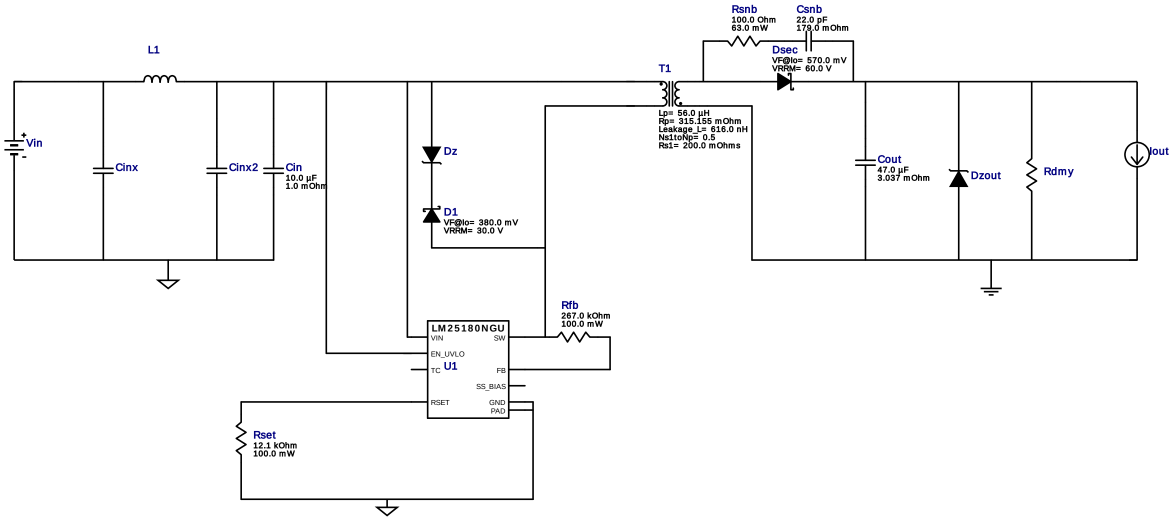
VinMin = 18.0V
VinMax = 18.0V
Vout = 13.0V
Iout = 0.23A

Device = LM25180NGUR
Topology = Flyback
Created = 2023-11-15 07:54:52.167
BOM Cost = NA
BOM Count = 11
Total Pd =

