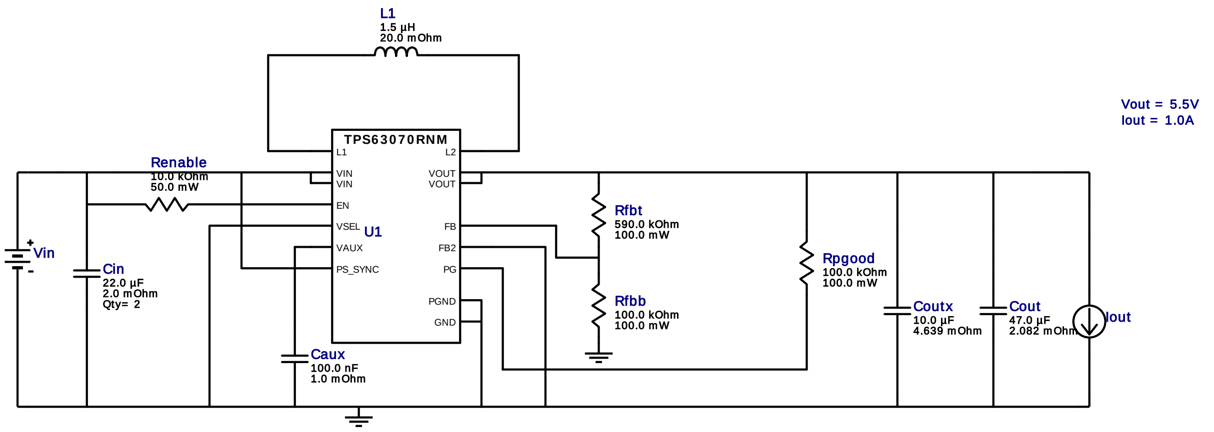
VinMin = 2.7V
VinMax = 12.0V
Vout = 5.5V
Iout = 1.0A

Device = TPS63070RNMR
Topology = Buck_Boost
Created = 2022-03-17 11:14:47.675
BOM Cost = $3.22
BOM Count = 11
Total Pd = 1.64W

