TEXAS INSTRUMENTS

VinMin = 6.0V
VinMax = 17.0V
Vout = 3.3V
Iout = 3.0A

Device = TPS568236RJNR
Topology = Buck
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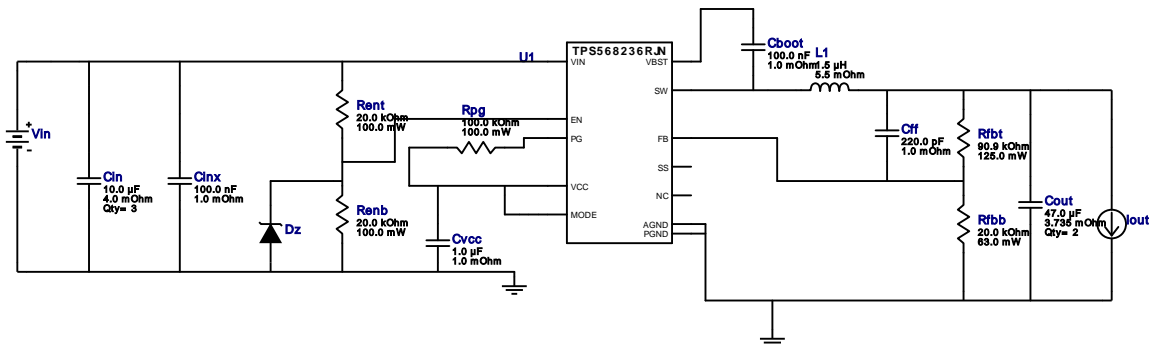BOM Cost = $1.85
BOM Count = 17
Total Pd = 0.61W

WEBENCH ® Design Report

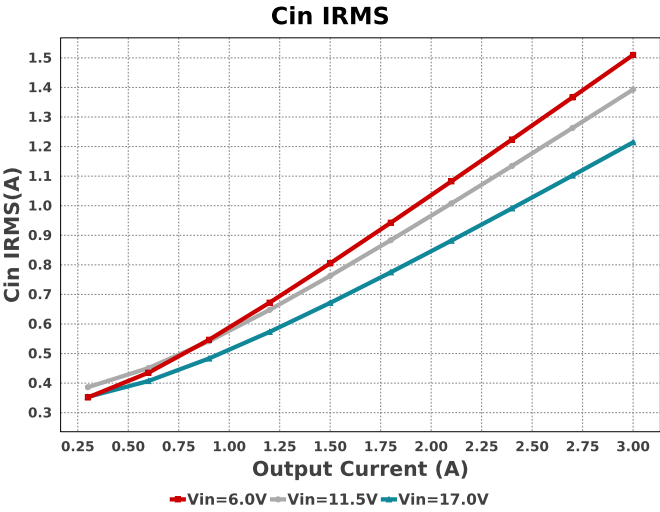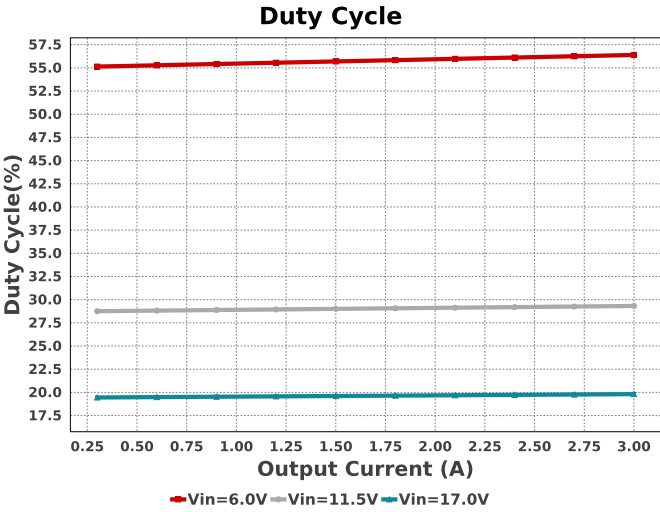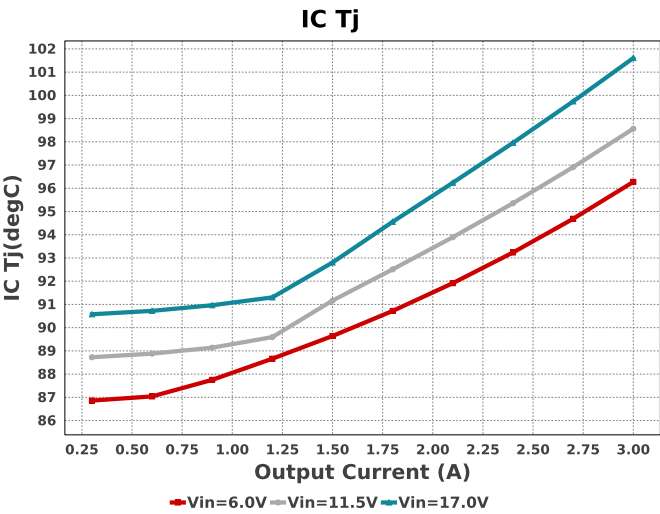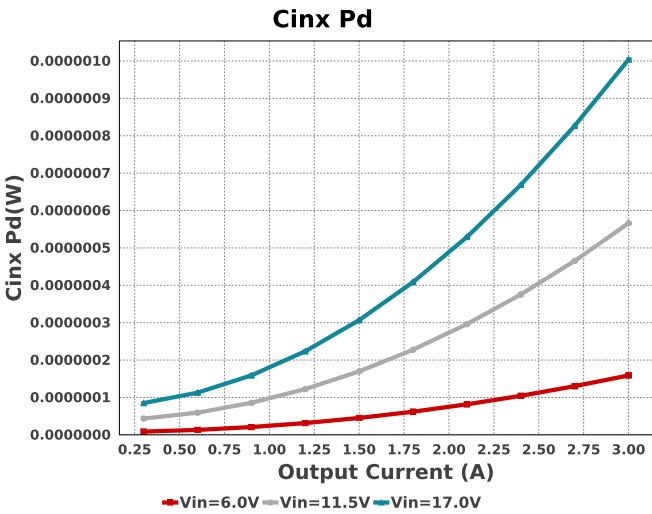Design : 17 TPS568236RJNR
TPS568236RJNR 5.5V-18V to 5.00V @ 8A