WEBENCH ® Design Report

Design : 7 LM25180NGUR
LM25180NGUR 18V-18V to 13.00V @ 0.23A



Design Alerts

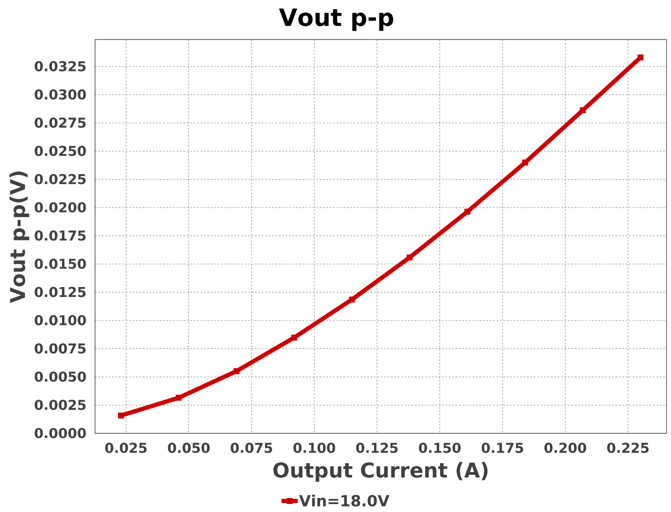
Component Selection Information

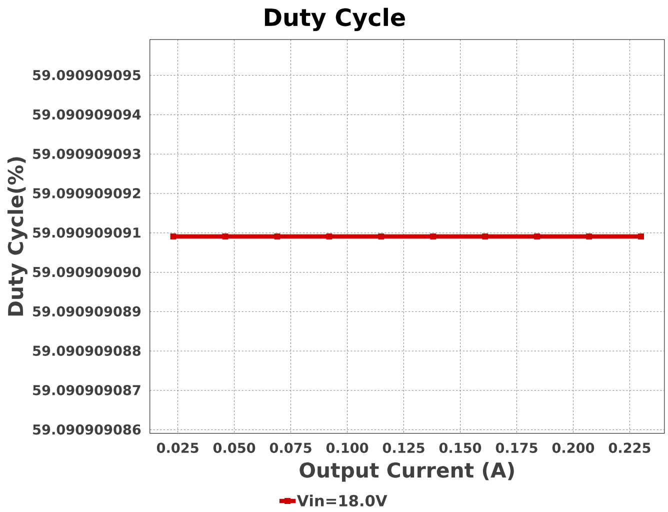
Click on the transformer symbol in the schematic and select "Explore Transformer Core/Bobbin Selection" to design using specific transformer cores and bobbin.

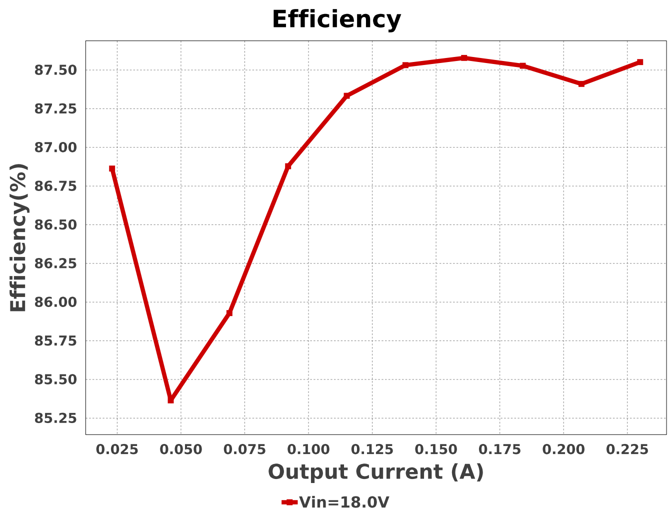
Electrical BOM

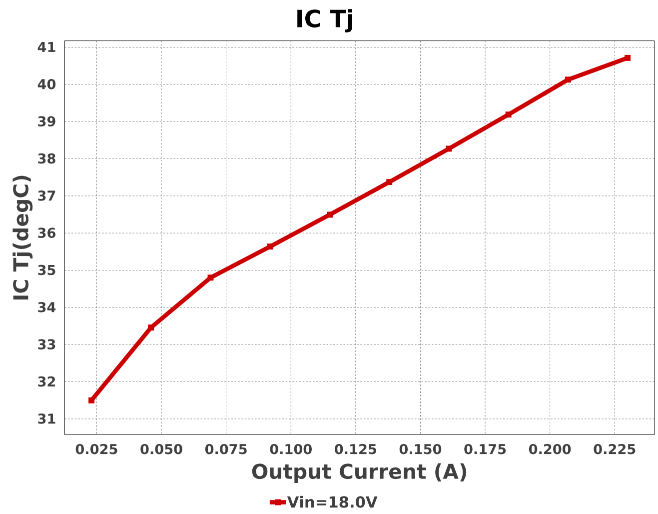
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cin	TDK	C3225X7R1H106M250AC Series= X7R	Cap= 10.0 uF ESR= 1.0 mOhm VDC= 50.0 V IRMS= 5.0 A	1	$0.27	1210 15 mm^2
Cout	MuRata	GRM32ER61C476KE15L Series= X5R	Cap= 47.0 uF ESR= 3.037 mOhm VDC= 16.0 V IRMS= 4.59346 A	1	$0.17	1210_280 15 mm^2
Csnb	Kemet	C0805C220J5GACTU Series= C0G/NP0	Cap= 22.0 pF ESR= 179.0 mOhm VDC= 50.0 V IRMS= 464.0 mA	1	$0.01	0805 7 mm^2
D1	Diodes Inc.	B130LAW-7-F	VF@Io= 380.0 mV VRRM= 30.0 V	1	$0.11	SOD-123 13 mm^2
Dsec	Nexperia	PMEG6010CEH,115	VF@Io= 570.0 mV VRRM= 60.0 V	1	$0.04	SOD-123F 12 mm^2
Dz	Diodes Inc.	MMSZ5259B-7-F	Zener	1	$0.04	SOD-123 13 mm^2