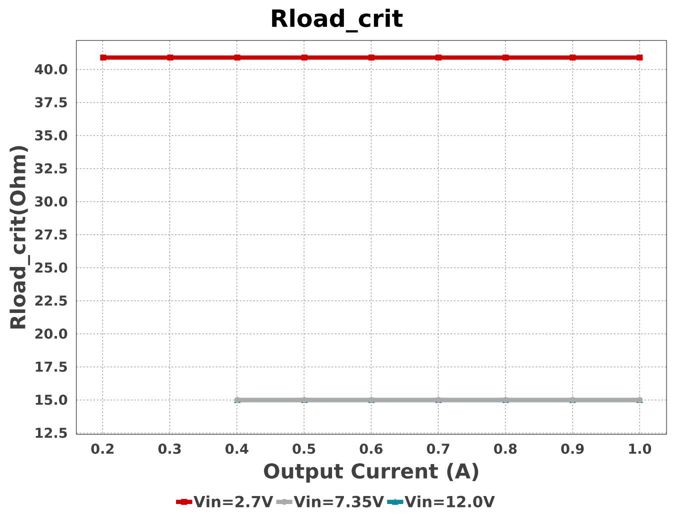
WEBENCH ® Design Report

Design : 75 TPS63070RNMR
TPS63070RNMR 2.7V-12V to 3.00V @ 1A

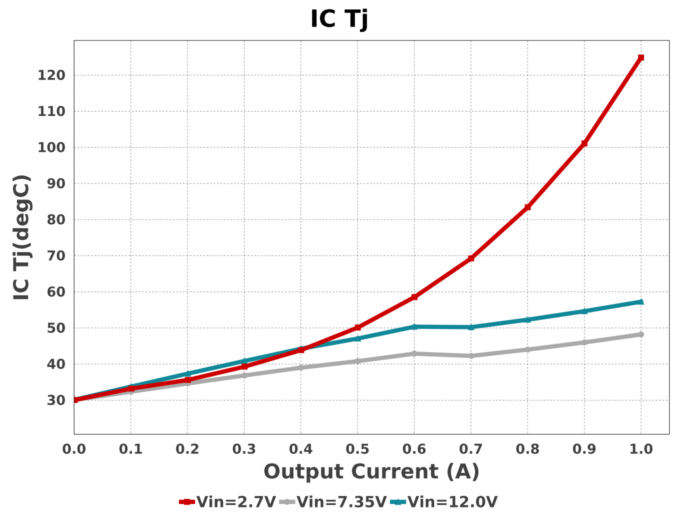


Electrical BOM

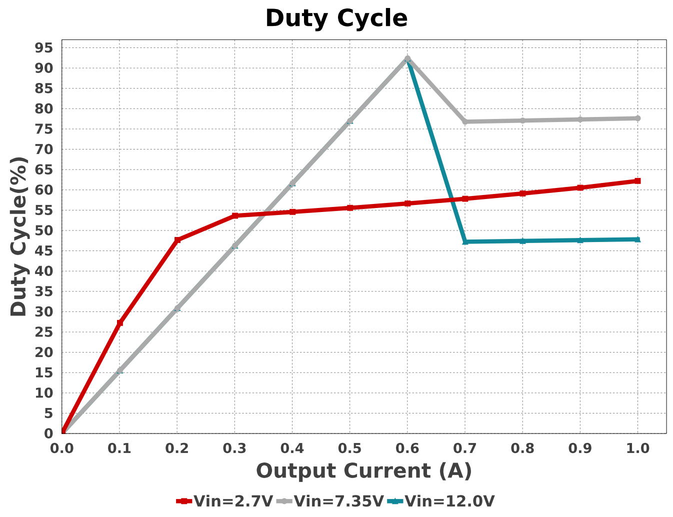
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Caux	MuRata	GRM155R71C104KA88D Series= X7R	Cap= 100.0 nF ESR= 1.0 mOhm VDC= 16.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
Cin	MuRata	GRM32ER61E226KE15L Series= X5R	Cap= 22.0 uF ESR= 2.0 mOhm VDC= 25.0 V IRMS= 3.67 A	2	$0.65	1210 15 mm²
Cout	TDK	C3216X5R1E476M160AC Series= X5R	Cap= 47.0 uF ESR= 2.082 mOhm VDC= 25.0 V IRMS= 5.0279 A	1	$0.39	1206 11 mm²
Coutx	TDK	C1608X5R1E106M080AC Series= X5R	Cap= 10.0 uF ESR= 4.639 mOhm VDC= 25.0 V IRMS= 2.4141 A	1	$0.20	0603 5 mm²
L1	Bourns	SDR0805-1R5ML	L= 1.5 µH 20.0 mOhm	1	$0.27	SDR0805 96 mm²
Renable	Yageo	RC0201FR-0710KL Series= ?	Res= 10.0 kOhm Power= 50.0 mW Tolerance= 1.0%	1	$0.01	0201 2 mm²
Rfbb	Vishay-Dale	CRCW0603100KFKEA Series= CRCW..e3	Res= 100.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	0603 5 mm²
Rfbt	Yageo	RC0603FR-07590KL Series= ?	Res= 590.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	0603 5 mm²
Rpgood	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	TPS63070RNMR	Switcher	1	$1.01	RNM0015A 14 mm²



