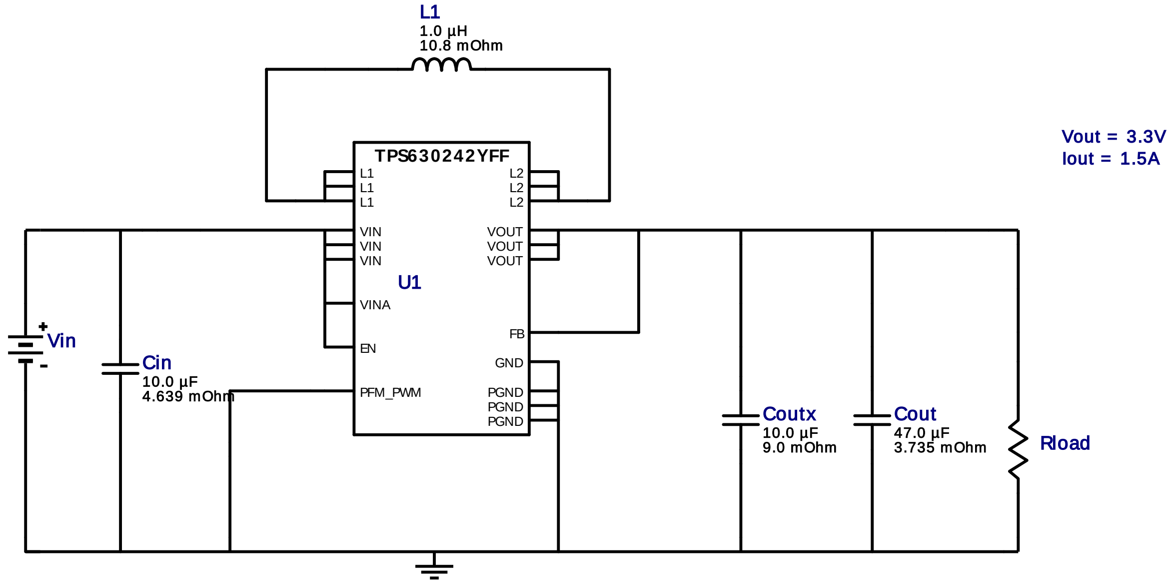
WEBENCH ® Design Report

VinMin = 3.0V
VinMax = 5.0V
Vout = 3.3V
Iout = 1.5A

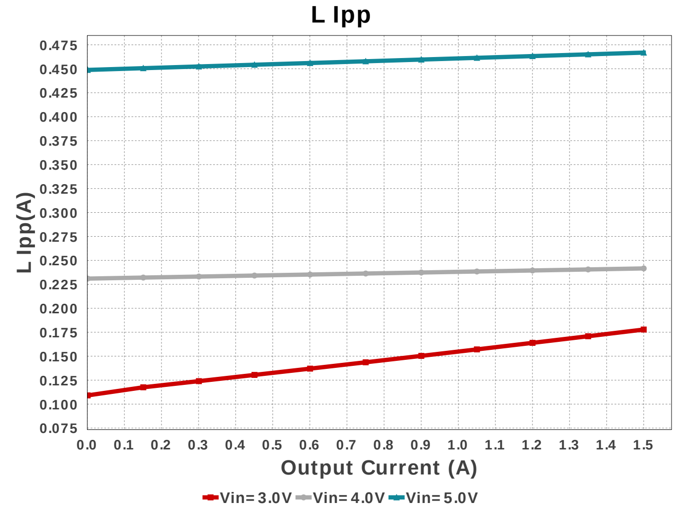
Device = TPS630242YFFR
Topology = Buck_Boost
Created = 2021-05-06 16:36:25.828
BOM Cost = $1.77
BOM Count = 5
Total Pd = 0.41W

