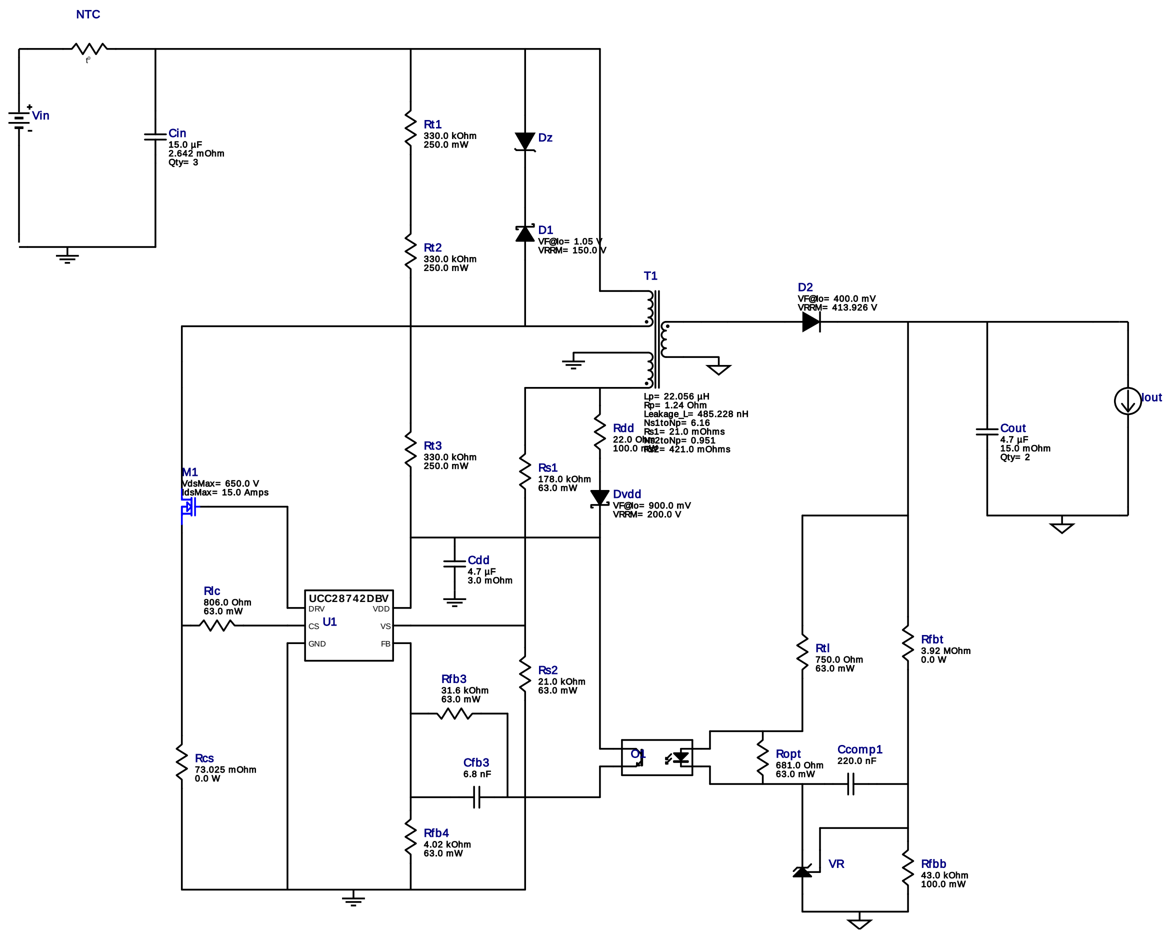
VinMin = 40.0V
VinMax = 56.0V
Vout = 230.0V
Iout = 0.35A

Device = UCC28742DBVR
Topology = Flyback
Created = 2020-06-01 14:47:52.048
BOM Cost = NA
BOM Count = 32
Total Pd =

WEBENCH ® Design Report

Design : 16 UCC28742DBVR
UCC28742DBVR 40V-56V to 230.00V @ 0.348A



1. Rlc, Rtl and the feedback resistors for this design are a starting point, but may need adjustment based on the actual transformer used. For more information please click the design assistance button.