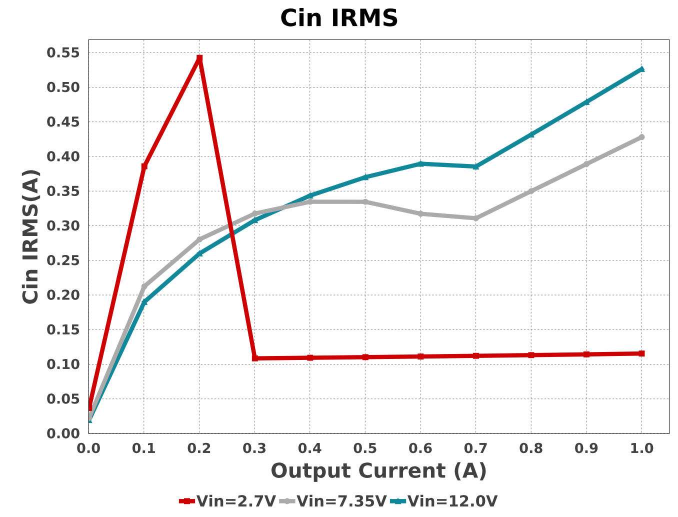
Rload_crit
Rload_crit(Ohm)
Output Current (A)
Vin=2.7V Vin=7.35V Vin=12.0V



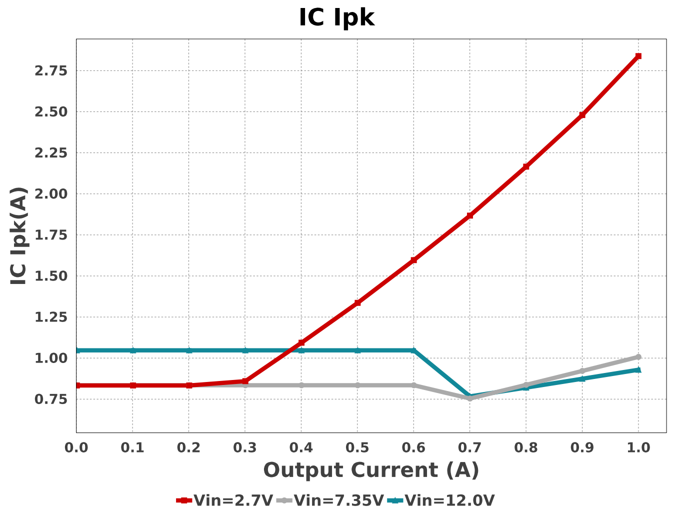
IC Tj
IC Tj(degC)
Output Current (A)
Vin=2.7V Vin=7.35V Vin=12.0V



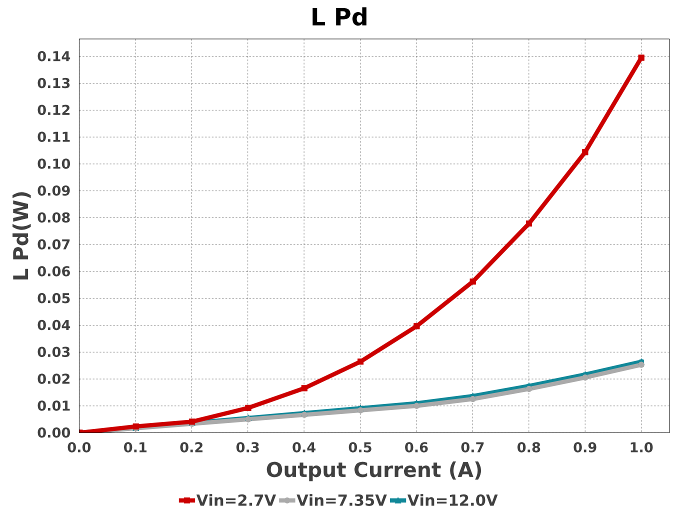
Duty Cycle
Duty Cycle(%)
Output Current (A)
Vin=2.7V Vin=7.35V Vin=12.0V