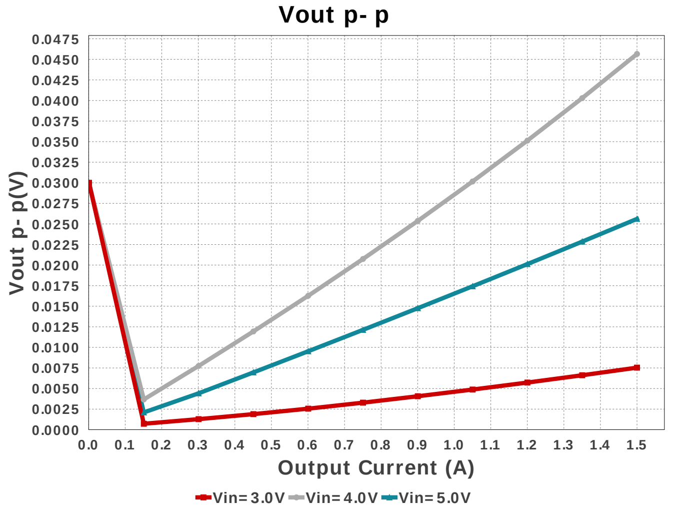
Design : 22 TPS630242YFFR
TPS630242YFFR 3V-5V to 3.30V @ 1.5A

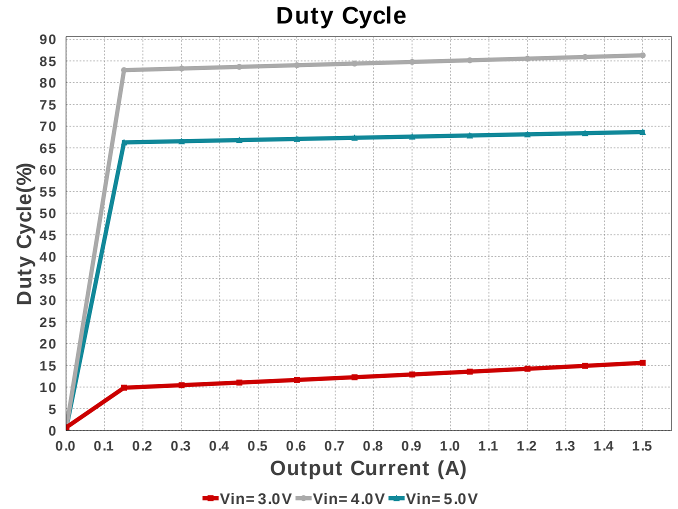


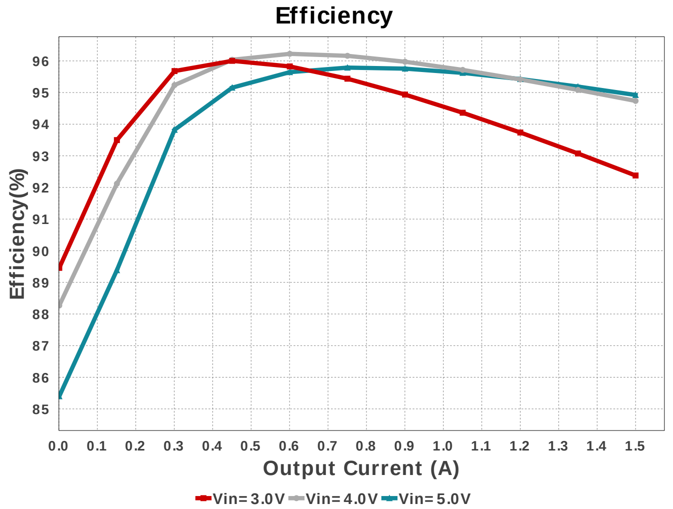
Electrical BOM

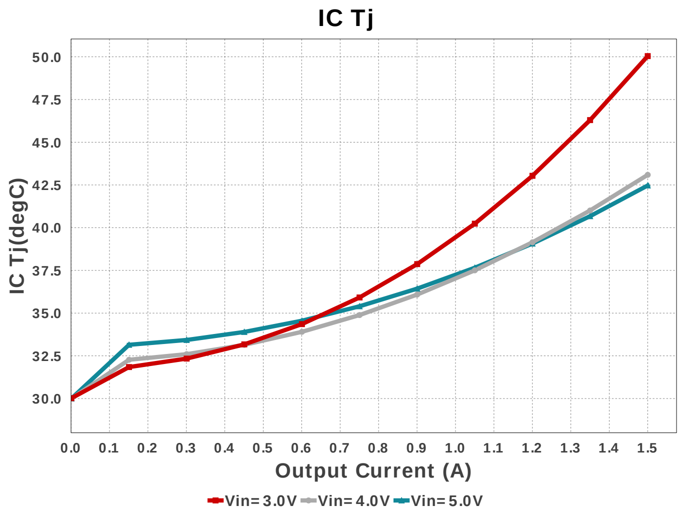
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cin	TDK	C1608X5R1A106K080AC Series= X5R	Cap= 10.0 uF ESR= 4.639 mOhm VDC= 10.0 V IRMS= 2.4141 A	1	$0.11	0603 5 mm²
Cout	MuRata	GRM31CC80J476KE18L Series= X6S	Cap= 47.0 uF ESR= 3.735 mOhm VDC= 6.3 V IRMS= 4.0522 A	1	$0.20	1206_190 11 mm²
Coutx	MuRata	GRM188R60J106ME47D Series= X5R	Cap= 10.0 uF ESR= 9.0 mOhm VDC= 6.3 V IRMS= 2.74 A	1	$0.08	0603 5 mm²
L1	Coilcraft	XFL4020-102MEB	L= 1.0 µH 10.8 mOhm	1	$0.61	XFL4020 25 mm²
U1	Texas Instruments	TPS630242YFFR	Switcher	1	$0.77	YFF0020AEBA 9 mm²