Design Alerts

UCC28742 Design

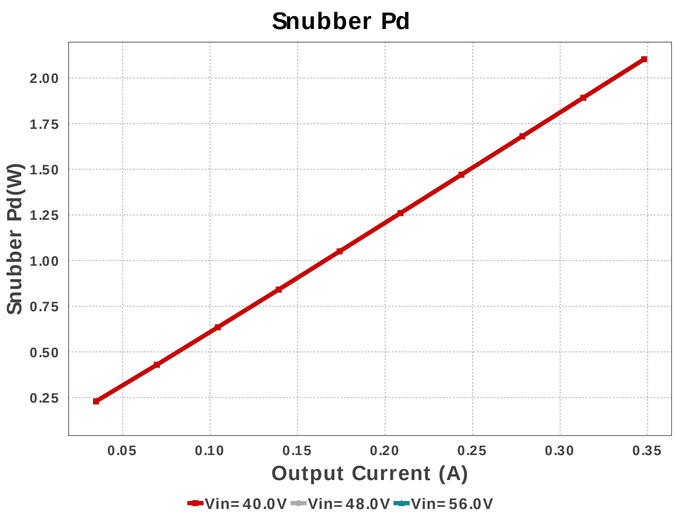
With the current design condition, suitable FET could not be found in the current database. Hence, this design is created using an ideal FET. Please note that the resulting FET parameters are ideal, so the efficiency/loss values have been disabled. Also, the schematic/PCB export and Thermal simulations will not work with the ideal FET.

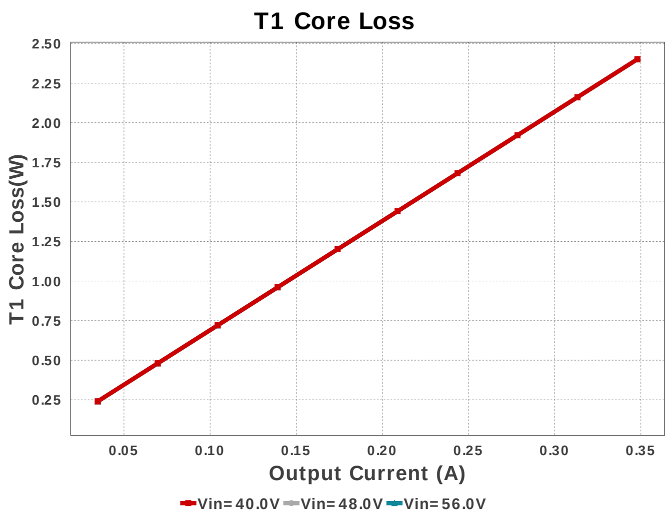
Electrical BOM

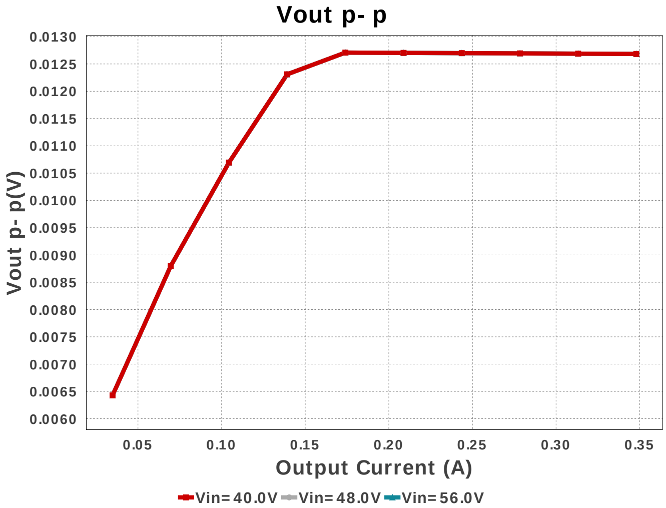
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Ccomp1	CUSTOM	CUSTOM Series= ?	Cap= 220.0 nF VDC= 0.0 V IRMS= 0.0 A	1	NA	CUSTOM 0 mm^2
Cdd	MuRata	GRM31CR71H475KA12L Series= X7R	Cap= 4.7 uF ESR= 3.0 mOhm VDC= 50.0 V IRMS= 4.98 A	1	$0.22	1206 11 mm^2
Cfb3	CUSTOM	CUSTOM Series= ?	Cap= 6.8 nF VDC= 0.0 V IRMS= 0.0 A	1	NA	CUSTOM 0 mm^2