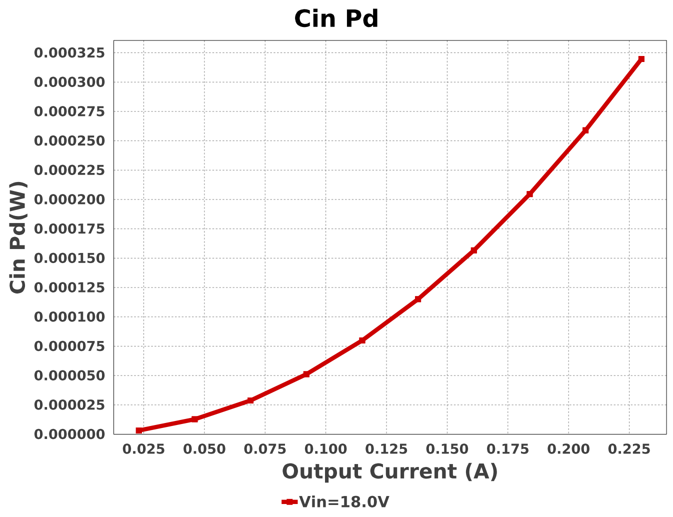
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Rfb	Vishay-Dale	CRCW0603267KFKEA Series= CRCW..e3	Res= 267.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	0603 5 mm^2
Rset	Vishay-Dale	CRCW060312K1FKEA Series= CRCW..e3	Res= 12.1 kOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	0603 5 mm^2
Rsnb	Vishay-Dale	CRCW0402100RFKED Series= CRCW..e3	Res= 100.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
T1	CUSTOM	CUSTOM	Lp= 56.0 µH Rp= 315.155 mOhm Leakage_L= 616.0 nH Ns1toNp= 500.0 m Rs1= 200.0 mOhms	1	NA	CUSTOM 0 mm^2
U1	Texas Instruments	LM25180NGUR	Switcher	1	$1.39	0 mm^2

