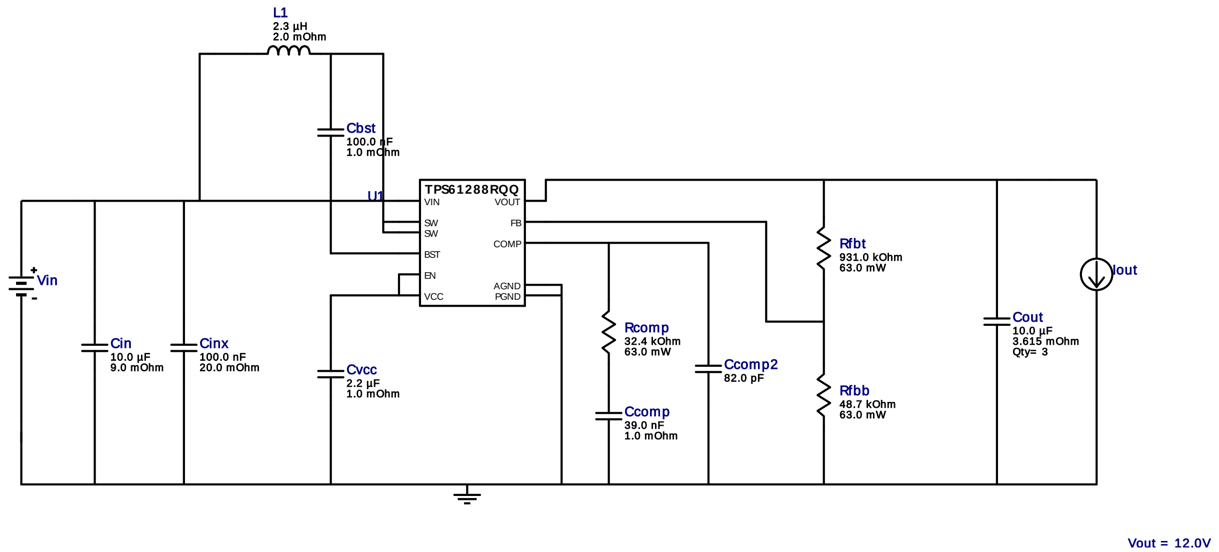
VinMin = 2.0V
VinMax = 3.7V
Vout = 12.0V
Iout = 1.0A

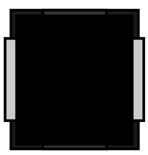
Device = TPS61288RQQR
Topology = Boost
Created = 2021-04-20 07:57:22.591
BOM Cost = $3.82
BOM Count = 14
Total Pd = 0.9W

WEBENCH® Design Report

Design : 12 TPS61288RQQR
TPS61288RQQR 2V-3.7V to 12.00V @ 1A

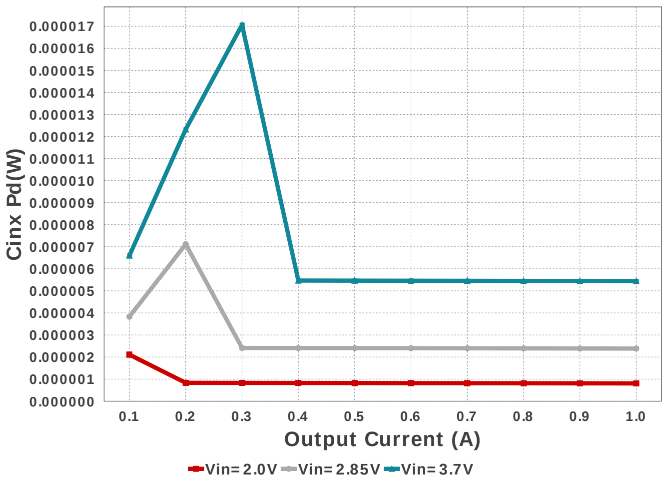


Electrical BOM

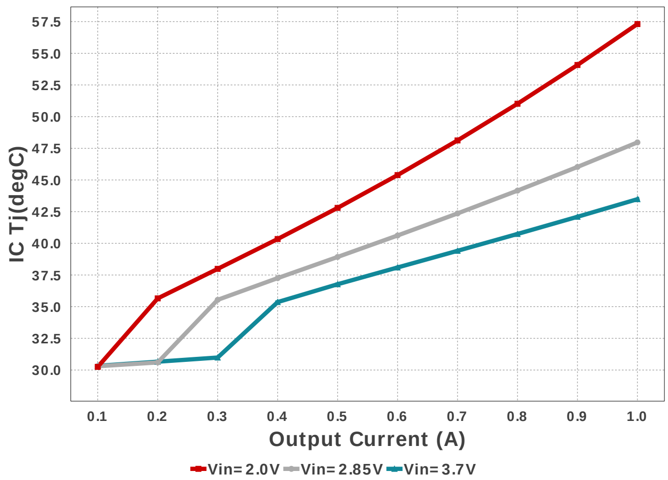
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cbst	MuRata	GRM155R71A104KA01D Series= X7R	Cap= 100.0 nF ESR= 1.0 mOhm VDC= 10.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm^2
Ccomp	MuRata	GRM033R60J393KE19D Series= X5R	Cap= 39.0 nF ESR= 1.0 mOhm VDC= 6.3 V IRMS= 0.0 A	1	$0.01	0201 2 mm^2
Ccomp2	Samsung Electro-Mechanics	CL21C820JBANNNC Series= C0G/NP0	Cap= 82.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
Cin	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 mm^2
Cinx	MuRata	GRM188R71H104KA93D Series= X7R	Cap= 100.0 nF ESR= 20.0 mOhm VDC= 50.0 V IRMS= 3.8 A	1	$0.02	0603 5 mm^2
Cout	MuRata	GRM31CR61C106KA88L Series= X5R	Cap= 10.0 uF ESR= 3.615 mOhm VDC= 16.0 V IRMS= 3.8281 A	3	$0.08	1206_190 11 mm^2
Cvcc	Kemet	C0603C225K8PACTU Series= X5R	Cap= 2.2 uF ESR= 1.0 mOhm VDC= 10.0 V IRMS= 0.0 A	1	$0.04	0603 5 mm^2
L1	Coiltronics	HC1-2R3-R	L= 2.3 µH 2.0 mOhm	1	$1.97	 HC1 225 mm^2

Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Rcomp	Vishay-Dale	CRCW040232K4FKED Series= CRCW..e3	Res= 32.4 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
Rfbb	Vishay-Dale	CRCW040248K7FKED Series= CRCW..e3	Res= 48.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
Rfbt	Vishay-Dale	CRCW0402931KFKED Series= CRCW..e3	Res= 931.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
U1	Texas Instruments	TPS61288RQQR	Switcher	1	$1.41	RQQ0011A-MFG 9 mm^2

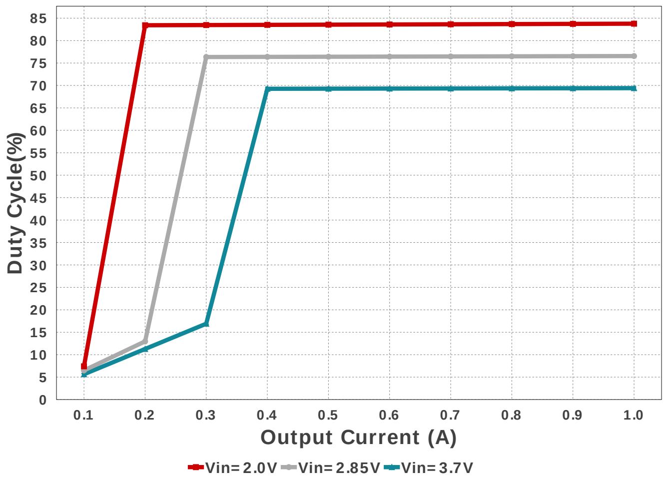
Cinx Pd



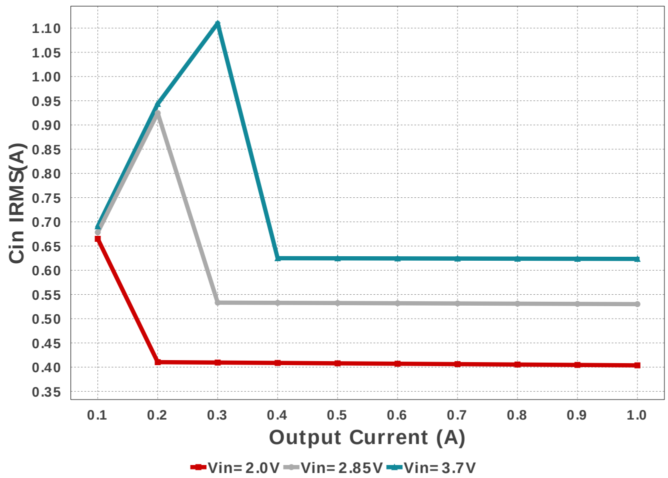
IC Tj

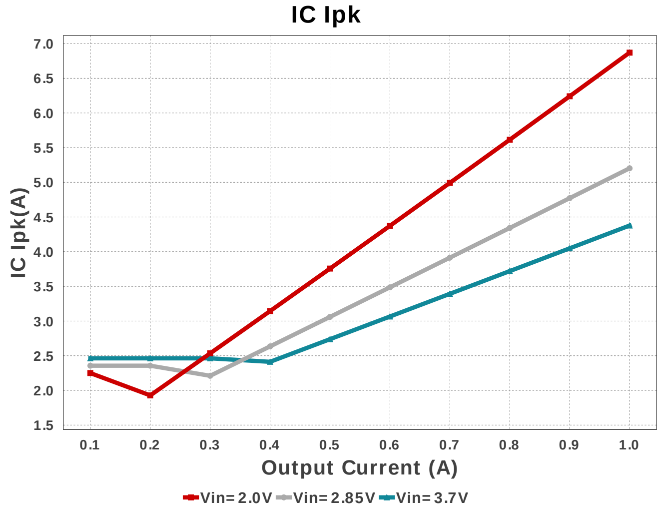


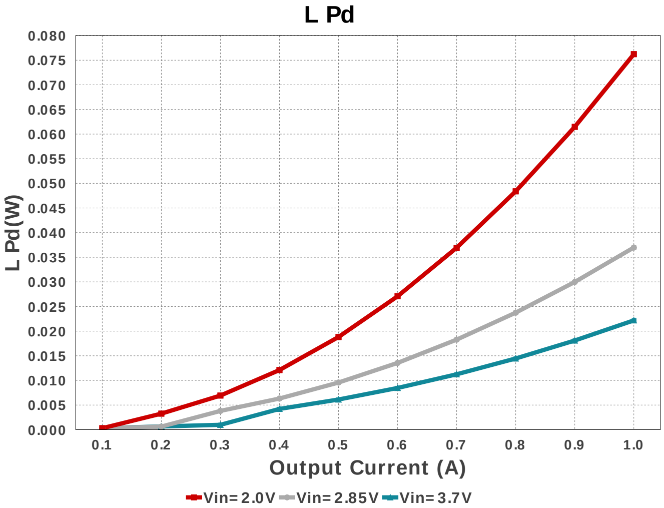
Duty Cycle

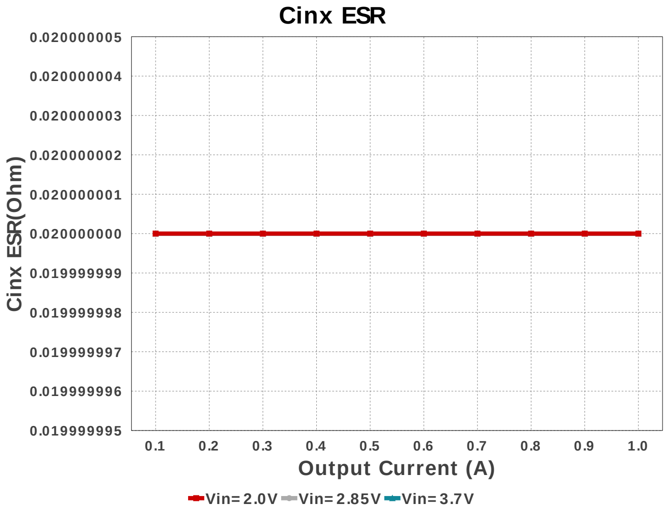


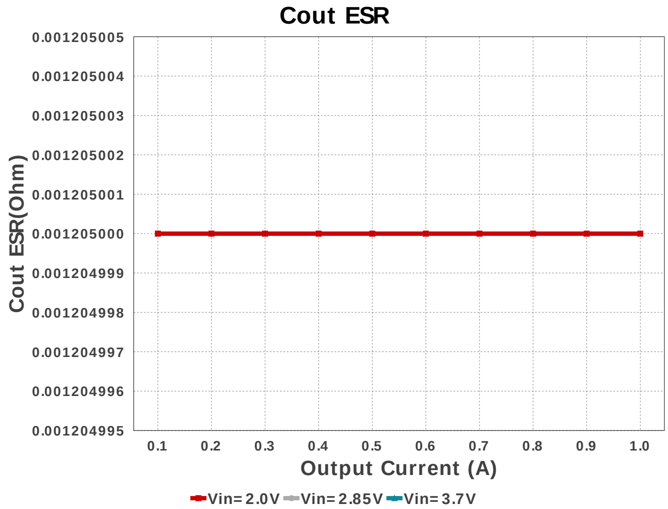
Cin IRMS

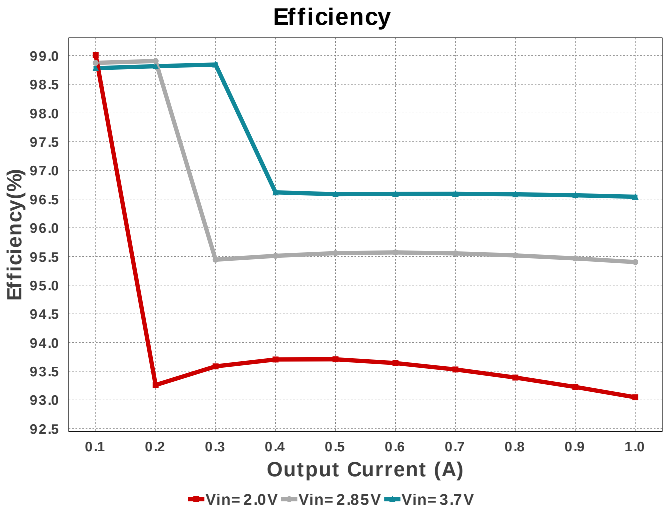


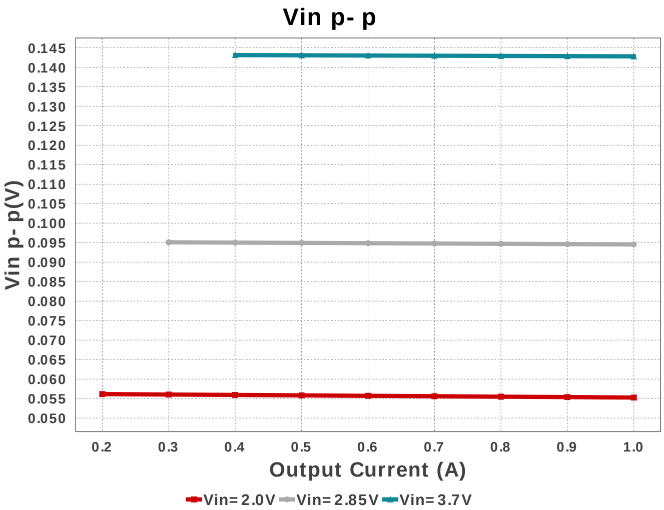

IC Ipk
IC Ipk(A)
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Output Current (A)
Vin=2.0V Vin=2.85V Vin=3.7V