1. For given softstart time, the softstart capacitor selected in schematic is the nearest available capacitor to the calculated value.Recommend to double check based on datasheet soft-start formula

Electrical BOM

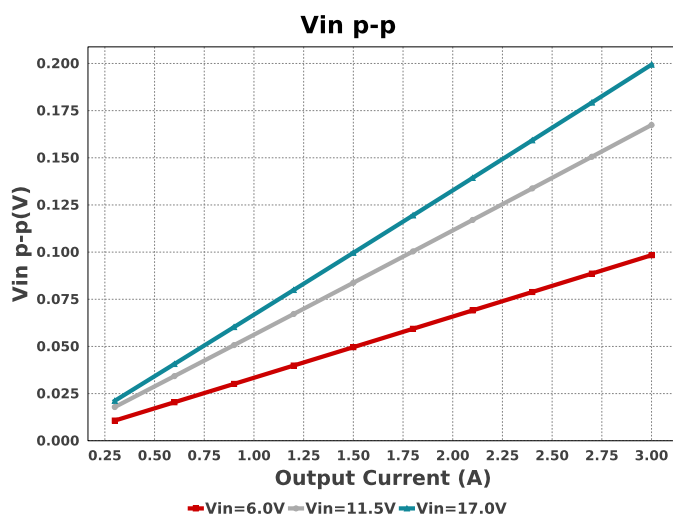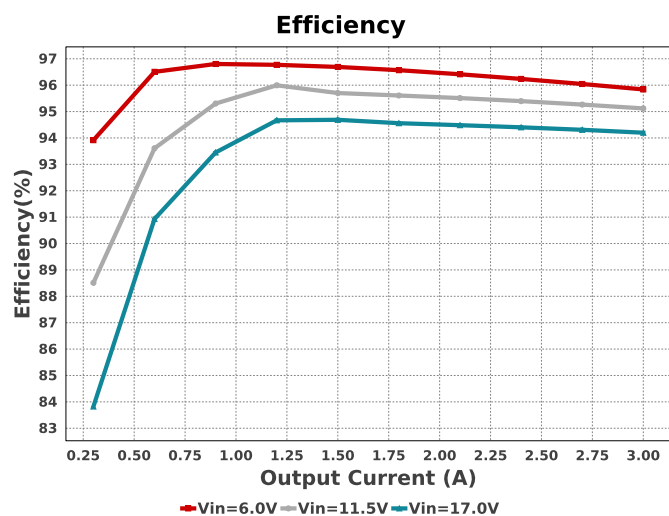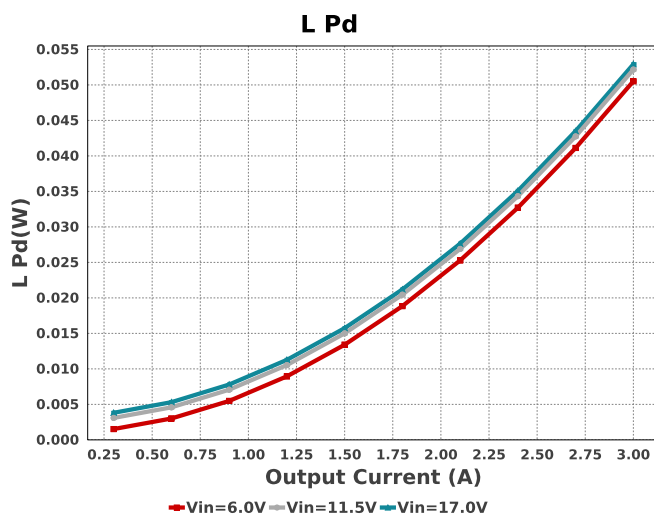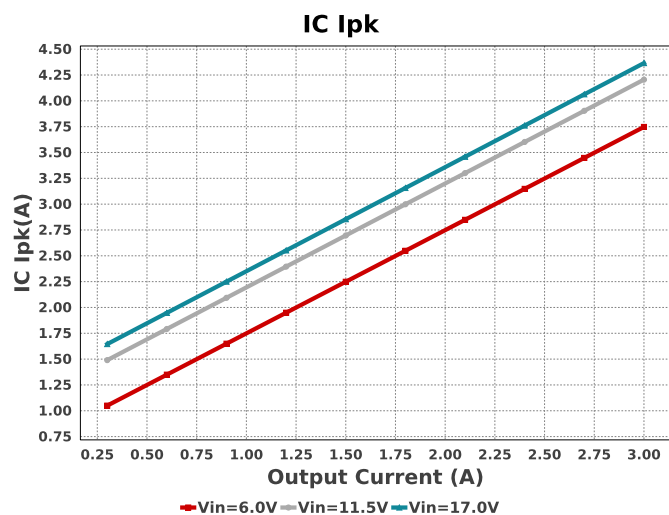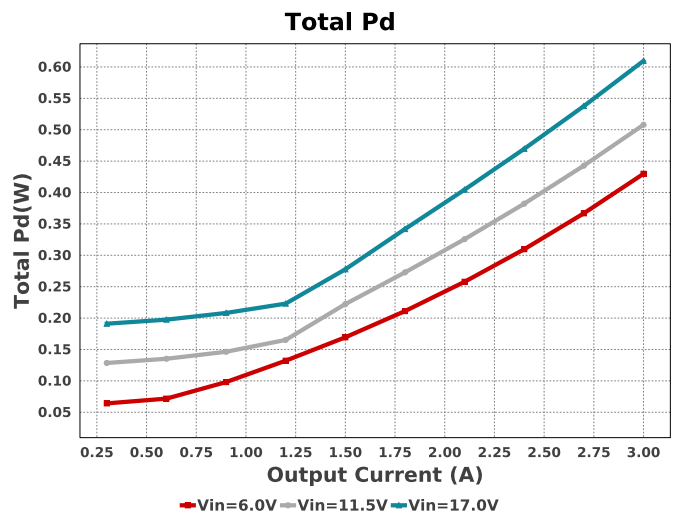| Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cboot	Taiyo Yuden	EMK107B7104KA-T Series= X7R	Cap= 100.0 nF ESR= 1.0 mOhm VDC= 16.0 V IRMS= 0.0 A	1	$0.01	0603 5 mm²
Cff	MuRata	GRM1885C1H221JA01D Series= C0G/NP0	Cap= 220.0 pF ESR= 1.0 mOhm VDC= 50.0 V IRMS= 0.0 A	1	$0.02	0603 5 mm²
Cin	MuRata	GRM21BR61E106MA73L Series= X5R	Cap= 10.0 uF ESR= 4.0 mOhm VDC= 25.0 V IRMS= 2.8 A	3	$0.04	0805 7 mm²
Cinx	MuRata	GRM21BR71H104KA01L Series= X7R	Cap= 100.0 nF ESR= 1.0 mOhm VDC= 50.0 V IRMS= 3.85 A	1	$0.03	0805 7 mm²
Cout	MuRata	GRM31CR60J476KE19L Series= X5R	Cap= 47.0 uF ESR= 3.735 mOhm VDC= 6.3 V IRMS= 4.091 A	2	$0.13	1206_190 11 mm²
Cvcc	Kemet	C0603C105Z8VACTU Series= Y5V	Cap= 1.0 uF ESR= 1.0 mOhm VDC= 10.0 V IRMS= 0.0 A	1	$0.01	0603 5 mm²
Dz	ON Semiconductor	MMBZ5231BLT1G	Zener	1	$0.03	SOT-23 14 mm²
L1	Bourns	SRP1235-1R5M	L= 1.5 µH 5.5 mOhm	1	$0.72	SRP1235 253 mm²

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Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Renb	Vishay-Dale	CRCW060320K0FKEA Series= CRCW..e3	Res= 20.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	0603 5 mm²
Rent	Vishay-Dale	CRCW060320K0FKEA Series= CRCW..e3	Res= 20.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	0603 5 mm²
Rfbb	Vishay-Dale	CRCW040220K0FKED Series= CRCW..e3	Res= 20.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
Rfbt	Panasonic	ERJ-6ENF9092V Series= ERJ-6E	Res= 90.9 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm²
Rpg	Vishay-Dale	CRCW0603100KFKEA Series= CRCW..e3	Res= 100.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	0603 5 mm²
U1	Texas Instruments	TPS568236RJNR	Switcher	1	$0.60	RJN0012A-MFG 12 mm²