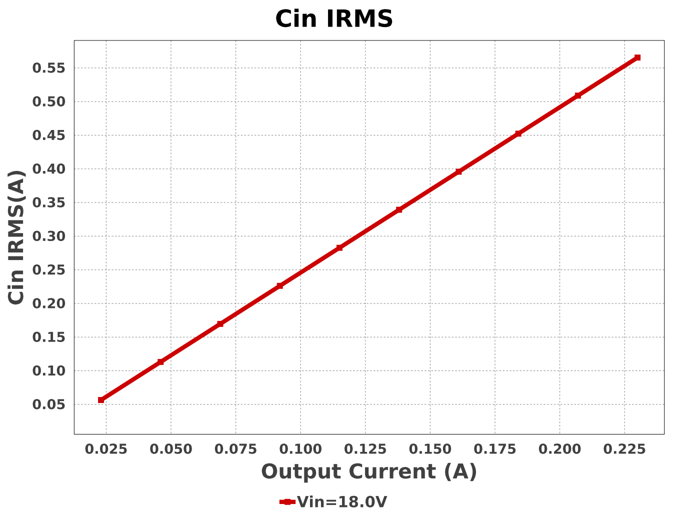


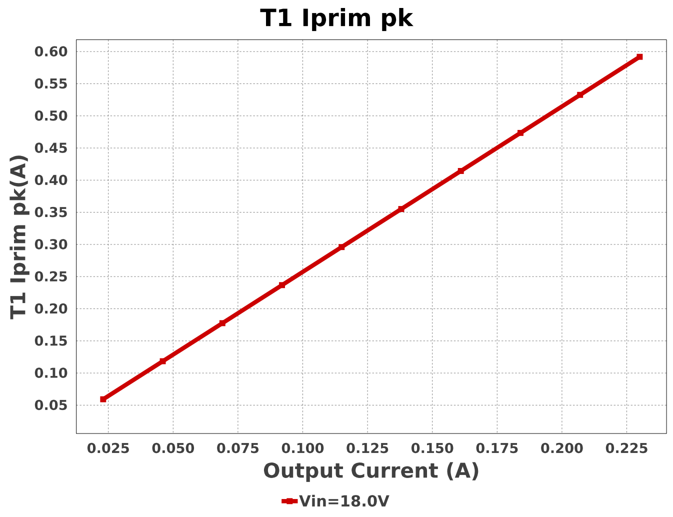


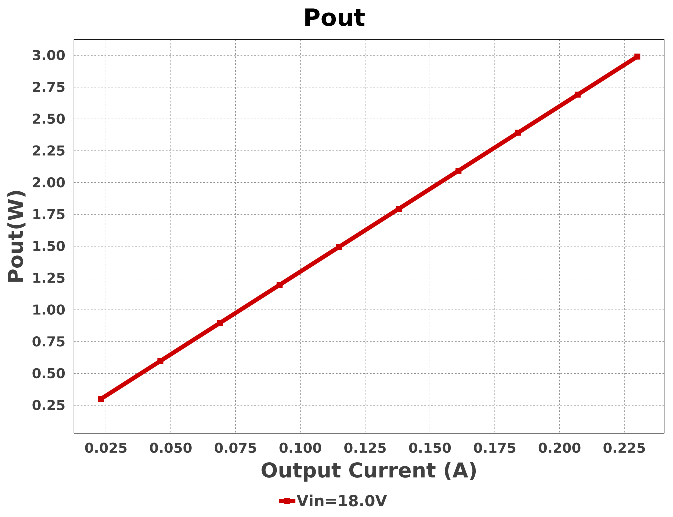


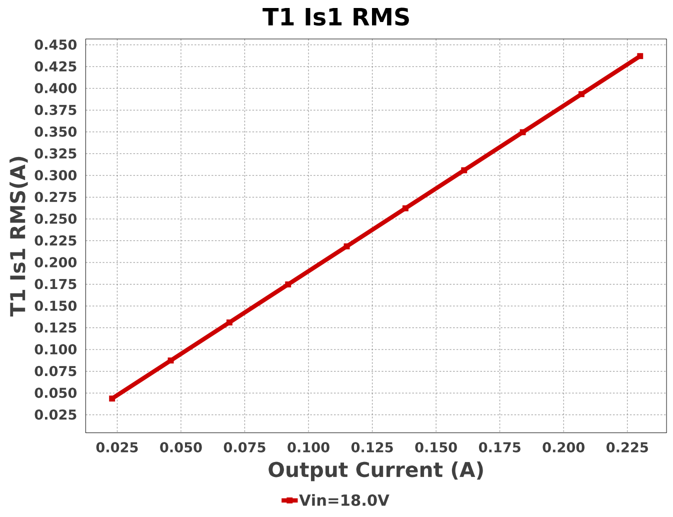


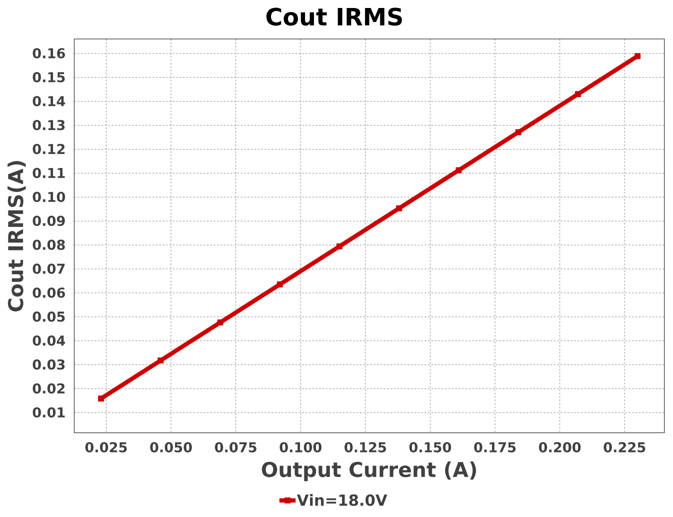

Cin Pd
Cin Pd(W)
0.000325
0.000300
0.000275
0.000250
0.000225
0.000200
0.000175
0.000150
0.000125
0.000100
0.000075
0.000050
0.000025
0.000000
0.025 0.050 0.075 0.100 0.125 0.150 0.175 0.200 0.225
Output Current (A)
Vin=18.0V