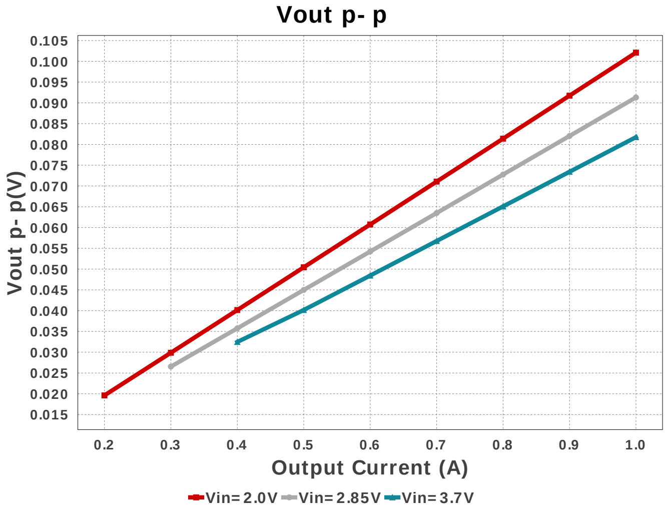

L Pd
L Pd(W)
0.080
0.075
0.070
0.065
0.060
0.055
0.050
0.045
0.040
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Output Current (A)
Vin=2.0V Vin=2.85V Vin=3.7V

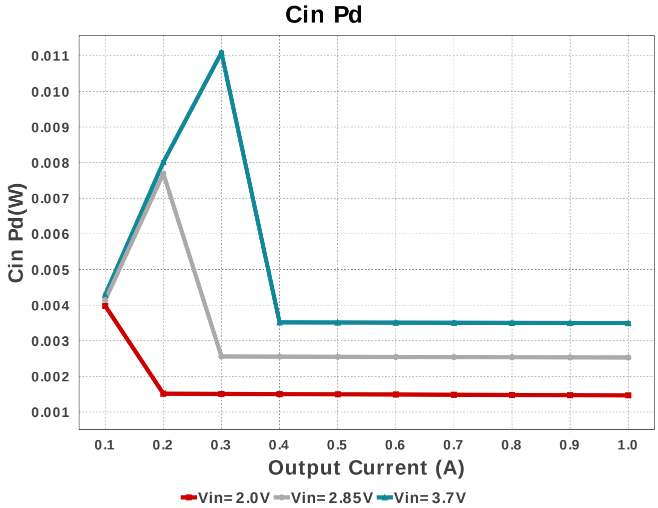

Cinx ESR
Cinx ESR(Ohm)
0.020000005
0.020000004
0.020000003
0.020000002
0.020000001
0.020000000
0.019999999
0.019999998
0.019999997
0.019999996
0.019999995
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Output Current (A)
Vin=2.0V Vin=2.85V Vin=3.7V

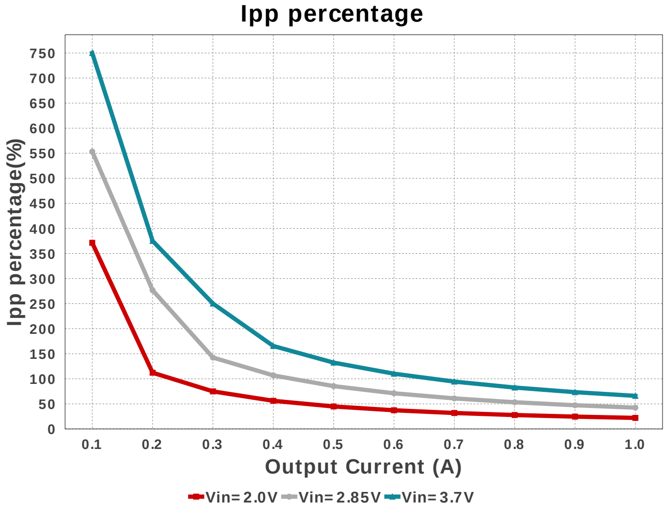

Cout ESR
Cout ESR(Ohm)
0.001205005
0.001205004
0.001205003
0.001205002
0.001205001
0.001205000
0.001204999
0.001204998
0.001204997
0.001204996
0.001204995
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Output Current (A)
Vin=2.0V Vin=2.85V Vin=3.7V