Cin IRMS
Cin IRMS(A)
Output Current (A)
Vin=2.7V Vin=7.35V Vin=12.0V

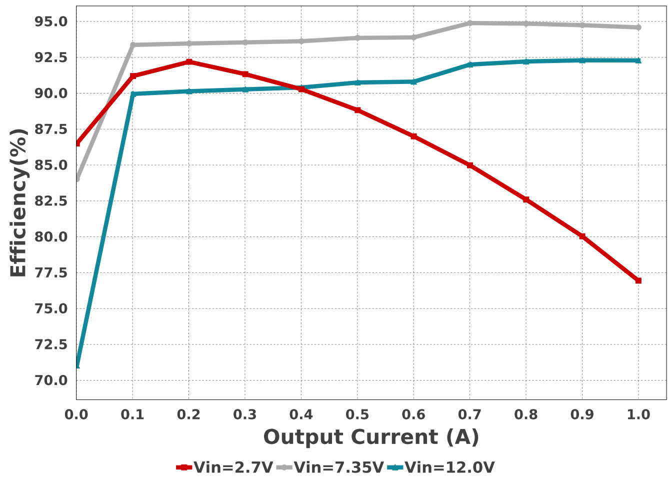


IC Ipk
IC Ipk(A)
Output Current (A)
Vin=2.7V Vin=7.35V Vin=12.0V

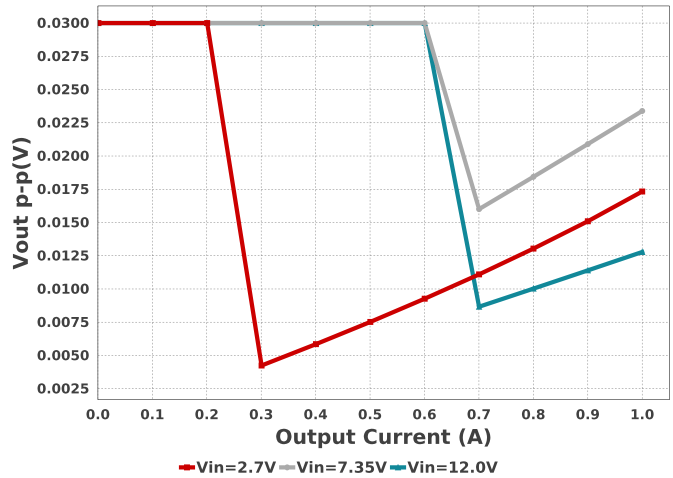


L Pd
L Pd(W)
Output Current (A)
Vin=2.7V Vin=7.35V Vin=12.0V

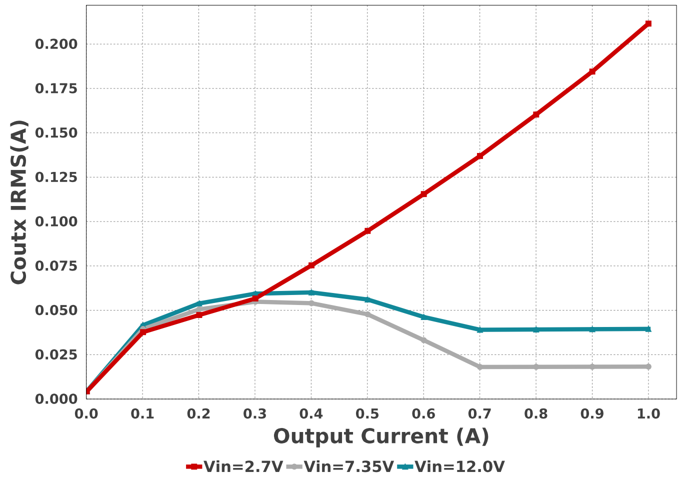
Efficiency



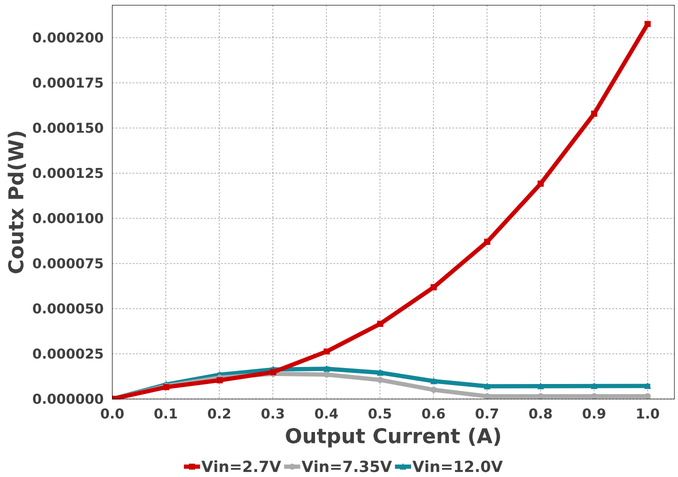
Vout p-p



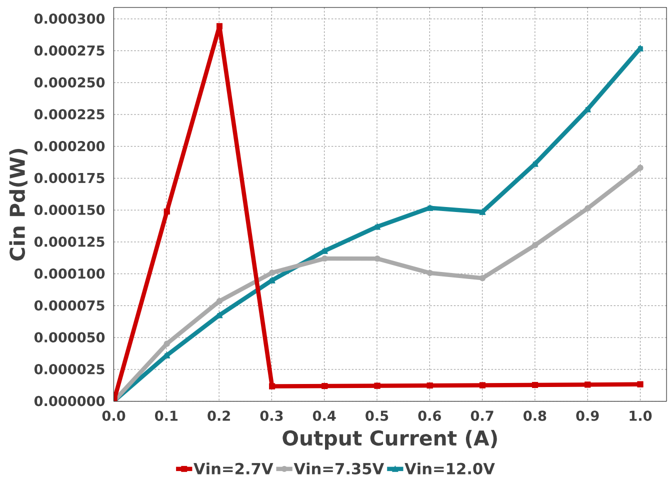
Coutx IRMS



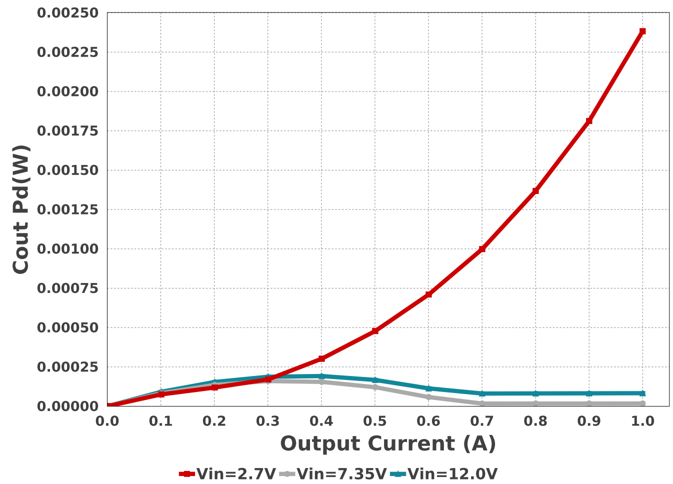
Coutx Pd

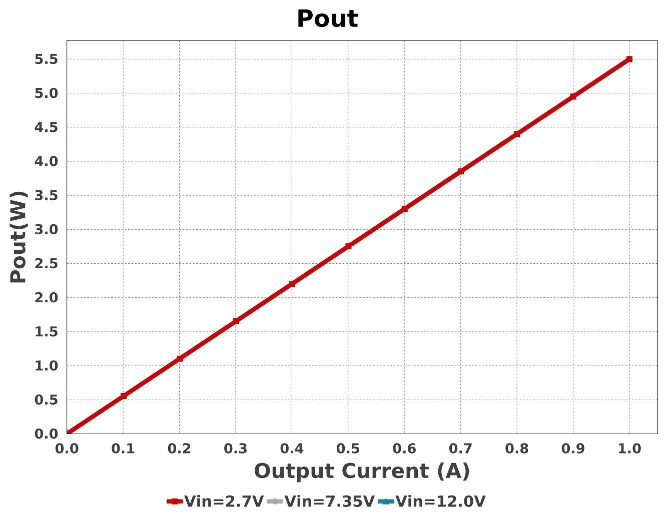


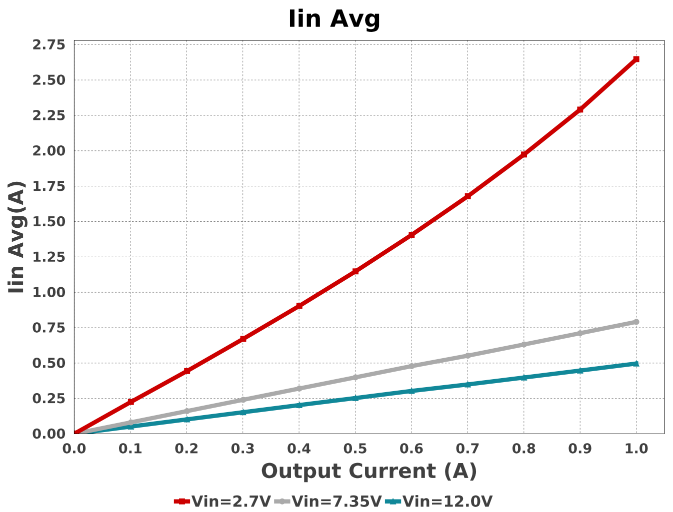
Cin Pd

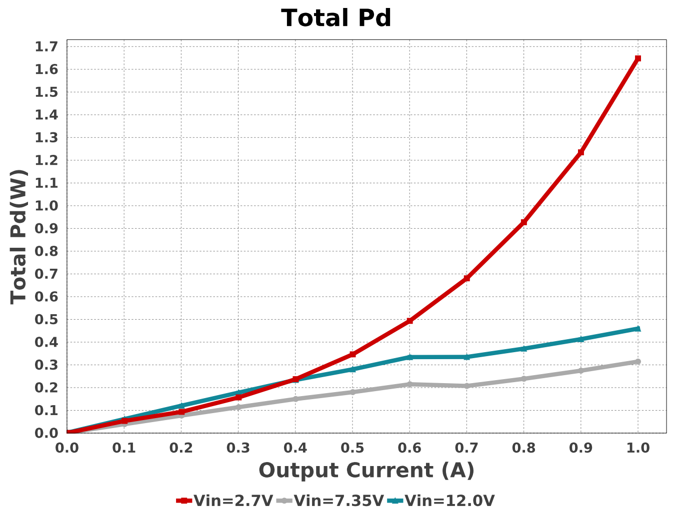


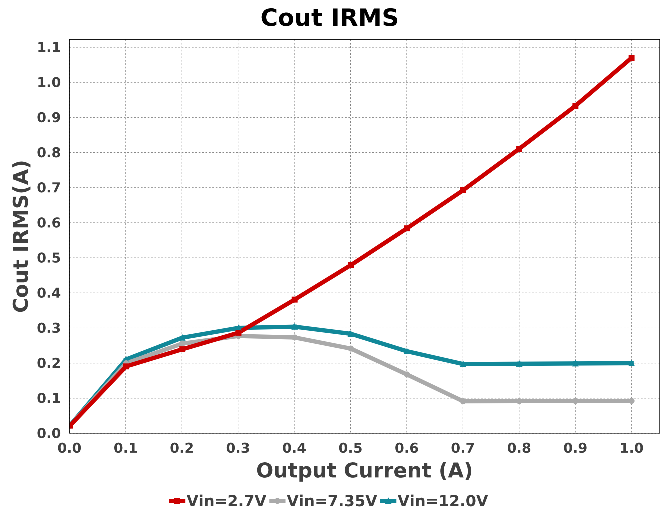
Cout Pd

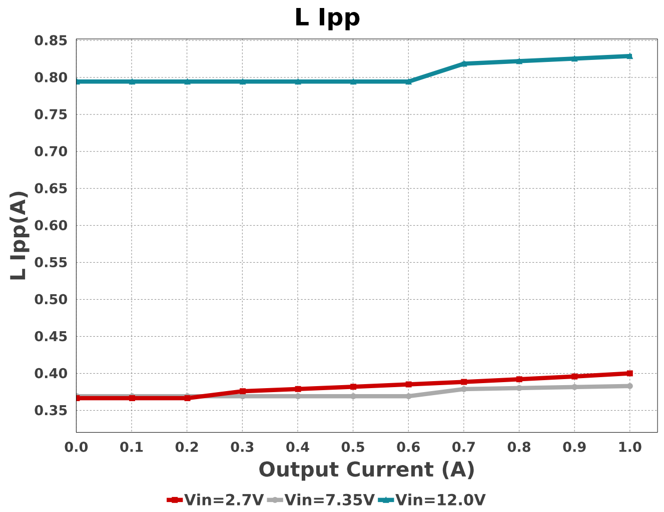


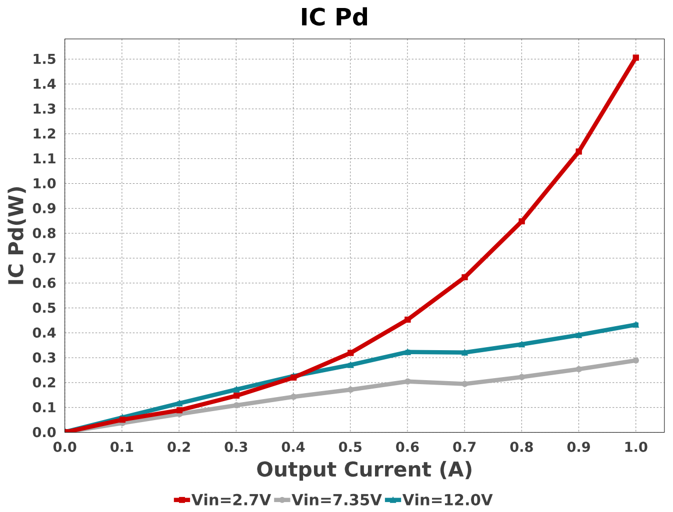

Pout