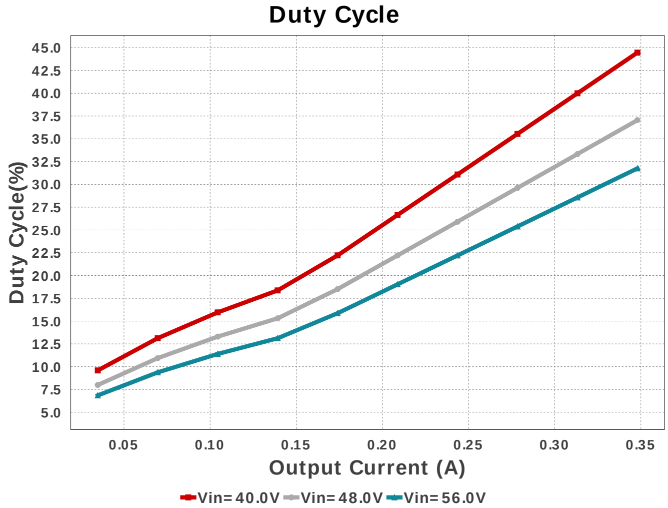
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cin	TDK	C5750X7S2A156M250KB Series= X7S	Cap= 15.0 uF ESR= 2.642 mOhm VDC= 100.0 V IRMS= 5.6162 A	3	$1.23	2220_280 54 mm^2
Cout	TDK	B32924D3475K Series= B32924	Cap= 4.7 uF ESR= 15.0 mOhm VDC= 630.0 V IRMS= 457.0 mA	2	$1.26	B32924_31mm 770 mm^2
D1	SMC Diode Solutions	SB20150TR	VF@Io= 1.05 V VRRM= 150.0 V	1	$0.20	DO-201AD 166 mm^2
D2	CUSTOM	CUSTOM	VF@Io= 400.0 mV VRRM= 413.926 V	1	NA	CUSTOM 0 mm^2
Dvdd	SMC Diode Solutions	SK220ATR	VF@Io= 900.0 mV VRRM= 200.0 V	1	$0.04	SMA 37 mm^2
Dz	Diodes Inc.	SMBJ58A-13-F	Zener	1	$0.09	SMB 44 mm^2
M1	NA	IdealFET	VdsMax= 650.0 V IdsMax= 15.0 Amps	1	NA	NA 0 mm^2
NTC	GE Sensing	CL-40 Series= CL	Thermistor	1	$0.72	Thermistor_CL-40 164 mm^2
O1	California Eastern Laboratories	PS2811-1	Optocoupler	1	$0.41	SSOP-4 111 mm^2
Rcs	CUSTOM	CUSTOM Series= ?	Res= 73.025 mOhm Power= 0.0 W Tolerance= 0.0%	1	NA	CUSTOM 0 mm^2
Rdd	Yageo	RC0603FR-0722RL Series= ?	Res= 22.0 Ohm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	0603 5 mm^2
Rfb3	Vishay-Dale	CRCW040231K6FKED Series= CRCW..e3	Res= 31.6 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
Rfb4	Vishay-Dale	CRCW04024K02FKED Series= CRCW..e3	Res= 4.02 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
Rfbb	Yageo	RC0603FR-0743KL Series= ?	Res= 43.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	0603 5 mm^2
Rfbt	CUSTOM	CUSTOM Series= ?	Res= 3.92 MOhm Power= 0.0 W Tolerance= 0.0%	1	NA	CUSTOM 0 mm^2
Rlc	Vishay-Dale	CRCW0402806RFKED Series= CRCW..e3	Res= 806.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
Ropt	Vishay-Dale	CRCW0402681RFKED Series= CRCW..e3	Res= 681.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2

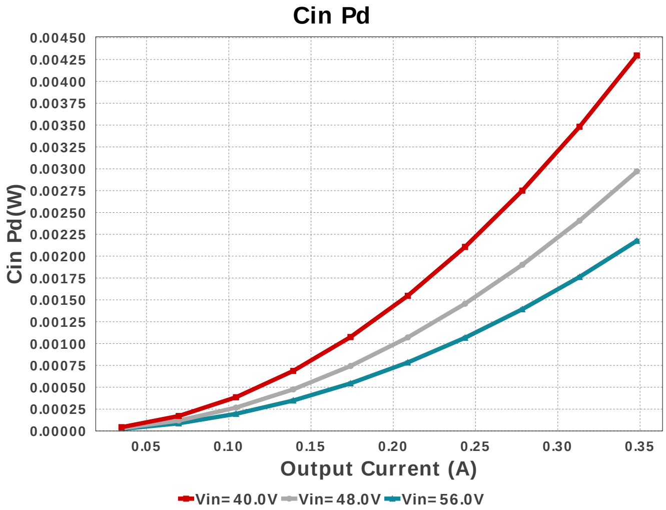
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Rs1	Vishay-Dale	CRCW0402178KFKED Series= CRCW..e3	Res= 178.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
Rs2	Vishay-Dale	CRCW040221K0FKED Series= CRCW..e3	Res= 21.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
Rt1	Yageo	RC1206FR-07330KL Series= ?	Res= 330.0 kOhm Power= 250.0 mW Tolerance= 1.0%	1	$0.01	1206 11 mm^2
Rt2	Yageo	RC1206FR-07330KL Series= ?	Res= 330.0 kOhm Power= 250.0 mW Tolerance= 1.0%	1	$0.01	1206 11 mm^2
Rt3	Yageo	RC1206FR-07330KL Series= ?	Res= 330.0 kOhm Power= 250.0 mW Tolerance= 1.0%	1	$0.01	1206 11 mm^2
Rtl	Vishay-Dale	CRCW0402750RFKED Series= CRCW..e3	Res= 750.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
T1	CUSTOM	CUSTOM	Lp= 22.056 µH Rp= 1.24 Ohm Leakage_L= 485.228 nH Ns1toNp= 6.16 Rs1= 21.0 mOhms Ns2toNp= 0.951 Rs2= 421.0 mOhms	1	NA	CUSTOM 0 mm^2
U1	Texas Instruments	UCC28742DBVR	Switcher	1	$0.22	R-PDSO-G6 10 mm^2
VR	Texas Instruments	TL431IDBVR	Voltage References	1	$0.06	R-PDSO-G3 16 mm^2

