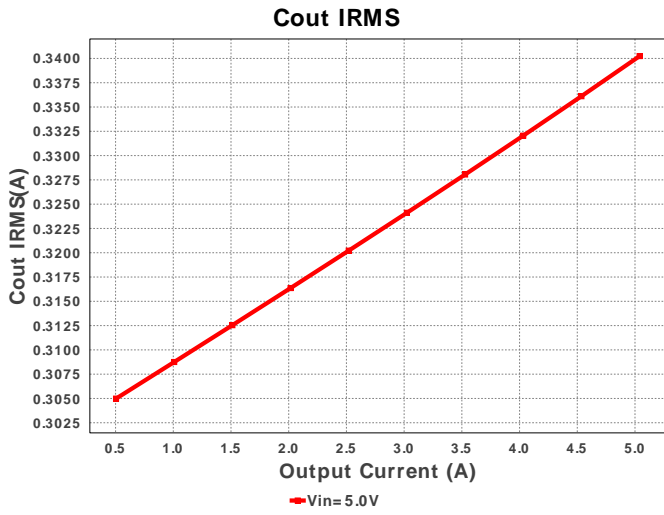
### Electrical BOM

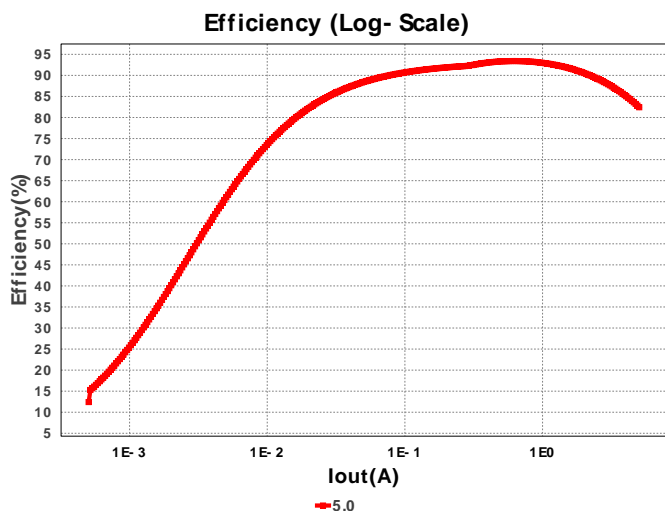
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbst	TDK	C1005X5R1A104K Series= X5R	Cap= 100.0 nF ESR= 20.413 mOhm VDC= 10.0 V IRMS= 0.0 A	1	\$0.01	 0402 3 mm <sup>2</sup>
2.	Cin	TDK	C3216X5R1C106KT Series= X5R	Cap= 10.0 uF ESR= 4.6 mOhm VDC= 16.0 V IRMS= 2.7 A	2	\$0.08	 1206 11 mm <sup>2</sup>
3.	Cout	MuRata	GRM31CR60J476ME19L Series= X5R	Cap= 47.0 uF ESR= 3.0 mOhm VDC= 6.3 V IRMS= 0.0 A	1	\$0.12	 1206 11 mm <sup>2</sup>
4.	Creg	TDK	C1608X5R1A105K Series= X5R	Cap= 1.0 uF ESR= 9.603 mOhm VDC= 10.0 V IRMS= 0.0 A	1	\$0.01	 0603 5 mm <sup>2</sup>
5.	Css	Kemet	C0805C103K5RACTU Series= X7R	Cap= 10.0 nF ESR= 1.739 Ohm VDC= 50.0 V IRMS= 411.0 mA	1	\$0.01	 0805 7 mm <sup>2</sup>
6.	L1	TDK	SPM6530T-1R5M100	L= 1.5 uH DCR= 10.7 mOhm	1	\$0.56	 SPM6530 77 mm <sup>2</sup>
7.	Ren	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm <sup>2</sup>

