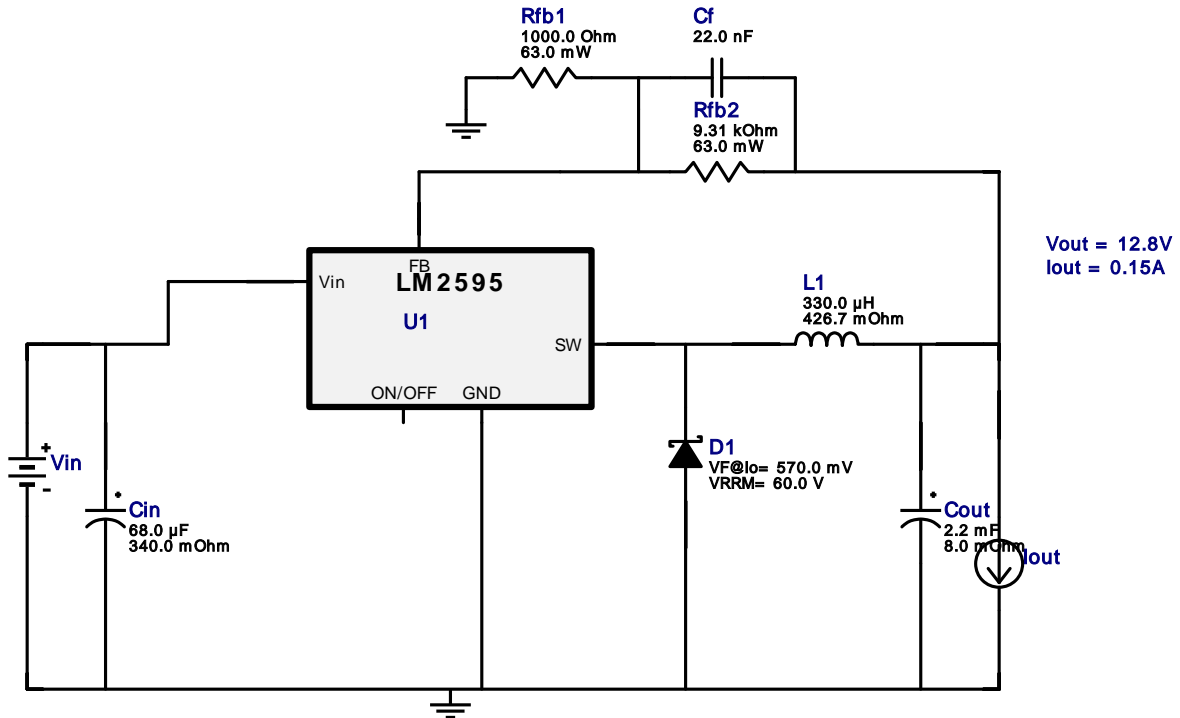


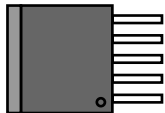
## WEBENCH® Design Report

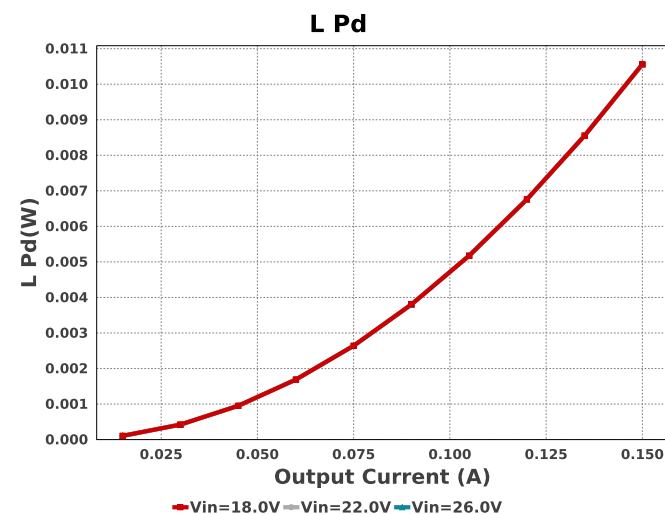
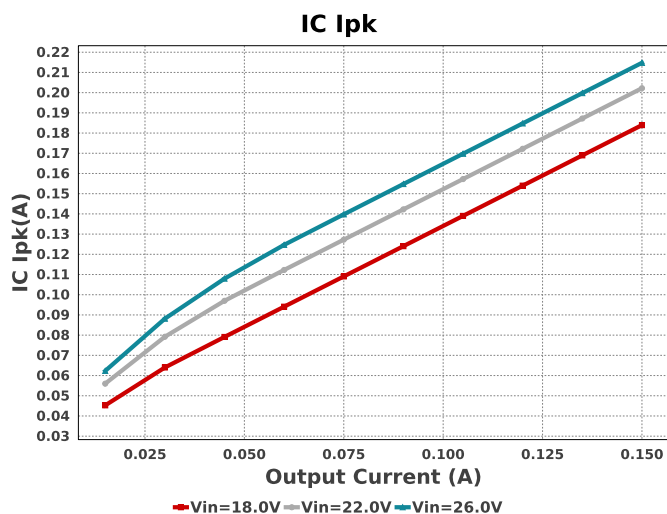