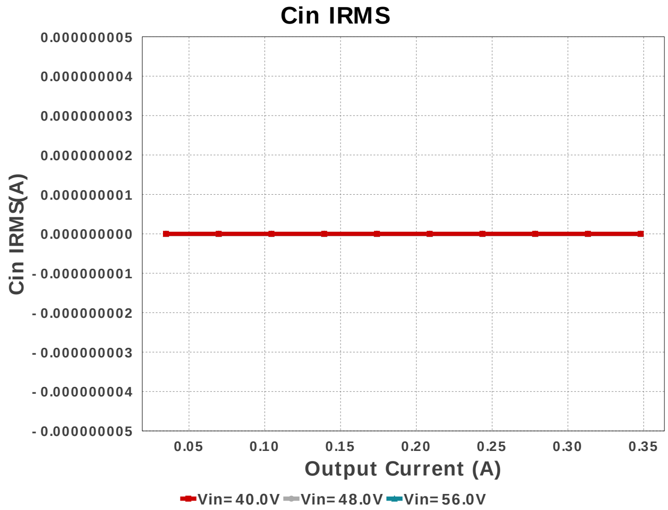


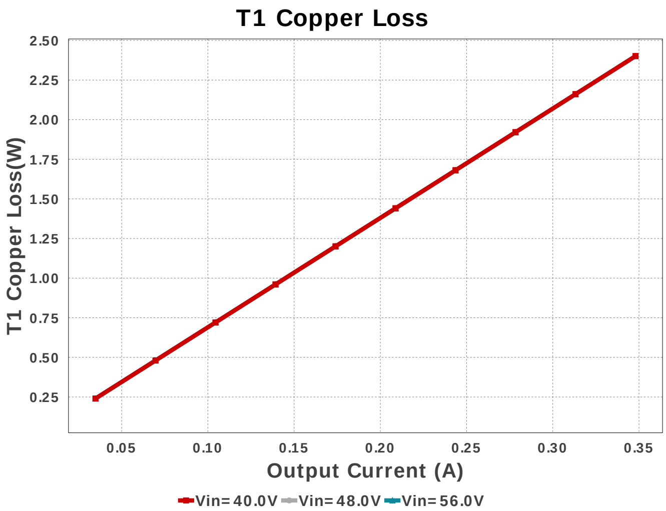


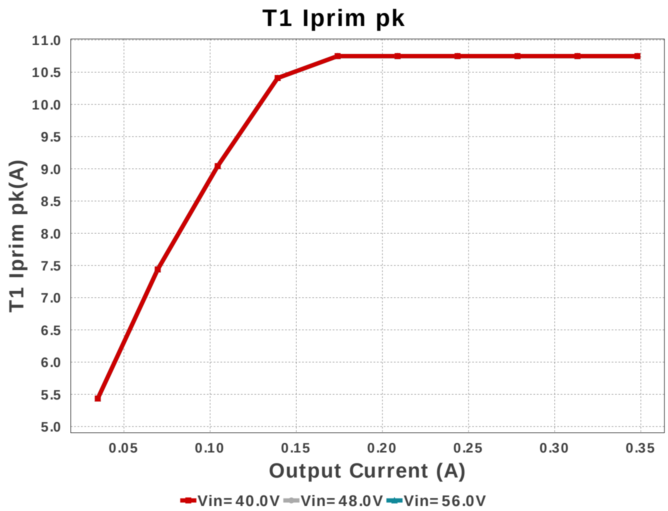

Vout p- p
Vout p- p(V)
0.0130
0.0125
0.0120
0.0115
0.0110
0.0105
0.0100
0.0095
0.0090
0.0085
0.0080
0.0075
0.0070
0.0065
0.0060
0.05 0.10 0.15 0.20 0.25 0.30 0.35
Output Current (A)
Vin= 40.0V Vin= 48.0V Vin= 56.0V