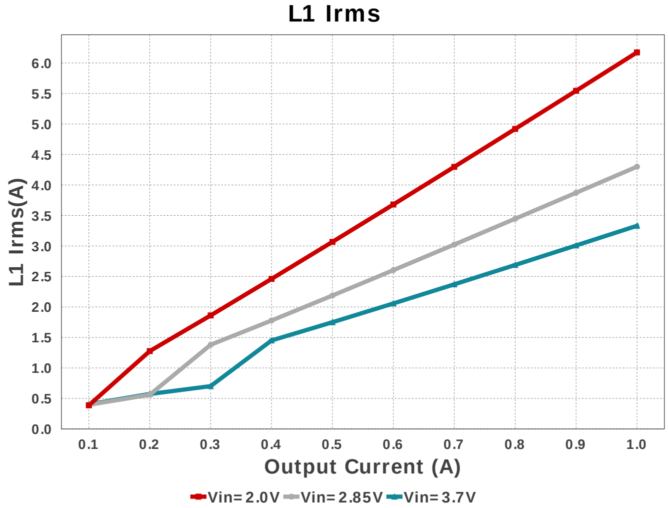

Efficiency
Efficiency(%)
99.0
98.5
98.0
97.5
97.0
96.5
96.0
95.5
95.0
94.5
94.0
93.5
93.0
92.5
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Output Current (A)
Vin=2.0V Vin=2.85V Vin=3.7V

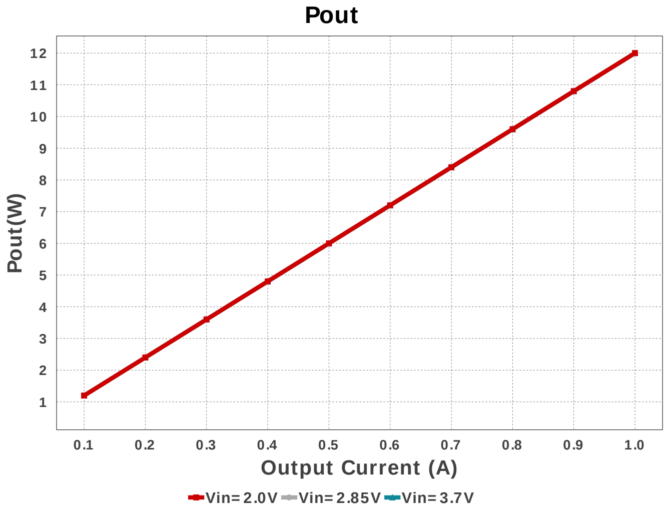

Vin p-p
Vin p-p(V)
0.145
0.140
0.135
0.130
0.125
0.120
0.115
0.110
0.105
0.100
0.095
0.090
0.085
0.080
0.075
0.070
0.065
0.060
0.055
0.050
0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Output Current (A)
Vin=2.0V Vin=2.85V Vin=3.7V