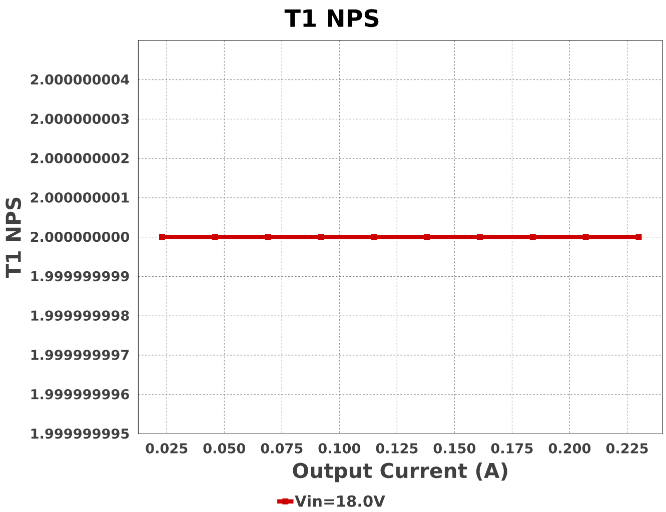

Cin IRMS
Cin IRMS(A)
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.025 0.050 0.075 0.100 0.125 0.150 0.175 0.200 0.225
Output Current (A)
Vin=18.0V

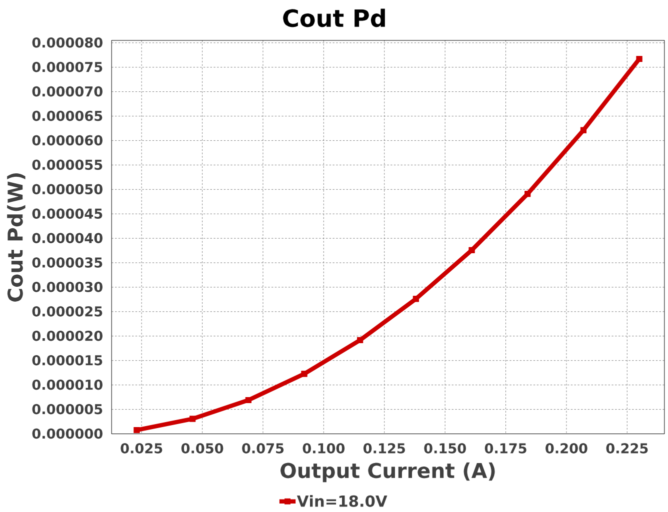

T1 Iprim pk
T1 Iprim pk(A)
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.025 0.050 0.075 0.100 0.125 0.150 0.175 0.200 0.225
Output Current (A)
Vin=18.0V

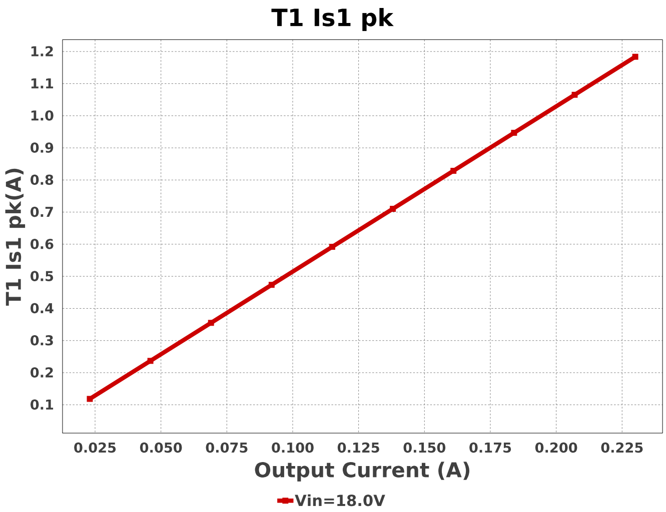

Pout
Pout(W)
3.00
2.75
2.50
2.25
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.025 0.050 0.075 0.100 0.125 0.150 0.175 0.200 0.225
Output Current (A)
Vin=18.0V