Cinx Pd

IC Tj

Duty Cycle

Cin IRMS

IC Ipk

L Pd

Efficiency

Vin p-p

Vout p-p

Cin Pd

Cout Pd

Ipp percentage

Pout

Iin Avg

Cinx IRMS

Total Pd

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Cout IRMS

Vin=6.0V Vin=11.5V Vin=17.0V

L Ipp

Vin=6.0V Vin=11.5V Vin=17.0V

IC Pd

Vin=6.0V Vin=11.5V Vin=17.0V
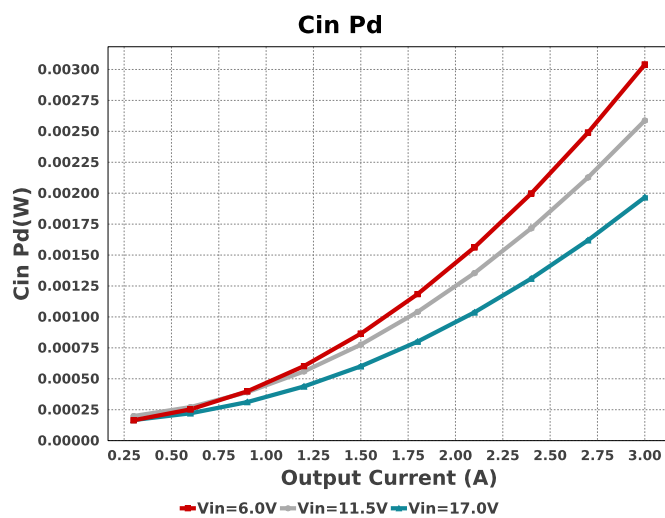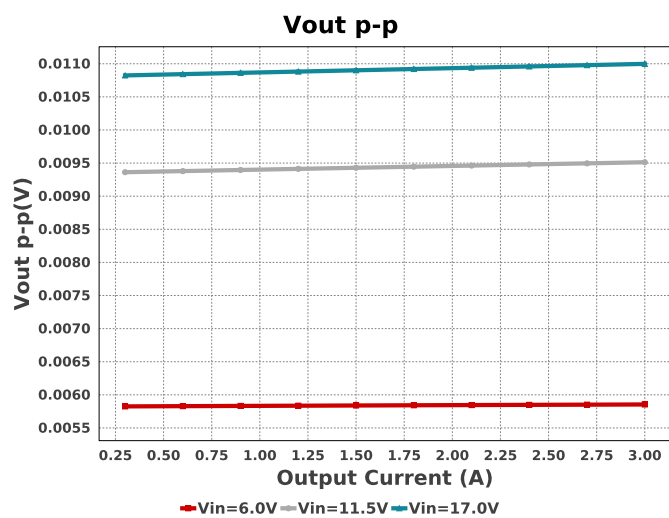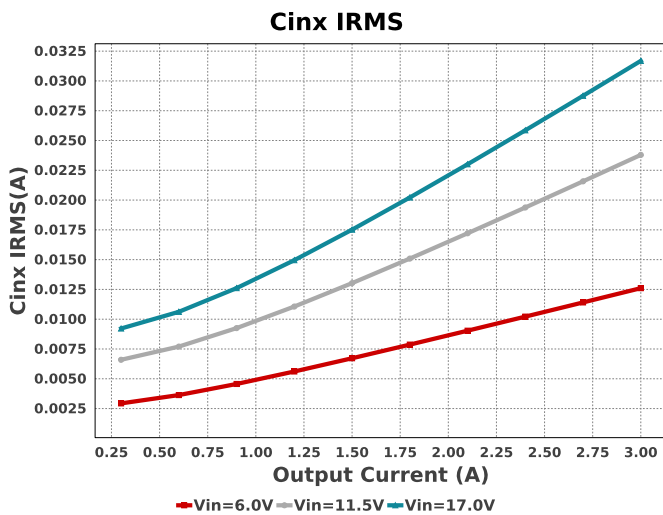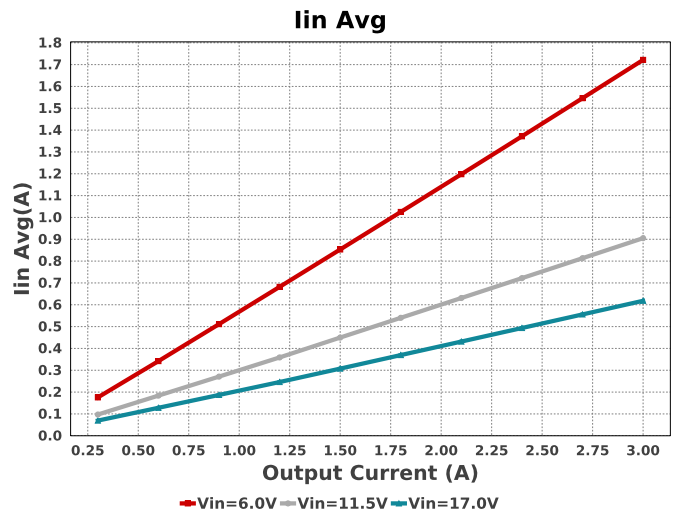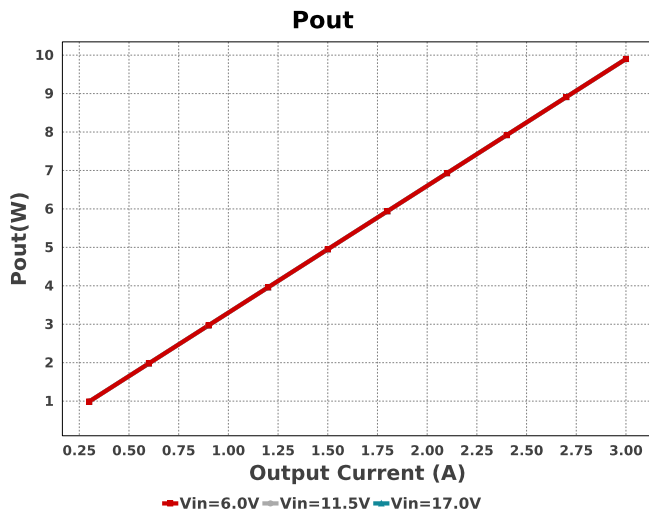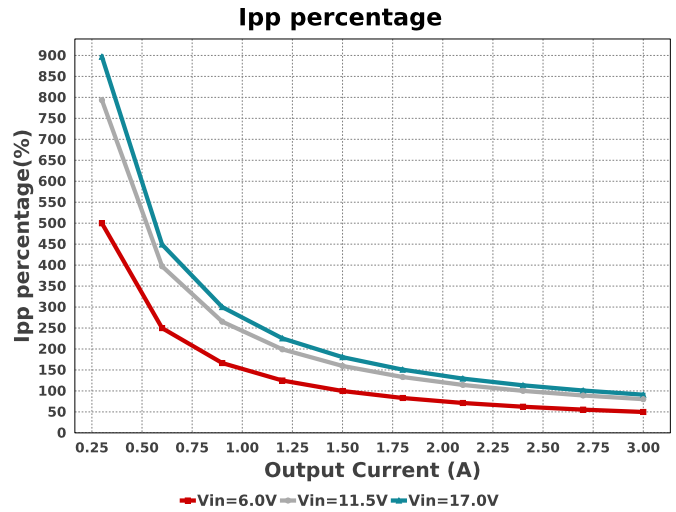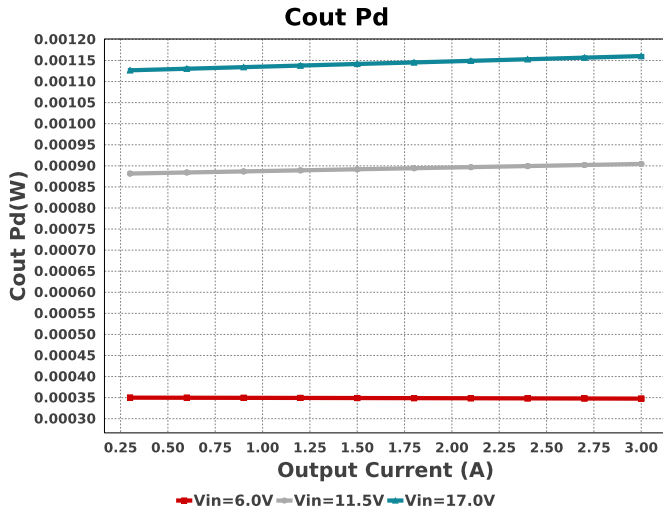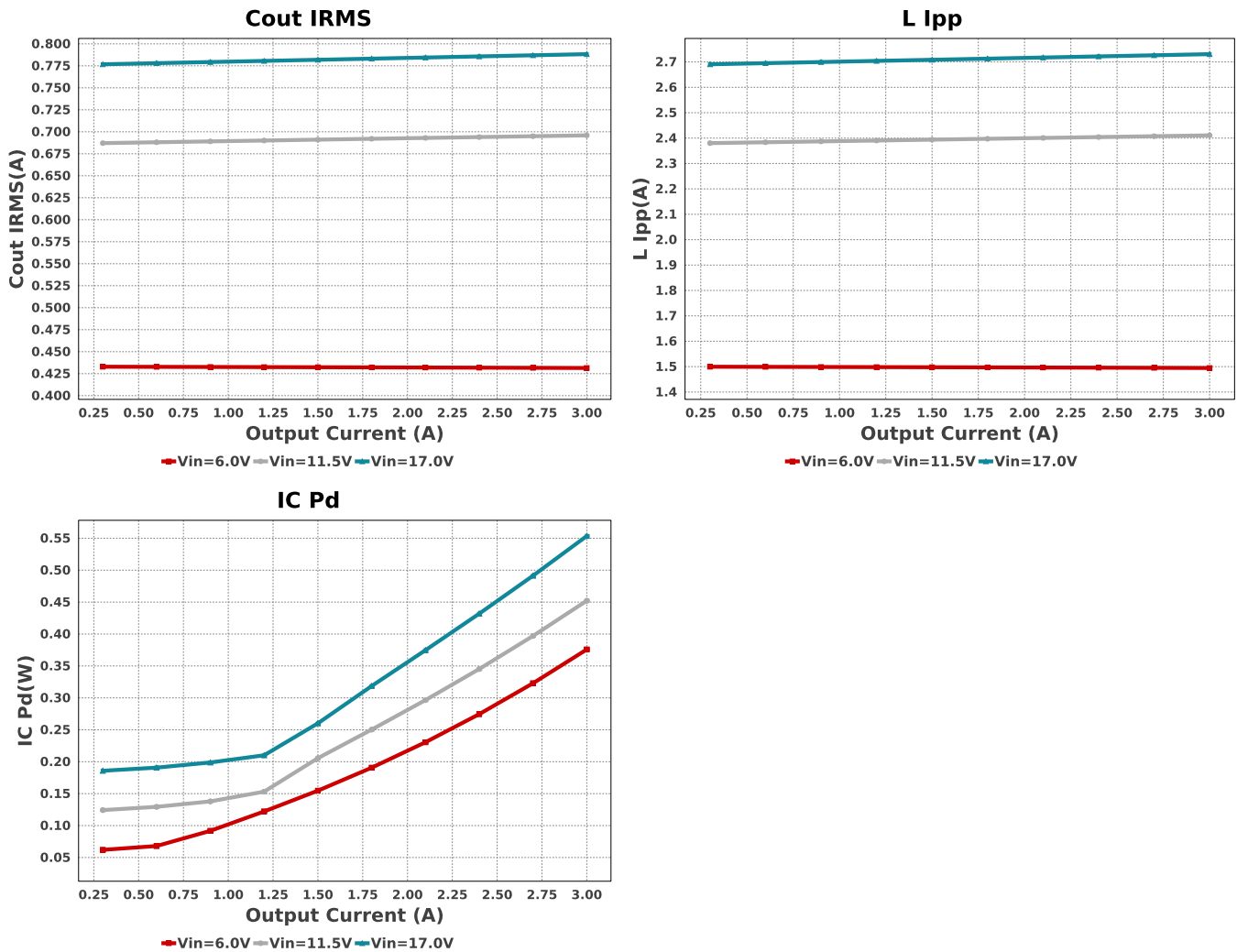
Operating Values