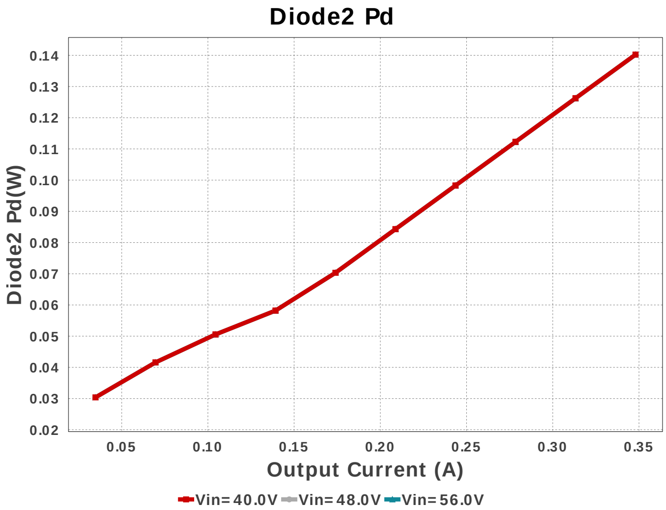

Duty Cycle
Duty Cycle(%)
45.0
42.5
40.0
37.5
35.0
32.5
30.0
27.5
25.0
22.5
20.0
17.5
15.0
12.5
10.0
7.5
5.0
0.05 0.10 0.15 0.20 0.25 0.30 0.35
Output Current (A)
Vin= 40.0V Vin= 48.0V Vin= 56.0V

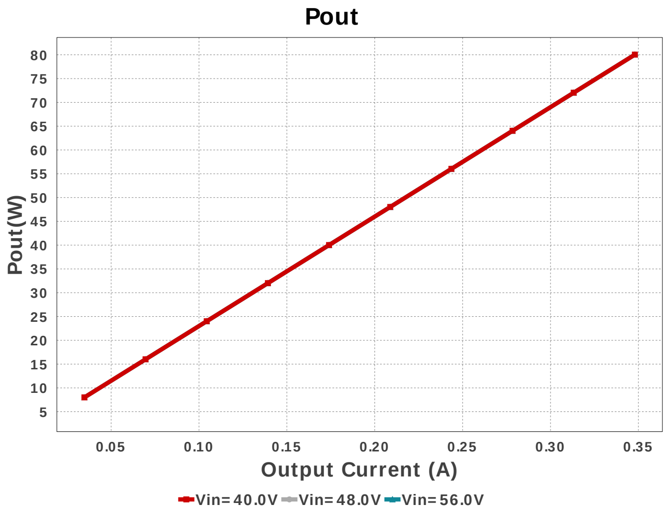

Cin Pd
Cin Pd(W)
0.00450
0.00425
0.00400
0.00375
0.00350
0.00325
0.00300
0.00275
0.00250
0.00225
0.00200
0.00175
0.00150
0.00125
0.00100
0.00075
0.00050
0.00025
0.00000
0.05 0.10 0.15 0.20 0.25 0.30 0.35
Output Current (A)
Vin= 40.0V Vin= 48.0V Vin= 56.0V

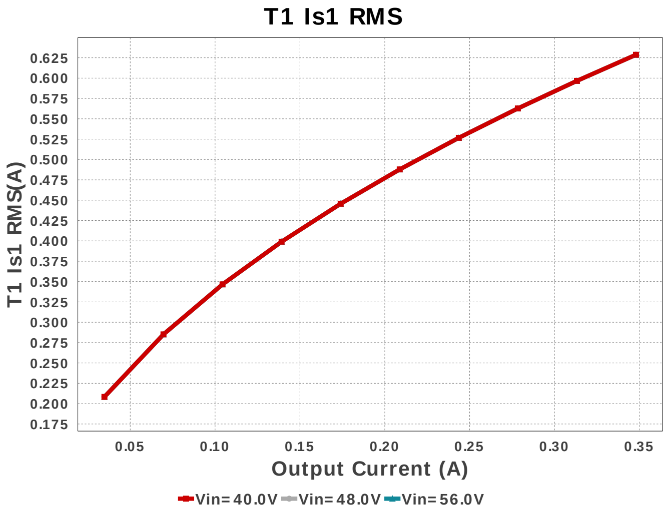

Cin IRMS
Cin IRMS(A)
0.000000005
0.000000004
0.000000003
0.000000002
0.000000001
0.000000000
- 0.000000001
- 0.000000002
- 0.000000003
- 0.000000004
- 0.000000005
0.05 0.10 0.15 0.20 0.25 0.30 0.35
Output Current (A)
Vin= 40.0V Vin= 48.0V Vin= 56.0V