Pout(W)
Output Current (A)
Vin=2.7V Vin=7.35V Vin=12.0V

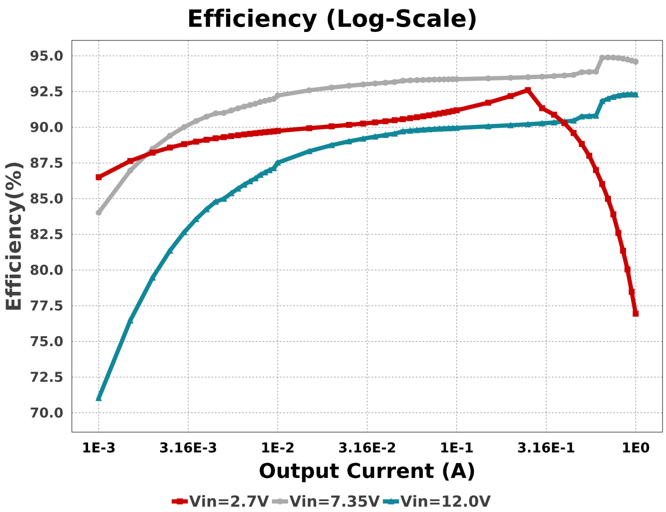

Iin Avg
Iin Avg(A)
Output Current (A)
Vin=2.7V Vin=7.35V Vin=12.0V


Total Pd
Total Pd(W)
Output Current (A)
Vin=2.7V Vin=7.35V Vin=12.0V


Cout IRMS
Cout IRMS(A)
Output Current (A)
Vin=2.7V Vin=7.35V Vin=12.0V


L Ipp
L Ipp(A)
Output Current (A)
Vin=2.7V Vin=7.35V Vin=12.0V


IC Pd
IC Pd(W)
Output Current (A)
Vin=2.7V Vin=7.35V Vin=12.0V



Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	115.482 mA	Capacitor	Input capacitor RMS ripple current
2.	Cin Pd	13.336 µW	Capacitor	Input capacitor power dissipation
3.	Cout IRMS	1.069 A	Capacitor	Output capacitor RMS ripple current
4.	Cout Pd	0.0 W	Capacitor	Output capacitor power dissipation