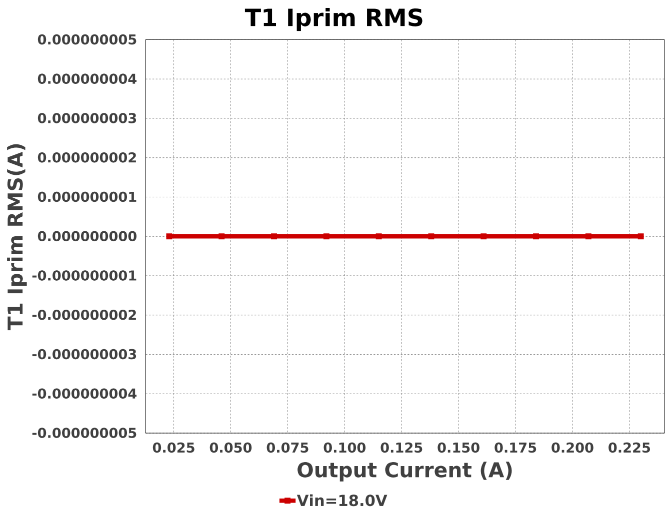

T1 Is1 RMS
T1 Is1 RMS(A)
0.450
0.425
0.400
0.375
0.350
0.325
0.300
0.275
0.250
0.225
0.200
0.175
0.150
0.125
0.100
0.075
0.050
0.025
0.025 0.050 0.075 0.100 0.125 0.150 0.175 0.200 0.225
Output Current (A)
Vin=18.0V

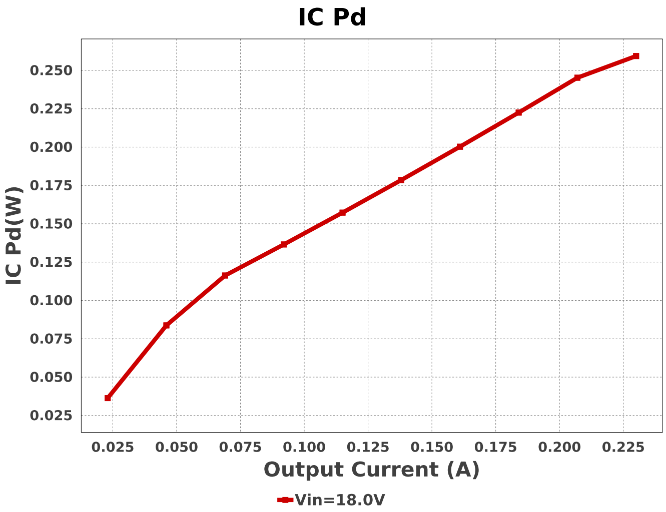

Cout IRMS
Cout IRMS(A)
0.16
0.15
0.14
0.13
0.12
0.11
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.025 0.050 0.075 0.100 0.125 0.150 0.175 0.200 0.225
Output Current (A)
Vin=18.0V