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
8.	Rfbb	Vishay-Dale	CRCW040222K1FKED Series= CRCW..e3	Res= 22.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm <sup>2</sup>
9.	Rfbt	Vishay-Dale	CRCW040221K0FKED Series= CRCW..e3	Res= 21.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm <sup>2</sup>
10.	Rpgood	Vishay-Dale	CRCW0402100KFKED Series= CRCW..e3	Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm <sup>2</sup>
11.	U1	Texas Instruments	TPS54526PWR	Switcher	1	\$1.22	 R-PDSO-G14 61 mm <sup>2</sup>









## Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	2.392 A	Current	Input capacitor RMS ripple current
2.	Cout IRMS	340.241 mA	Current	Output capacitor RMS ripple current
3.	IC Ipk	5.629 A	Current	Peak switch current in IC
4.	Iin Avg	1.834 A	Current	Average input current
5.	L Ipp	1.179 A	Current	Peak-to-peak inductor ripple current
6.	BOM Count	12	General	Total Design BOM count
7.	FootPrint	198.0 mm <sup>2</sup>	General	Total Foot Print Area of BOM components
8.	Frequency	678.218 kHz	General	Switching frequency
9.	Pout	7.56 W	General	Total output power
10.	Total BOM	\$2.12	General	Total BOM Cost
11.	Vout OP	1.5 V	Op_point	Operational Output Voltage
12.	Duty Cycle	34.259 %	Op_point	Duty cycle
13.	Efficiency	82.431 %	Op_point	Steady state efficiency
14.	IC Tj	73.727 degC	Op_point	IC junction temperature
15.	ICThetaJA	34.8 degC/W	Op_point	IC junction-to-ambient thermal resistance
16.	IOUT_OP	5.04 A	Op_point	Iout operating point
17.	VIN_OP	5.0 V	Op_point	Vin operating point
18.	Vout p-p	5.952 mV	Op_point	Peak-to-peak output ripple voltage
19.	Cin Pd	13.158 mW	Power	Input capacitor power dissipation
20.	Cout Pd	347.292 μW	Power	Output capacitor power dissipation
21.	IC Iq Pd	4.0 mW	Power	IC Iq Pd
22.	IC Pd	1.257 W	Power	IC power dissipation
23.	L Pd	341.295 mW	Power	Inductor power dissipation
24.	Total Pd	1.611 W	Power	Total Power Dissipation

## Design Inputs

#	Name	Value	Description
1.	Iout	5.04	Maximum Output Current
2.	Iout1	5.04	Output Current #1
3.	SoftStart	1.0 ms	Soft Start Time (ms)
4.	VinMax	5.0	Maximum input voltage
5.	VinMin	5.0	Minimum input voltage
6.	Vout	1.5	Output Voltage
7.	Vout1	1.5	Output Voltage #1
8.	base_pn	TPS54526	Texas Instruments Base Part Number
9.	source	DC	Input Source Type
10.	ta	30.0	Ambient temperature

## Design Assistance

1. TPS54526 Product Folder : <http://www.ti.com/product/TPS54526> : contains the data sheet and other resources.

Texas Instruments' WEBENCH simulation tools attempt to recreate the performance of a substantially equivalent physical implementation of the design. Simulations are created using Texas Instruments' published specifications as well as the published specifications of other device manufacturers. While Texas Instruments does update this information periodically, this information may not be current at the time the simulation is built. Texas Instruments does not warrant the accuracy or completeness of the specifications or any information contained therein. Texas Instruments does not warrant that any designs or recommended parts will meet the specifications you entered, will be suitable for your application or fit for any particular purpose, or will operate as shown in the simulation in a physical implementation. Texas Instruments does not warrant that the designs are production worthy.

**You should completely validate and test your design implementation to confirm the system functionality for your application prior to production.**

Use of Texas Instruments' WEBENCH simulation tools is subject to [Texas Instruments' Site Terms and Conditions of Use](#). Prototype boards based on WEBENCH created designs are provided AS IS without warranty of any kind for evaluation and testing purposes and are subject to the terms of the [Evaluation License Agreement](#).