5.	Coutx IRMS	211.425 mA	Capacitor	Output capacitor_x RMS ripple current
6.	Coutx Pd	0.0 W	Capacitor	Output capacitor_x power loss
7.	IC Ipk	2.837 A	IC	Peak switch current in IC
8.	IC Pd	1.504 W	IC	IC power dissipation
9.	IC Tj	124.751 degC	IC	IC junction temperature
10.	ICThetaJA	63.0 degC/W	IC	IC junction-to-ambient thermal resistance
11.	Iin Avg	2.646 A	IC	Average input current
12.	L Ipp	400.04 mA	Inductor	Peak-to-peak inductor ripple current
13.	L Pd	139.34 mW	Inductor	Inductor power dissipation
14.	Cin Pd	13.336 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	1.504 W	Power	IC power dissipation
18.	L Pd	139.34 mW	Power	Inductor power dissipation
19.	Total Pd	1.643 W	Power	Total Power Dissipation
20.	BOM Count	11	System Information	Total Design BOM count
21.	Duty Cycle	62.196 %	System Information	Duty cycle
22.	Efficiency	76.994 %	System Information	Steady state efficiency
23.	FootPrint	174.0 mm^2	System Information	Total Foot Print Area of BOM components
24.	Frequency	2.5 MHz	System Information	Switching frequency
25.	Iout	1.0 A	System Information	Iout operating point
26.	Mode	BOOST PWM CCM	System Information	PWM/PFM Mode
27.	Pout	5.5 W	System Information	Total output power
28.	Rload_crit	40.9 Ohm	System Information	Minimum Rload required during Start up
29.	Total BOM	$3.22	System Information	Total BOM Cost
30.	Vin	2.7 V	System Information	Vin operating point
31.	Vout Actual	5.52 V	System Information	Vout Actual calculated based on selected voltage divider resistors
32.	Vout Tolerance	1.727 %	System Information	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