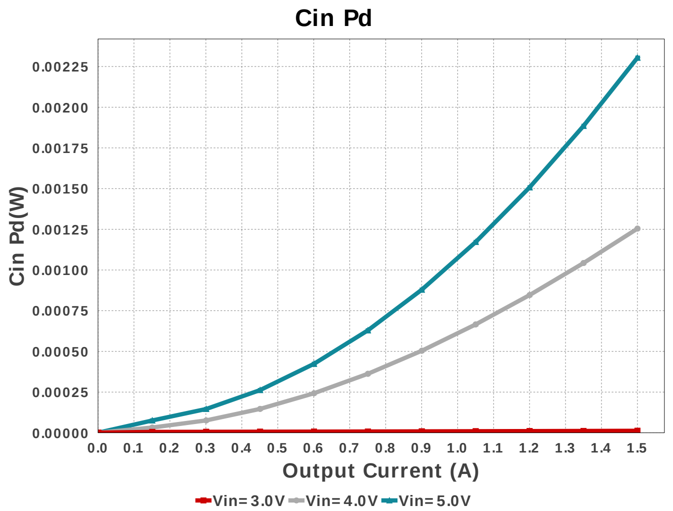

L Ipp
L Ipp(A)
Output Current (A)
Vin=3.0V Vin=4.0V Vin=5.0V

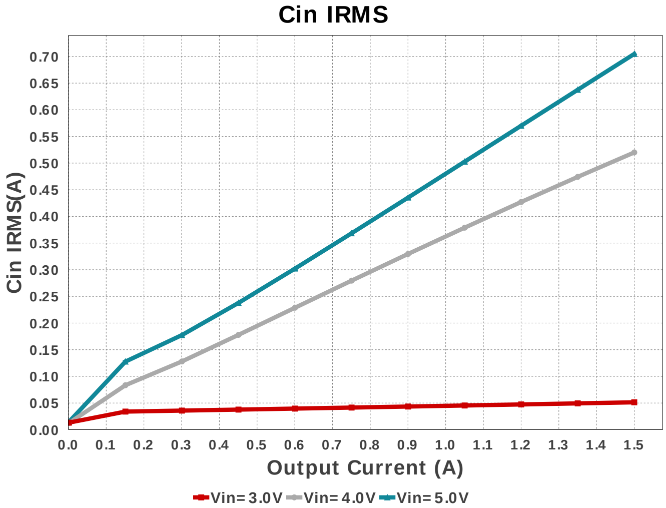

Vout p-p
Vout p-p(V)
Output Current (A)
Vin=3.0V Vin=4.0V Vin=5.0V

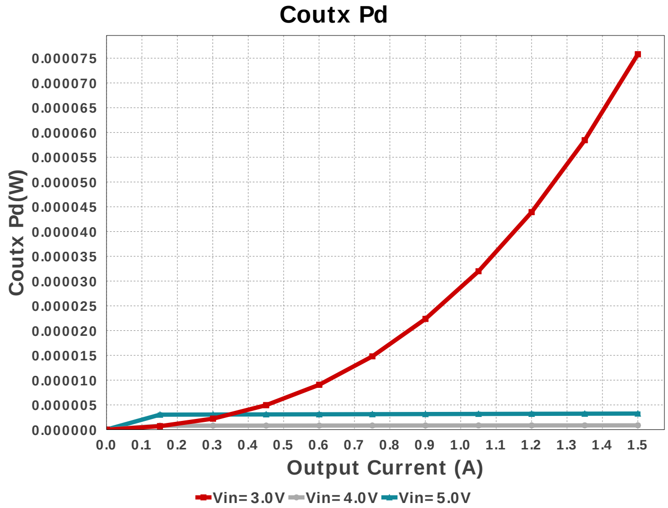

Duty Cycle
Duty Cycle(%)
Output Current (A)
Vin=3.0V Vin=4.0V Vin=5.0V

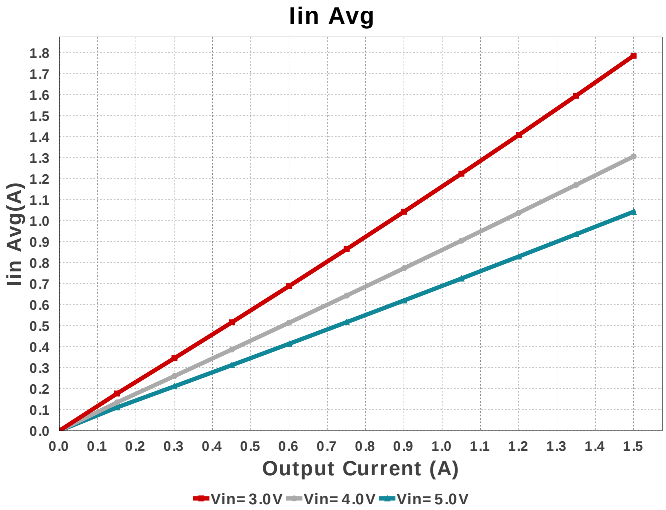