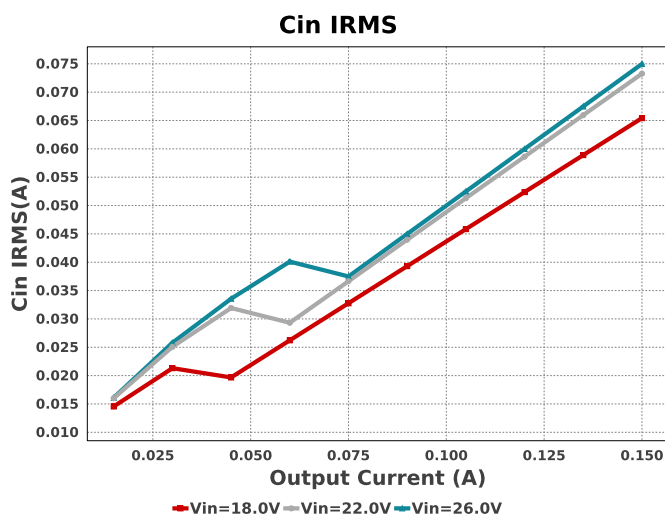
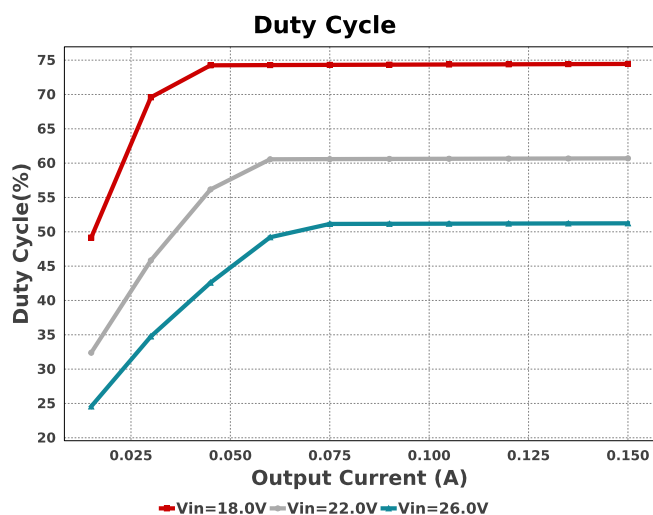
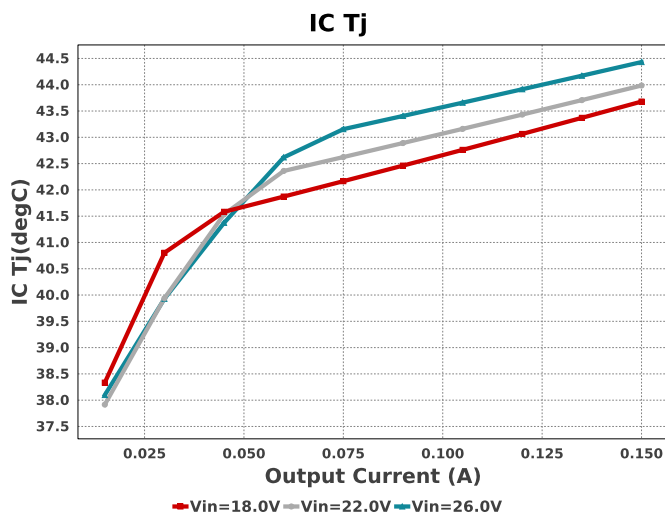
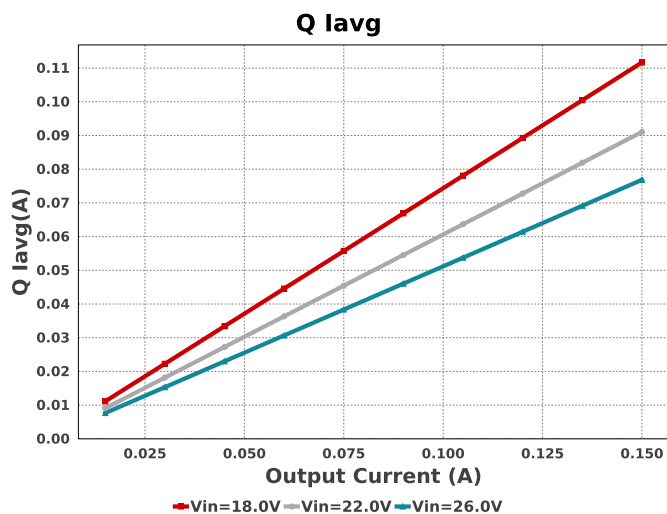
Design : 116 LM2595SX-ADJ/NOPB  