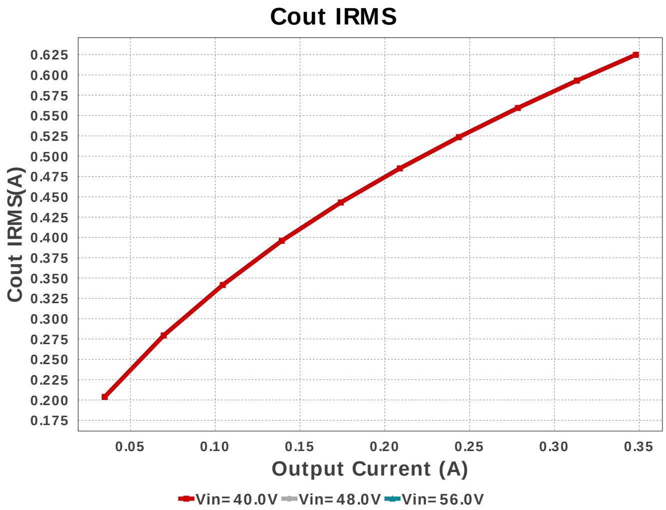

T1 Copper Loss
T1 Copper Loss(W)
2.50
2.25
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.05 0.10 0.15 0.20 0.25 0.30 0.35
Output Current (A)
Vin= 40.0V Vin= 48.0V Vin= 56.0V

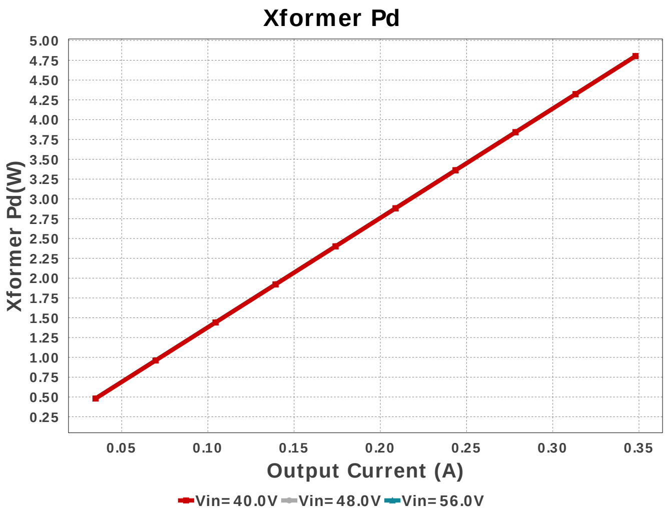

T1 Iprim pk
T1 Iprim pk(A)
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
0.05 0.10 0.15 0.20 0.25 0.30 0.35
Output Current (A)
Vin= 40.0V Vin= 48.0V Vin= 56.0V

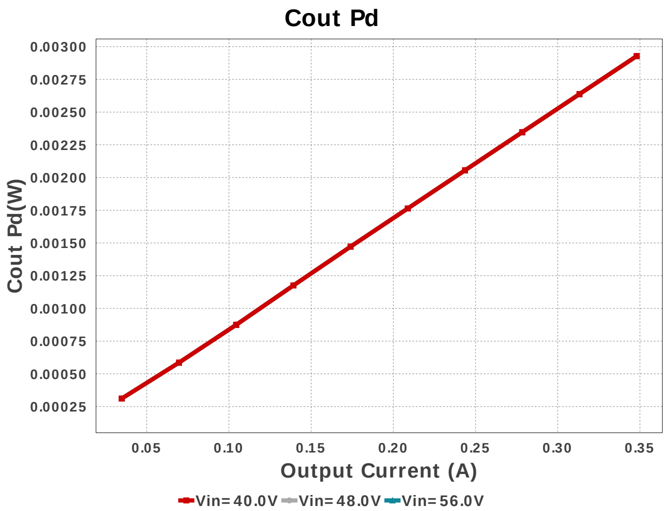

Diode2 Pd
Diode2 Pd(W)
0.14
0.13
0.12
0.11
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.05
0.10
0.15
0.20
0.25
0.30
0.35
Output Current (A)
Vin= 40.0V
Vin= 48.0V
Vin= 56.0V