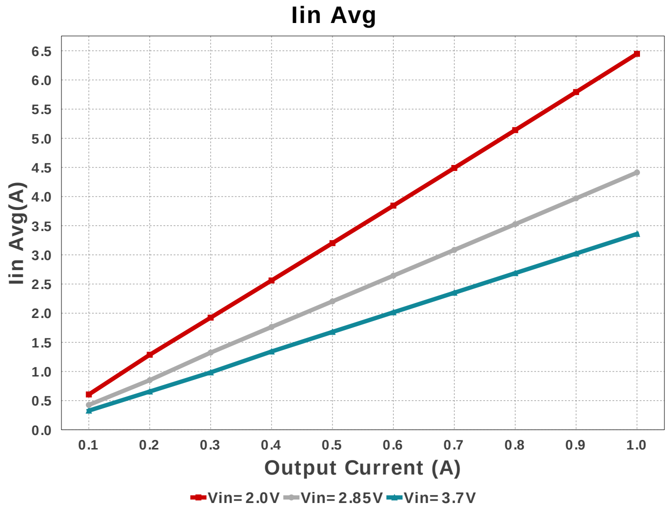

Vout p- p
Vout p- p(V)
Output Current (A)
Vin=2.0V Vin=2.85V Vin=3.7V

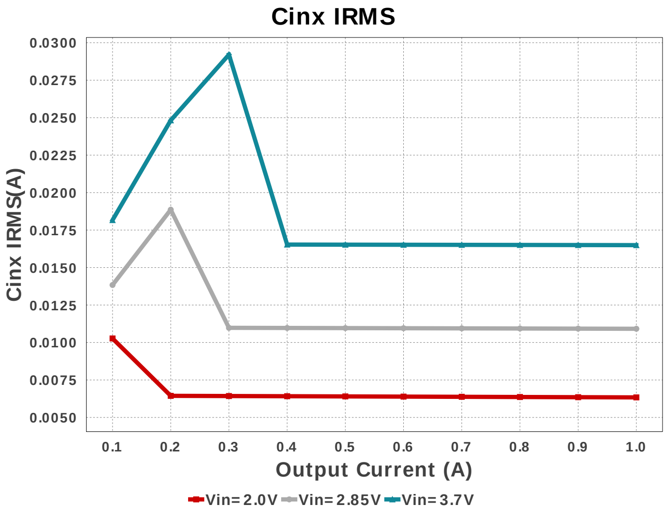

Cin Pd
Cin Pd(W)
Output Current (A)
Vin=2.0V Vin=2.85V Vin=3.7V

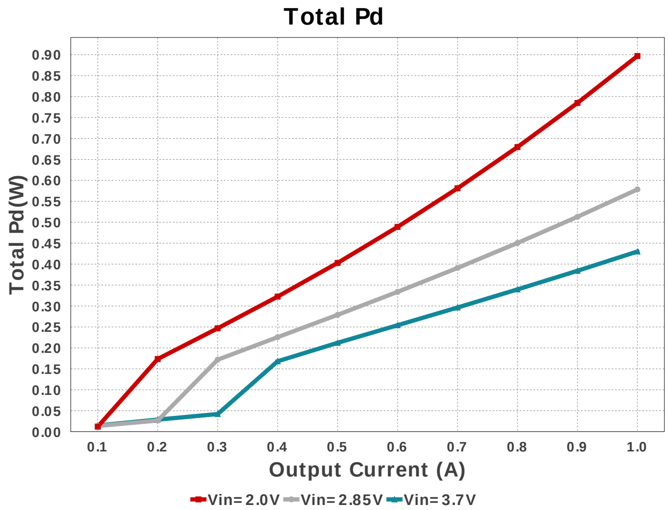

Ipp percentage
Ipp percentage(%)
Output Current (A)
Vin=2.0V Vin=2.85V Vin=3.7V

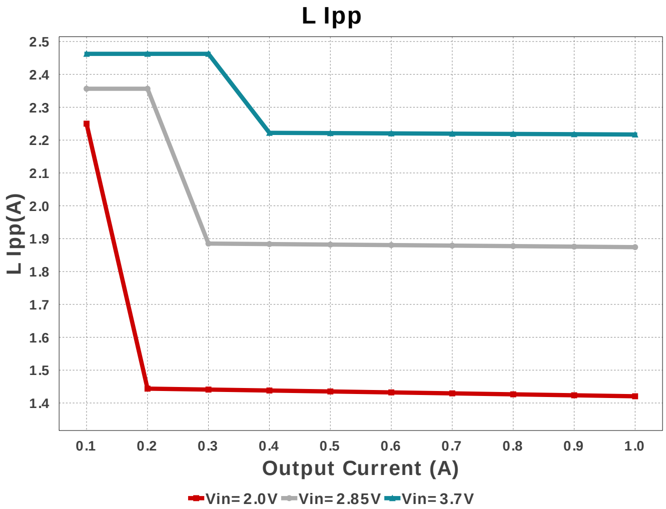

L1 Irms
L1 Irms(A)
Output Current (A)
Vin=2.0V Vin=2.85V Vin=3.7V

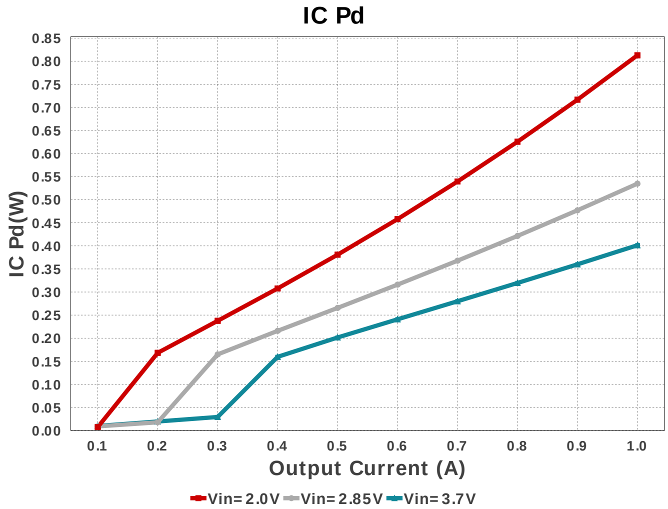

Pout
Pout(W)
Output Current (A)
Vin=2.0V Vin=2.85V Vin=3.7V

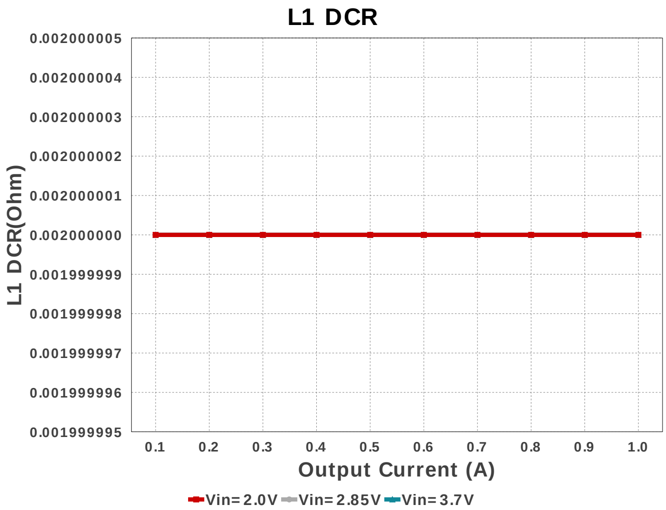

Iin Avg
Iin Avg(A)
Output Current (A)
Vin=2.0V Vin=2.85V Vin=3.7V

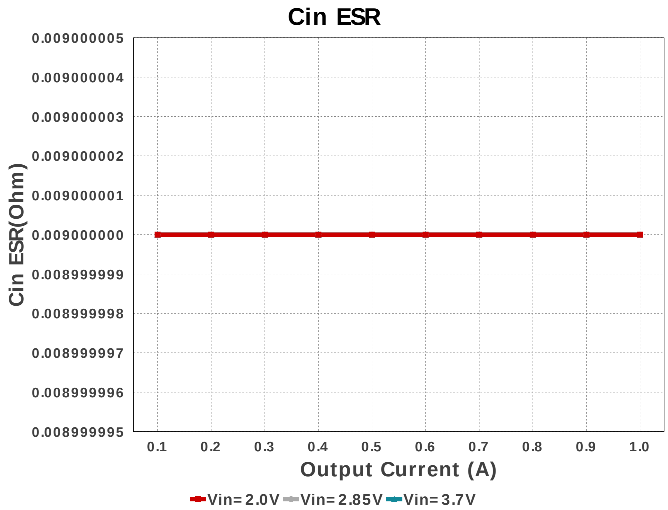

Cinx IRMS
Cinx IRMS(A)
0.0300
0.0275
0.0250
0.0225
0.0200
0.0175
0.0150
0.0125
0.0100
0.0075
0.0050
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Output Current (A)
Vin=2.0V Vin=2.85V Vin=3.7V

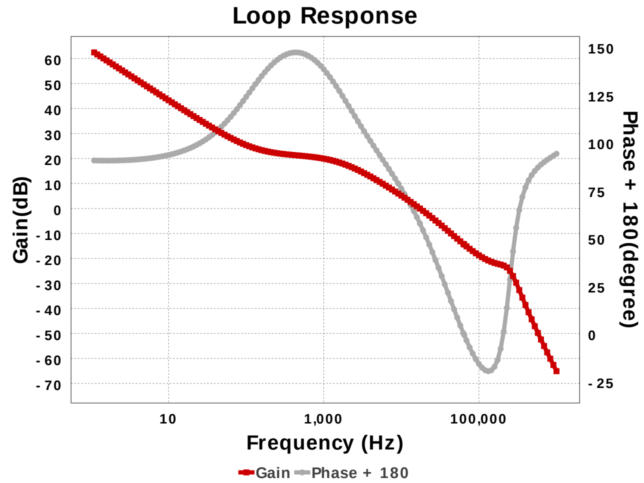

Total Pd
Total Pd(W)
0.90
0.85