#	Name	Value	Category	Description
1.	BOM Count	17		Total Design BOM count
2.	Total BOM	$1.85		Total BOM Cost
3.	Cin IRMS	1.214 A	Capacitor	Input capacitor RMS ripple current
4.	Cin Pd	1.967 mW	Capacitor	Input capacitor power dissipation
5.	Cinx IRMS	31.684 mA	Capacitor	Bulk capacitor RMS ripple current
6.	Cinx Pd	1.004 µW	Capacitor	Bulk capacitor power dissipation
7.	Cout IRMS	788.272 mA	Capacitor	Output capacitor RMS ripple current
8.	Cout Pd	1.16 mW	Capacitor	Output capacitor power dissipation
9.	IC Ipk	4.365 A	IC	Peak switch current in IC
10.	IC Pd	553.52 mW	IC	IC power dissipation
11.	IC Tj	101.606 degC	IC	IC junction temperature
12.	IC Tolerance	50.0 mV	IC	IC Feedback Tolerance
13.	ICThetaJA Effective	30.0 degC/W	IC	Effective IC Junction-to-Ambient Thermal Resistance
14.	Iin Avg	618.22 mA	IC	Average input current
15.	Ipp percentage	91.022 %	Inductor	Inductor ripple current percentage (with respect to average inductor current)
16.	L Ipp	2.731 A	Inductor	Peak-to-peak inductor ripple current
17.	L Pd	52.918 mW	Inductor	Inductor power dissipation
18.	Cin Pd	1.967 mW	Power	Input capacitor power dissipation
19.	Cinx Pd	1.004 µW	Power	Bulk capacitor power dissipation
20.	Cout Pd	1.16 mW	Power	Output capacitor power dissipation
21.	IC Pd	553.52 mW	Power	IC power dissipation
22.	L Pd	52.918 mW	Power	Inductor power dissipation
23.	Total Pd	609.67 mW	Power	Total Power Dissipation
24.	Duty Cycle	19.811 %	System Information	Duty cycle
25.	Efficiency	94.199 %	System Information	Steady state efficiency
26.	FootPrint	365.0 mm²	System Information	Total Foot Print Area of BOM components
27.	Frequency	657.687 kHz	System Information	Switching frequency