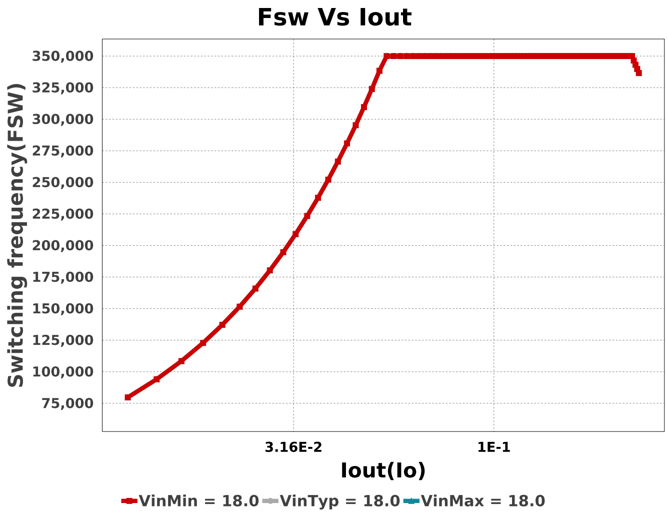












Operating Values

#	Name	Value	Category	Description
1.	T1 NPS	2.0		Transformer primary to secondary turns ratio
2.	Cin IRMS	565.392 mA	Capacitor	Input capacitor RMS ripple current
3.	Cin Pd	319.67 µW	Capacitor	Input capacitor power dissipation
4.	Cout IRMS	158.913 mA	Capacitor	Output capacitor RMS ripple current
5.	Cout Pd	76.694 µW	Capacitor	Output capacitor power dissipation
6.	T1 Iprim RMS	274.727 mA	Current	Transformer Primary RMS Current
7.	T1 Iprim pk	591.813 mA	Current	Transformer Primary Peak Current
8.	T1 Is1 RMS	437.083 mA	Current	Transformer Secondary1 RMS Current
9.	T1 Is1 pk	1.184 A	Current	Transformer Secondary1 Peak Current
10.	IC Pd	259.37 mW	IC	IC power dissipation
11.	IC Tj	40.712 degC	IC	IC junction temperature

#	Name	Value	Category	Description
12.	ICThetaJA	41.3 degC/W	IC	IC junction-to-ambient thermal resistance
13.	Cin Pd	319.67 µW	Power	Input capacitor power dissipation
14.	Cout Pd	76.694 µW	Power	Output capacitor power dissipation
15.	IC Pd	259.37 mW	Power	IC power dissipation
16.	BOM Count	11	System Information	Total Design BOM count
17.	Duty Cycle	59.091 %	System Information	Duty cycle
18.	Efficiency	87.551 %	System Information	Steady state efficiency
19.	FootPrint	116.0 mm^2	System Information	Total Foot Print Area of BOM components
20.	Frequency	336.611 kHz	System Information	Switching frequency
21.	Iout	230.0 mA	System Information	Iout operating point
22.	Mode	DCM/BCM	System Information	Conduction Mode
23.	Pout	2.99 W	System Information	Total output power
24.	Total BOM	NA	System Information	Total BOM Cost
25.	Vin	18.0 V	System Information	Vin operating point
26.	Vout	13.0 V	System Information	Operational Output Voltage
27.	Vout Tolerance	192.31 m%	System Information	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
28.	Vout p-p	33.301 mV	System Information	Peak-to-peak output ripple voltage

Design Inputs

Name	Value	Description
Iout	230.0 m	Maximum Output Current
VinMax	18.0	Maximum input voltage
VinMin	18.0	Minimum input voltage
Vout	13.0	Output Voltage
base_pn	LM25180	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

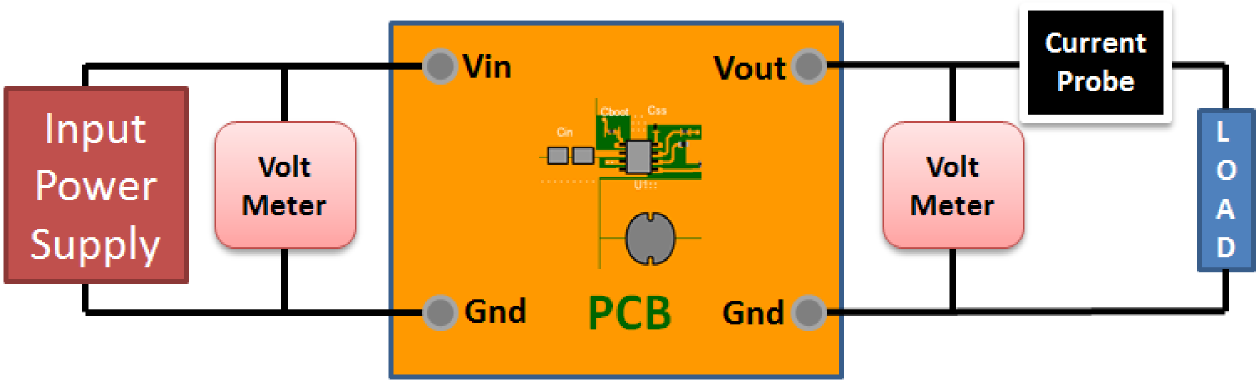
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. 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 18.0V 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 : 8E02C3F525EB4630EFBC3908027B17D2[v1]

2. **LM25180** Product Folder : http://www.ti.com/product/LM25180 : contains the data sheet and other resources.