Efficiency
Efficiency(%)
Output Current (A)
Vin=3.0V Vin=4.0V Vin=5.0V

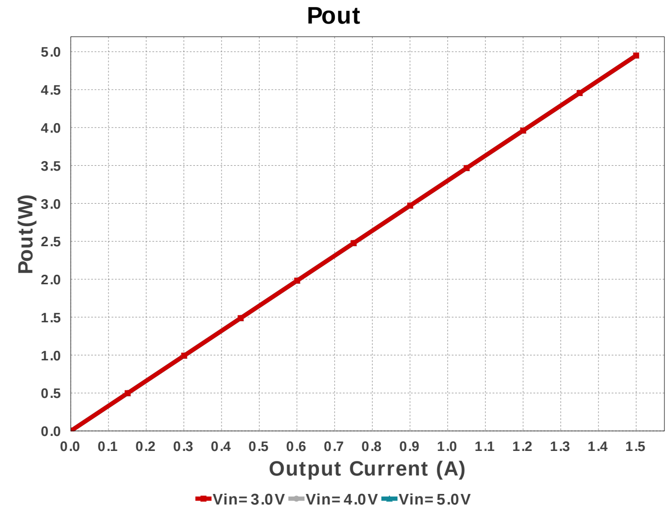

IC Tj
IC Tj(degC)
Output Current (A)
Vin=3.0V Vin=4.0V Vin=5.0V

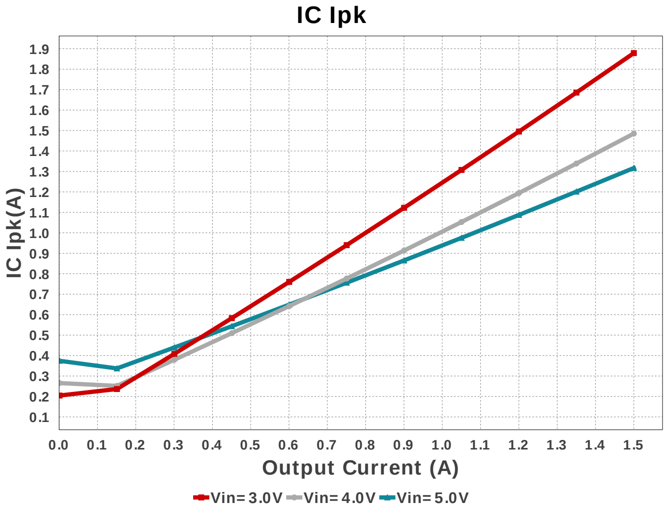

Cin Pd
Cin Pd(W)
Output Current (A)
Vin=3.0V Vin=4.0V Vin=5.0V

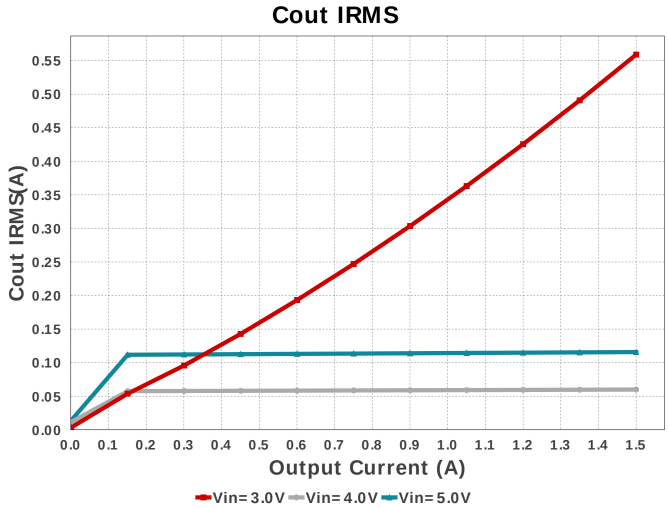

Cin IRMS
Cin IRMS(A)