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#	Name	Value	Category	Description
28.	Iout	3.0 A	System Information	Iout operating point
29.	Mode	CCM	System Information	Conduction Mode
30.	Pout	9.9 W	System Information	Total output power
31.	Vin	17.0 V	System Information	Vin operating point
32.	Vin p-p	199.371 mV	System Information	Peak-to-peak input voltage
33.	Vout	3.3 V	System Information	Operational Output Voltage
34.	Vout Actual	3.327 V	System Information	Vout Actual calculated based on selected voltage divider resistors
35.	Vout Tolerance	10.127 %	System Information	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
36.	Vout p-p	10.998 mV	System Information	Peak-to-peak output ripple voltage
37.	SoftStart Time Actual	0.0 ms		Softstart Time (Calculated)

Design Inputs

Name	Value	Description
Iout	3.0	Maximum Output Current
SoftStart	1.0 ms	Soft Start Time (ms)
VinMax	17.0	Maximum input voltage
VinMin	6.0	Minimum input voltage
Vout	3.3	Output Voltage
base_pn	TPS568236	Base Product Number
source	DC	Input Source Type
Ta	85.0	Ambient temperature

WEBENCH® Assembly

Component Testing

Some published data on components in datasheets such as Capacitor ESR and Inductor DC resistance is based on conservative values that will guarantee that the components always exceed the specification. For design purposes it is usually better to work with typical values. Since this data is not always available it is a good practice to measure the Capacitance and ESR values of Cin and Cout, and the inductance and DC resistance of L1 before assembly of the board. Any large discrepancies in values should be electrically simulated in WEBENCH to check for instabilities and thermally simulated in WebTHERM to make sure critical temperatures are not exceeded.

Soldering Component to Board

If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. To solder the tab town to the board place the iron down on the board while resting against the tab, heating both surfaces simultaneously. Apply light pressure to the top of the plastic case until the solder flows around the part and the part is flush with the PCB. If the solder is not flowing around the board you may need a higher wattage iron (generally 25W to 30W is enough).

Initial Startup of Circuit

It is best to initially power up the board by setting the input supply voltage to the lowest operating input voltage 6.0V and set the input supply's current limit to zero. With the input supply off connect up the input supply to Vin and GND. Connect a digital volt meter and a load if needed to set the minimum Iout of the design from Vout and GND. Turn on the input supply and slowly turn up the current limit on the input supply. If the voltage starts to rise on the input supply continue increasing the input supply current limit while watching the output voltage. If the current increases on the input supply, but the voltage remains near zero, then there may be a short or a component misplaced on the board. Power down the board and visually inspect for solder bridges and recheck the diode and capacitor polarities. Once the power supply circuit is operational then more extensive testing may include full load testing, transient load and line tests to compare with simulation results.