33.	Vout p-p	13.815 mV	System Information	Peak-to-peak output ripple voltage

Design Inputs

Name	Value	Description
Iout	1.0	Maximum Output Current

Name	Value	Description
VinMax	12.0	Maximum input voltage
VinMin	2.7	Minimum input voltage
Vout	5.5	Output Voltage
base_pn	TPS63070	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

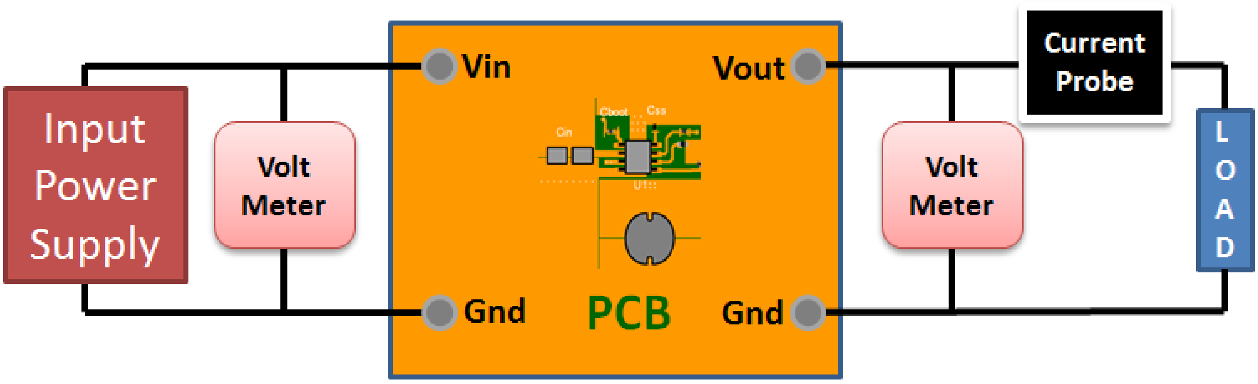
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. 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 2.7V 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 : 41E8874367B5AA92[v1]

2. **TPS63070** Product Folder : http://www.ti.com/product/TPS63070 : contains the data sheet and other resources.

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