Output Current (A)
Vin= 3.0V Vin= 4.0V Vin= 5.0V


Coutx Pd
Coutx Pd(W)
Output Current (A)
Vin= 3.0V Vin= 4.0V Vin= 5.0V

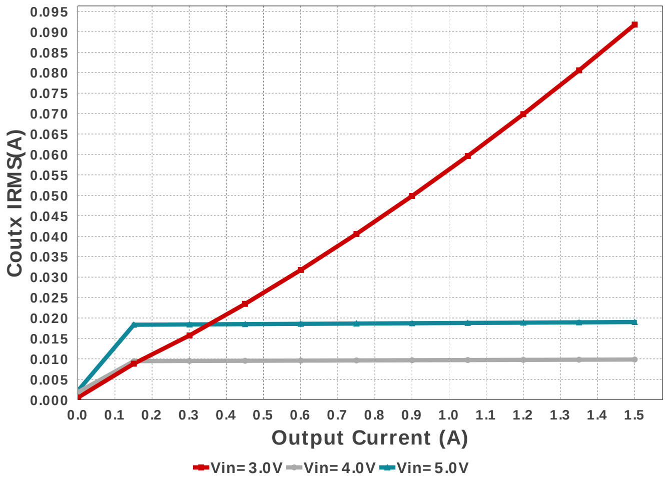

Iin Avg
Iin Avg(A)
Output Current (A)
Vin= 3.0V Vin= 4.0V Vin= 5.0V


Pout
Pout(W)
Output Current (A)
Vin= 3.0V Vin= 4.0V Vin= 5.0V

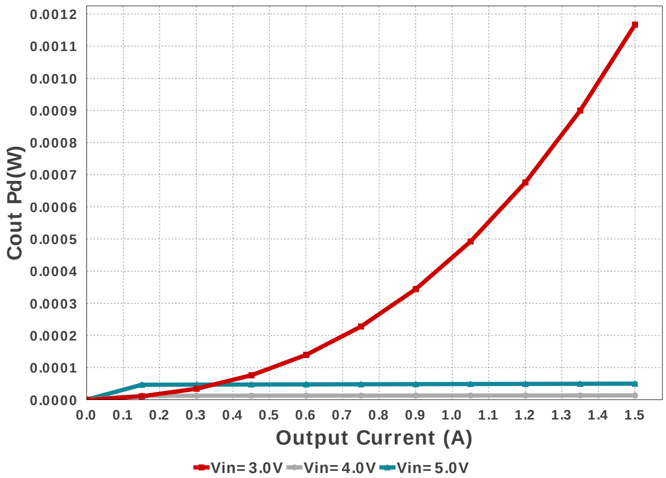

IC Ipk
IC Ipk(A)