Load Testing

The setup is the same as the initial startup, except that an additional digital voltmeter is connected between Vin and GND, a load is connected between Vout and GND and a current meter is connected in series between Vout and the load. The load must be able to handle at least rated output power + 50% (7.5 watts for this design). Ideally the load is supplied in the form of a variable load test unit. It can also be done in the form of suitably large power resistors. When using an oscilloscope to measure waveforms on the prototype board, the ground leads of the oscilloscope probes should be as short as possible and the area of the loop formed by the ground lead should be kept to a minimum. This will help reduce ground lead inductance and eliminate EMI noise that is not actually present in the circuit.
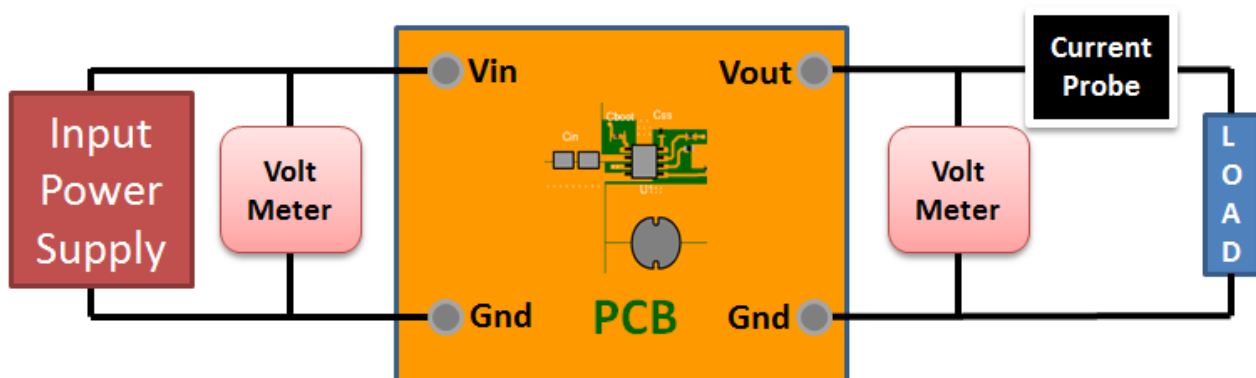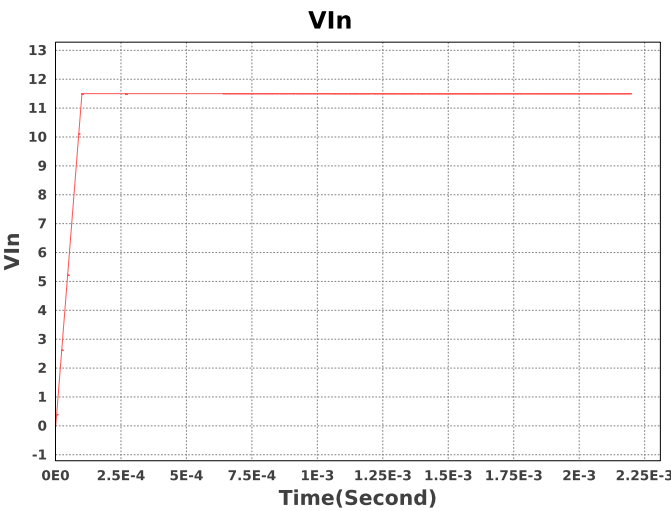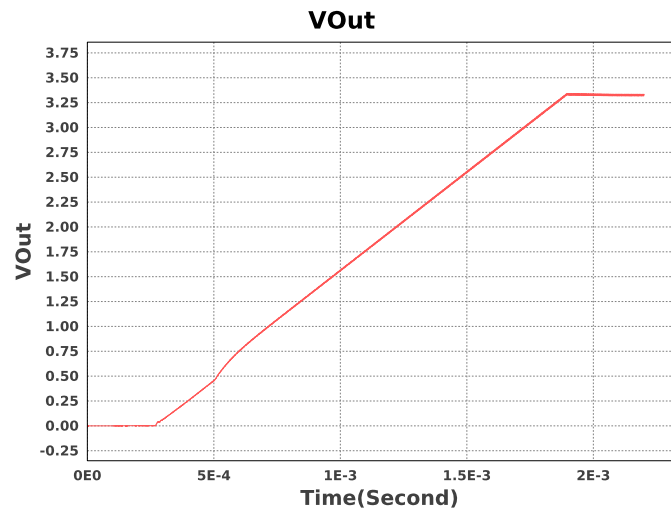
WEBENCH® Electrical Simulation Report

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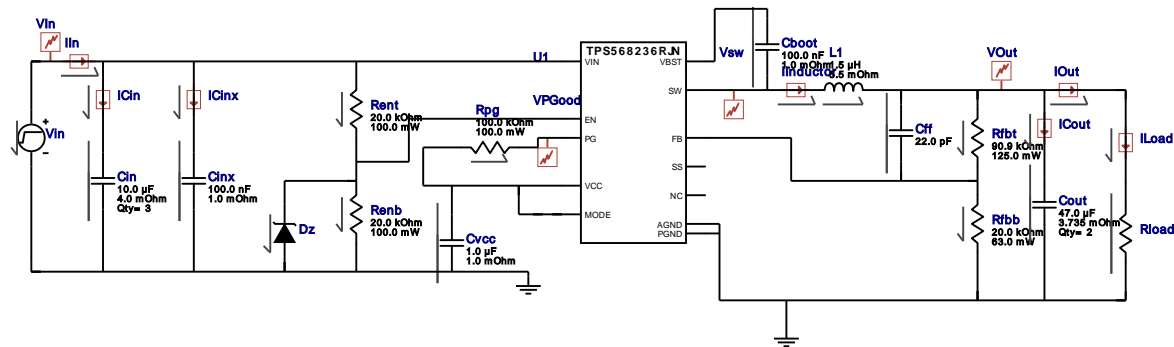
Simulation Parameters

#	Name	Parameter Name	Description	Values
1.	Cout	IC	Initial Voltage	0 V
2.	Rload	R	Load Resistance	1.0999999999999999 ohm

Design Assistance

1. Master key : D68E24039D8F716A[v1]

2. **TPS568236** Product Folder : https://www.ti.com/product/TPS568236 : contains the data sheet and other resources.

WEBENCH® Design Report   TPS568236RJNR : TPS568236RJNR 5.5V-18V to 5.00V @ 8A   June 19, 2024 11:19:11 GMT-05:00