0.80
0.75
0.70
0.65
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Output Current (A)
Vin=2.0V Vin=2.85V Vin=3.7V

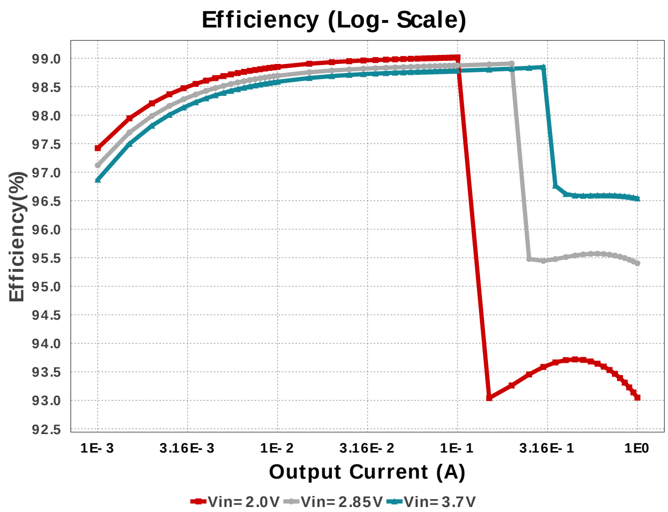

L Ipp
L Ipp(A)
2.5
2.4
2.3
2.2
2.1
2.0
1.9
1.8
1.7
1.6
1.5
1.4
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Output Current (A)
Vin=2.0V Vin=2.85V Vin=3.7V


IC Pd
IC Pd(W)
0.85
0.80
0.75
0.70
0.65
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Output Current (A)
Vin=2.0V Vin=2.85V Vin=3.7V


L1 DCR
L1 DCR(Ohm)
0.002000005
0.002000004
0.002000003
0.002000002
0.002000001
0.002000000
0.001999999
0.001999998
0.001999997
0.001999996
0.001999995
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Output Current (A)
Vin=2.0V Vin=2.85V Vin=3.7V


Cin ESR
Cin ESR(Ohm)
0.009000005
0.009000004
0.009000003
0.009000002
0.009000001
0.009000000
0.008999999
0.008999998
0.008999997
0.008999996
0.008999995
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Output Current (A)
Vin=2.0V Vin=2.85V Vin=3.7V