Output Current (A)
Vin= 3.0V Vin= 4.0V Vin= 5.0V


Cout IRMS
Cout IRMS(A)
Output Current (A)
Vin= 3.0V Vin= 4.0V Vin= 5.0V

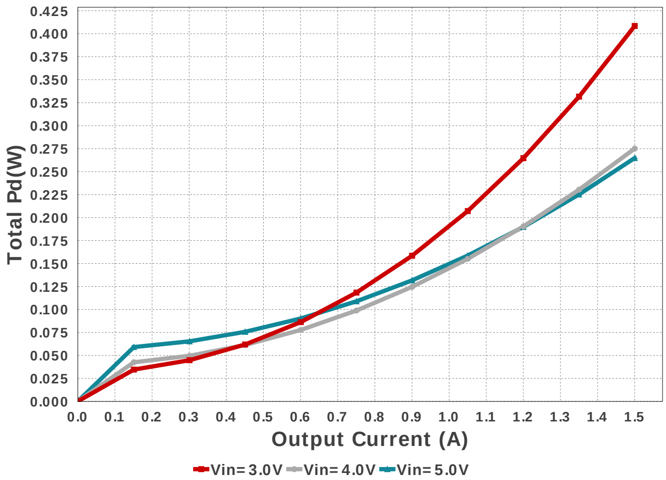
Coutx IRMS



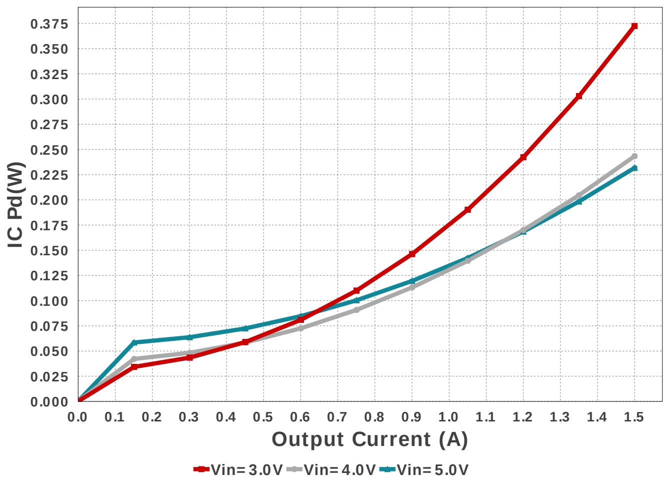
Cout Pd



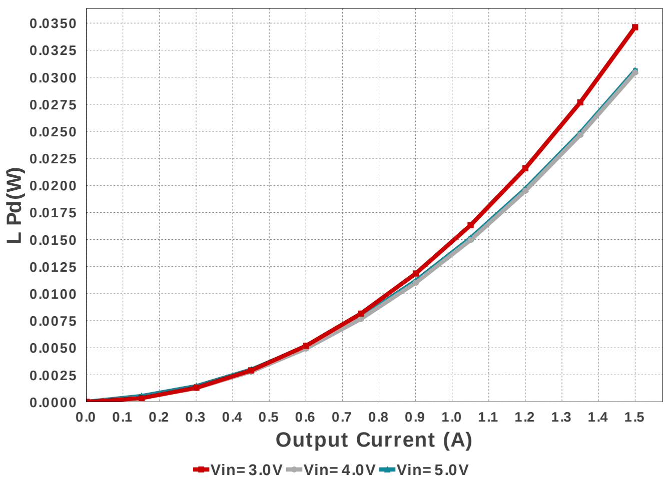
Total Pd



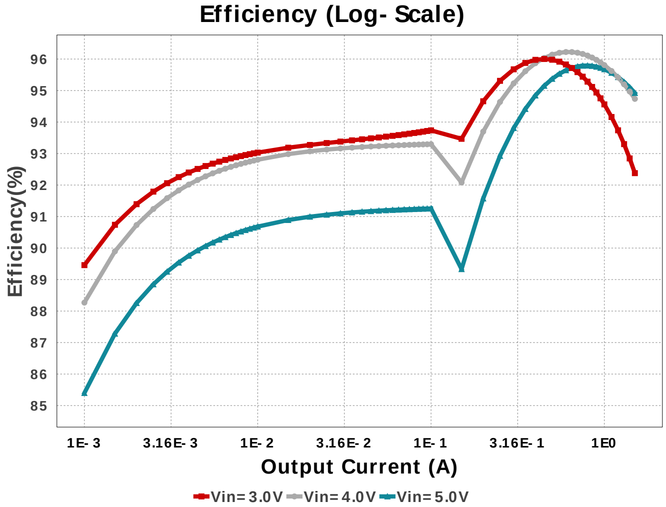
IC Pd



L Pd



Efficiency (Log- Scale)



Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	51.328 mA	Capacitor	Input capacitor RMS ripple current
2.	Cin Pd	12.222 µW	Capacitor	Input capacitor power dissipation
3.	Cout IRMS	558.685 mA	Capacitor	Output capacitor RMS ripple current
4.	Cout Pd	0.0 W	Capacitor	Output capacitor power dissipation
5.	Coutx IRMS	91.743 mA	Capacitor	Output capacitor_x RMS ripple current
6.	Coutx Pd	0.0 W	Capacitor	Output capacitor_x power loss
7.	IC Ipk	1.878 A	IC	Peak switch current in IC
8.	IC Pd	372.35 mW	IC	IC power dissipation
9.	IC Tj	50.032 degC	IC	IC junction temperature
10.	ICThetaJA	53.8 degC/W	IC	IC junction-to-ambient thermal resistance
11.	Iin Avg	1.786 A	IC	Average input current

#	Name	Value	Category	Description
12.	L Ipp	177.81 mA	Inductor	Peak-to-peak inductor ripple current
13.	L Pd	34.603 mW	Inductor	Inductor power dissipation
14.	Cin Pd	12.222 µW	Power	Input capacitor power dissipation
15.	Cout Pd	0.0 W	Power	Output capacitor power dissipation
16.	Coutx Pd	0.0 W	Power	Output capacitor_x power loss
17.	IC Pd	372.35 mW	Power	IC power dissipation
18.	L Pd	34.603 mW	Power	Inductor power dissipation
19.	Total Pd	406.979 mW	Power	Total Power Dissipation
20.	BOM Count	5	System Information	Total Design BOM count
21.	Duty Cycle	15.565 %	System Information	Duty cycle
22.	Efficiency	92.403 %	System Information	Steady state efficiency
23.	FootPrint	54.0 mm^2	System Information	Total Foot Print Area of BOM components
24.	Frequency	2.5 MHz	System Information	Switching frequency
25.	Iout	1.5 A	System Information	Iout operating point
26.	Mode	BOOST PWM CCM	System Information	PWM/PFM Mode
27.	Pout	4.95 W	System Information	Total output power
28.	Total BOM	$1.77	System Information	Total BOM Cost
29.	Vin	3.0 V	System Information	Vin operating point
30.	Vout p-p	3.083 mV	System Information	Peak-to-peak output ripple voltage

Design Inputs

Name	Value	Description
Iout	1.5	Maximum Output Current
VinMax	5.0	Maximum input voltage
VinMin	3.0	Minimum input voltage
Vout	3.3	Output Voltage
base_pn	TPS630242	Base Product Number
source	DC	Input Source Type
Ta	30.0	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

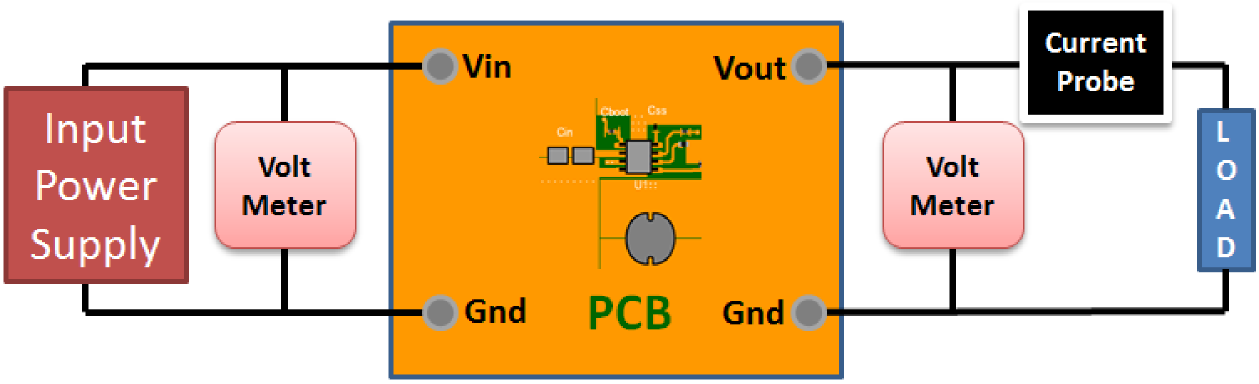
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. 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 3.0V 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.



Design Assistance

1. Master key : 3772F8B254884A20[v1]

2. **TPS630242** Product Folder : http://www.ti.com/product/TPS630242 : contains the data sheet and other resources.

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