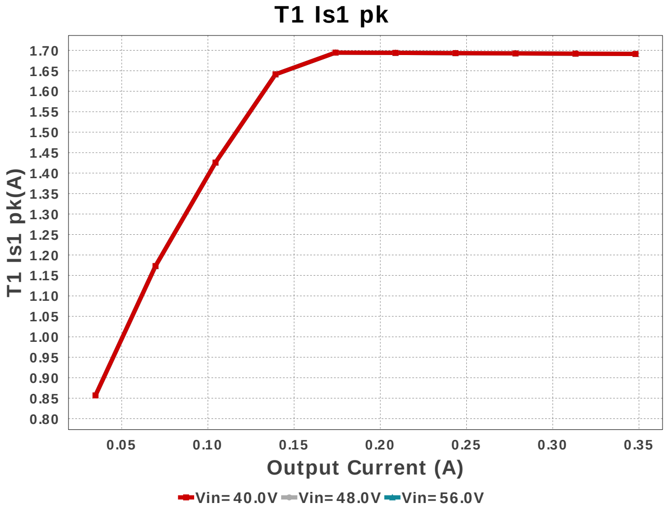

Pout
Pout(W)
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0.05
0.10
0.15
0.20
0.25
0.30
0.35
Output Current (A)
Vin= 40.0V
Vin= 48.0V
Vin= 56.0V

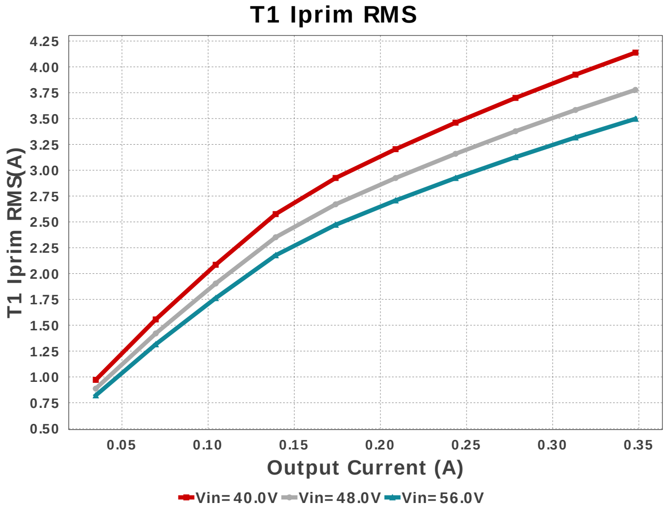

T1 Is1 RMS
T1 Is1 RMS(A)
0.625
0.600
0.575
0.550
0.525
0.500
0.475
0.450
0.425
0.400
0.375
0.350
0.325
0.300
0.275
0.250
0.225
0.200
0.175
0.05
0.10
0.15
0.20
0.25
0.30
0.35
Output Current (A)
Vin= 40.0V
Vin= 48.0V
Vin= 56.0V


Cout IRMS
Cout IRMS(A)
0.625
0.600
0.575
0.550
0.525
0.500
0.475
0.450
0.425
0.400
0.375
0.350
0.325
0.300
0.275
0.250
0.225
0.200
0.175
0.05
0.10
0.15
0.20
0.25
0.30
0.35
Output Current (A)
Vin= 40.0V
Vin= 48.0V
Vin= 56.0V


Xformer Pd
Xformer Pd(W)
5.00
4.75
4.50
4.25
4.00
3.75
3.50
3.25
3.00
2.75
2.50
2.25
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.05
0.10
0.15
0.20
0.25
0.30
0.35
Output Current (A)
Vin= 40.0V
Vin= 48.0V
Vin= 56.0V


Cout Pd
Cout Pd(W)
0.00300
0.00275
0.00250
0.00225
0.00200
0.00175
0.00150
0.00125
0.00100
0.00075
0.00050
0.00025
0.05
0.10
0.15
0.20
0.25
0.30
0.35
Output Current (A)
Vin= 40.0V
Vin= 48.0V
Vin= 56.0V





Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	16.849 A	Capacitor	Input capacitor RMS ripple current
2.	Cin Pd	4.277 mW	Capacitor	Input capacitor power dissipation
3.	Cout IRMS	624.22 mA	Capacitor	Output capacitor RMS ripple current
4.	Cout Pd	2.922 mW	Capacitor	Output capacitor power dissipation
5.	Diode2 Pd	139.6 mW	Diode	Diode2 power dissipation
6.	ICThetaJA	150.0 degC/W	IC	IC junction-to-ambient thermal resistance
7.	Cin Pd	4.277 mW	Power	Input capacitor power dissipation
8.	Cout Pd	2.922 mW	Power	Output capacitor power dissipation
9.	Diode2 Pd	139.6 mW	Power	Diode2 power dissipation
10.	Snubber Pd	1.899 W	Power	Snubber Power Dissipation
11.	T1 Copper Loss	2.401 W	Power	Transformer Copper Loss Power Dissipation
12.	T1 Core Loss	2.401 W	Power	Transformer Core Loss Power Dissipation
13.	Xformer Pd	4.802 W	Power	Transformer power dissipation
14.	BOM Count	32	System Information	Total Design BOM count
15.	Duty Cycle	44.155 %	System Information	Duty cycle
16.	FootPrint	2.55 k mm^2	System Information	Total Foot Print Area of BOM components
17.	Frequency	74.494 kHz	System Information	Switching frequency
18.	Frequency	74.494 kHz	System Information	Switching frequency
19.	Iout	348.0 mA	System Information	Iout operating point
20.	Mode	DCM	System Information	Conduction Mode
21.	Pout	80.04 W	System Information	Total output power
22.	Total BOM	NA	System Information	Total BOM Cost
23.	Vin	56.0 V	System Information	Vin operating point
24.	Vout	230.0 V	System Information	Operational Output Voltage
25.	Vout Actual	230.0 V	System Information	Vout Actual calculated based on selected voltage divider resistors
26.	Vout Tolerance	1.325 %	System Information	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
27.	Vout p-p	12.699 mV	System Information	Peak-to-peak output ripple voltage
28.	T1 Copper Loss	2.401 W	Transformer	Transformer Copper Loss Power Dissipation
29.	T1 Core Loss	2.401 W	Transformer	Transformer Core Loss Power Dissipation
30.	T1 Iprim RMS	4.124 A	Transformer	Transformer Primary RMS Current
31.	T1 Iprim pk	10.75 A	Transformer	Transformer Primary Peak Current
32.	T1 Is1 RMS	627.645 mA	Transformer	Transformer Secondary1 RMS Current
33.	T1 Is1 pk	1.693 A	Transformer	Transformer Secondary1 Peak Current
34.	Xformer Pd	4.802 W	Transformer	Transformer power dissipation

Design Inputs

Name	Value	Description
Iout	348.0 m	Maximum Output Current
VinMax	56.0	Maximum input voltage
VinMin	40.0	Minimum input voltage
Vout	230.0	Output Voltage
base_pn	UCC28742	Base Product Number
source	DC	Input Source Type
Ta	30.0	Ambient temperature
UserFsw	70.0 k	Customer Selected Frequency

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

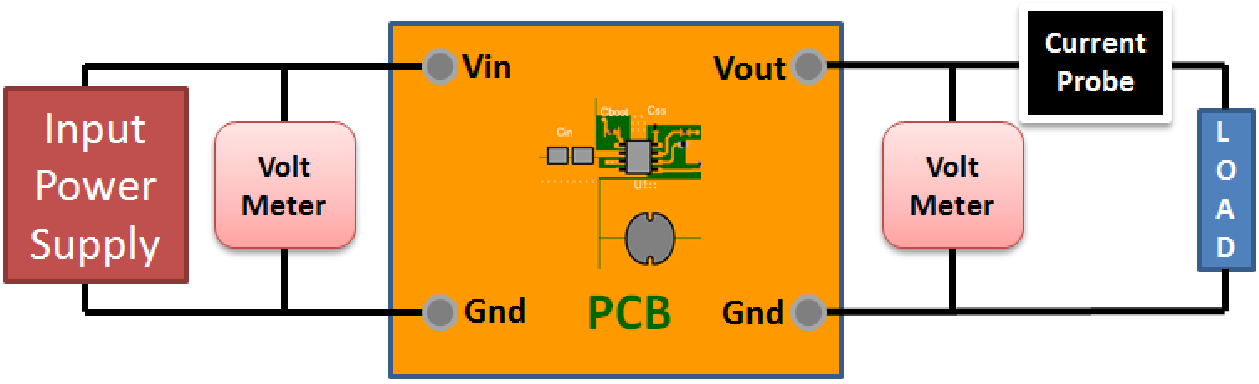
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. 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 40.0V 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 : A532A4F33C5A54E4[v1]

2. **UCC28742** Product Folder : http://www.ti.com/product/UCC28742 : contains the data sheet and other resources.

Important Notice and Disclaimer

TI provides technical and reliability data (including datasheets), design resources (including reference designs), application or other design advice, web tools, safety information, and other resources AS IS and with all faults, and disclaims all warranties. These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

Providing these resources does not expand or otherwise alter TI's applicable Terms of Sale or other applicable terms available either on ti.com or provided in conjunction with TI products.