Comprobar para 2A/3A

Operating Values

#	Name	Value	Category	Description
1.	Cin ESR	9.0 mOhm	Capacitor	Cin Capacitor ESR
2.	Cin IRMS	403.708 mA	Capacitor	Input capacitor RMS ripple current
3.	Cin Pd	1.467 mW	Capacitor	Input capacitor power dissipation
4.	Cinx ESR	20.0 mOhm	Capacitor	Cin Capacitor ESR
5.	Cinx IRMS	6.338 mA	Capacitor	Bulk capacitor RMS ripple current
6.	Cinx Pd	803.38 nW	Capacitor	Bulk capacitor power dissipation
7.	Cout ESR	1.205 mOhm	Capacitor	Cout Capacitor ESR
8.	IC Ipk	6.87 A	IC	Peak switch current in IC
9.	IC Pd	812.74 mW	IC	IC power dissipation
10.	IC Tj	57.308 degC	IC	IC junction temperature
11.	IC Tolerance	12.0 mV	IC	IC Feedback Tolerance
12.	ICThetaJA Effective	33.6 degC/W	IC	Effective IC Junction-to-Ambient Thermal Resistance
13.	Iin Avg	6.448 A	IC	Average input current
14.	Ipp percentage	22.028 %	Inductor	Inductor ripple current percentage (with respect to average inductor current)
15.	L Ipp	1.42 A	Inductor	Peak-to-peak inductor ripple current
16.	L Pd	76.222 mW	Inductor	Inductor power dissipation
17.	L1 DCR	2.0 mOhm	Inductor	L1 DCR
18.	L1 Irms	6.173 A	Inductor	Inductor ripple current
19.	Cin Pd	1.467 mW	Power	Input capacitor power dissipation
20.	Cinx Pd	803.38 nW	Power	Bulk capacitor power dissipation
21.	IC Pd	812.74 mW	Power	IC power dissipation
22.	L Pd	76.222 mW	Power	Inductor power dissipation
23.	Total Pd	896.843 mW	Power	Total Power Dissipation
24.	BOM Count	14	System Information	Total Design BOM count
25.	Cross Freq	10.828 kHz	System Information	Bode plot crossover frequency
26.	Duty Cycle	83.766 %	System Information	Duty cycle
27.	Efficiency	93.046 %	System Information	Steady state efficiency
28.	FootPrint	302.0 mm^2	System Information	Total Foot Print Area of BOM components
29.	Frequency	500.0 kHz	System Information	Switching frequency
30.	Gain Marg	-7.888 dB	System Information	Bode Plot Gain Margin
31.	Iout	1.0 A	System Information	Iout operating point
32.	Iout transient step used for Cout calculations	500.0 mA	System Information	Custom Transient current step requirement that was used for Cout selection (A).
33.	Low Freq Gain	57.567 dB	System Information	Gain at 1Hz
34.	Mode	CCM	System Information	Conduction Mode
35.	Overshoot Value	12.875 mV	System Information	Theoretical Vout Overshoot Value
36.	Phase Marg	56.661 deg	System Information	Bode Plot Phase Margin
37.	Pout	12.0 W	System Information	Total output power

#	Name	Value	Category	Description
38.	Total BOM	$3.82	System Information	Total BOM Cost
39.	Undershoot Value	9.503 mV	System Information	Theoretical Vout Undershoot Value
40.	Vin	2.0 V	System Information	Vin operating point
41.	Vin p-p	55.264 mV	System Information	Peak-to-peak input voltage
42.	Vout	12.07 V	System Information	Operational Output Voltage
43.	Vout Actual	12.07 V	System Information	Vout Actual calculated based on selected voltage divider resistors
44.	Vout Ripple requirement used for Cout calculations	1.0 %	System Information	Custom maximum output ripple requirement that was used for Cout selection(% of Vout).
45.	Vout Tolerance	3.958 %	System Information	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
46.	Vout p-p	102.092 mV	System Information	Peak-to-peak output ripple voltage
47.	Vout transient requirement used for Cout calculations	3.0 %	System Information	Custom Transient voltage change requirement that was used for Cout selection (% of Vout).

Design Inputs

Name	Value	Description
Iout	1.0	Maximum Output Current
VinMax	3.7	Maximum input voltage
VinMin	2.0	Minimum input voltage
Vout	12.0	Output Voltage
base_pn	TPS61288	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

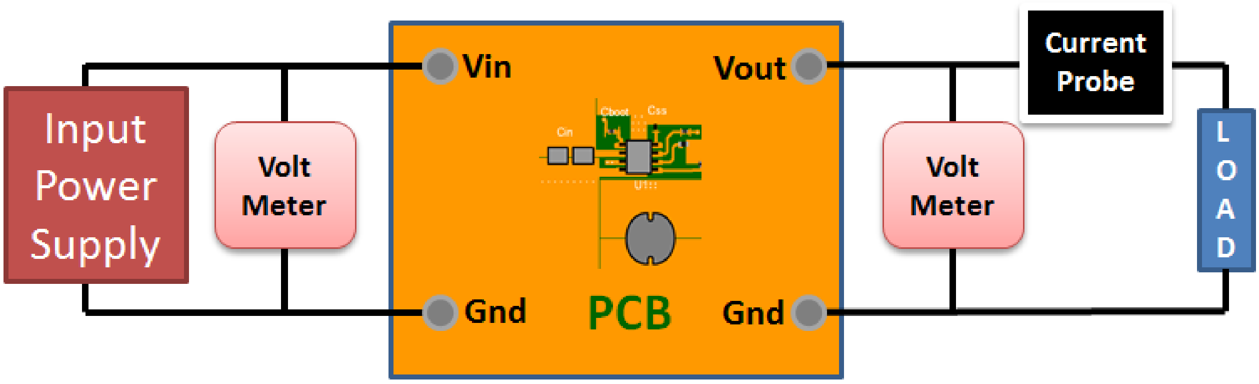
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. 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 2.0V 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. **TPS61288** Product Folder : https://www.ti.com/product/TPS61288 : contains the data sheet and other resources.

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