LM2595SX-ADJ/NOPB 18V-26V to 12.80V @ 0.15A

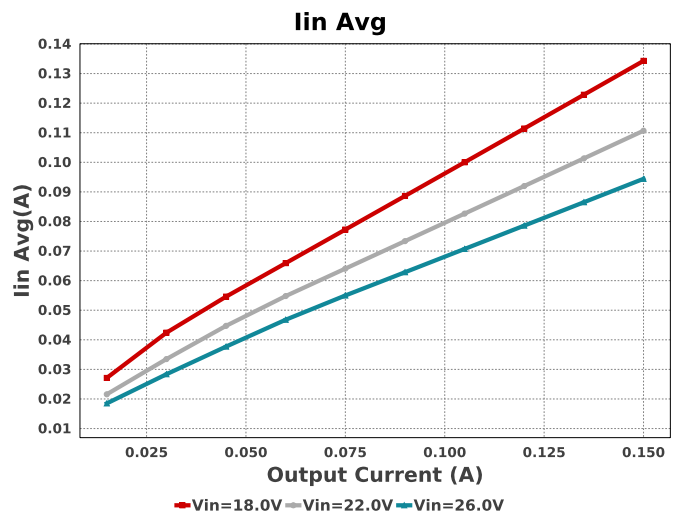
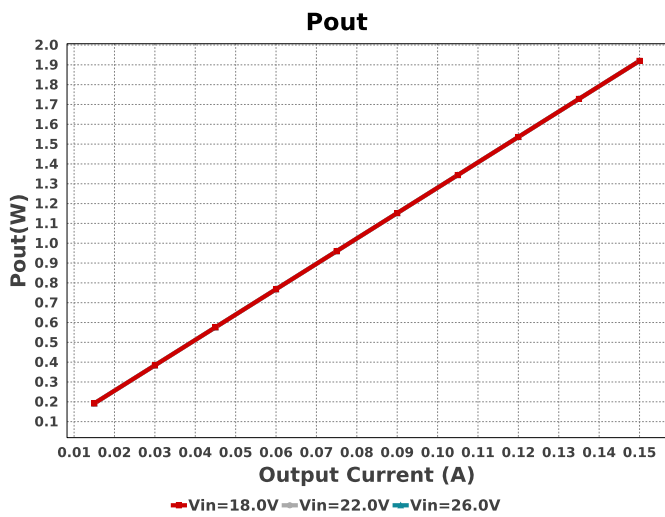
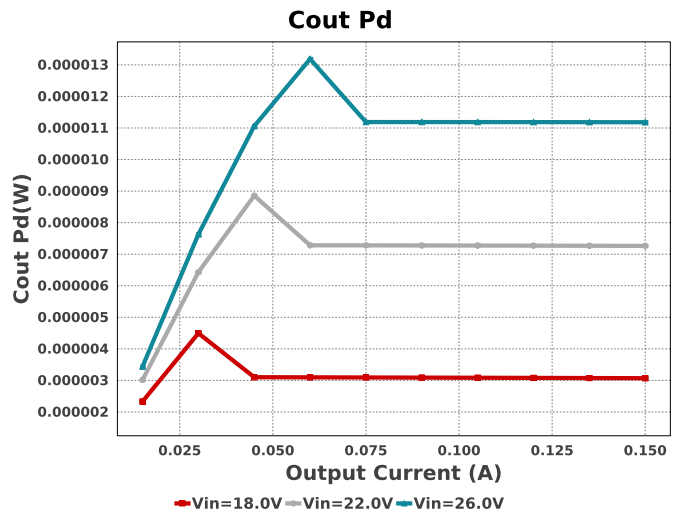
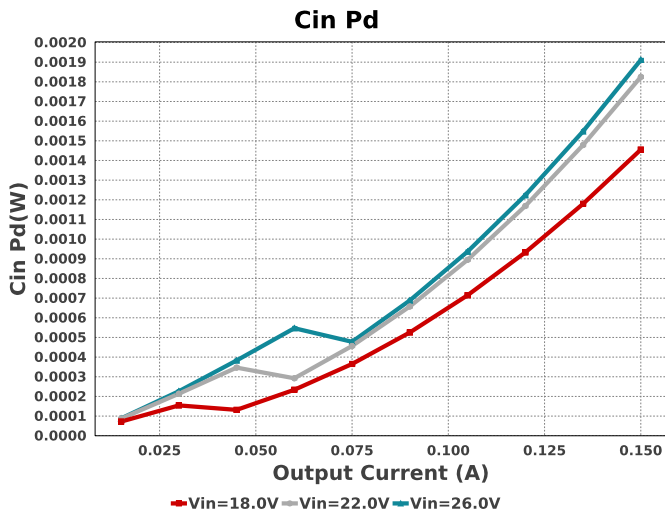
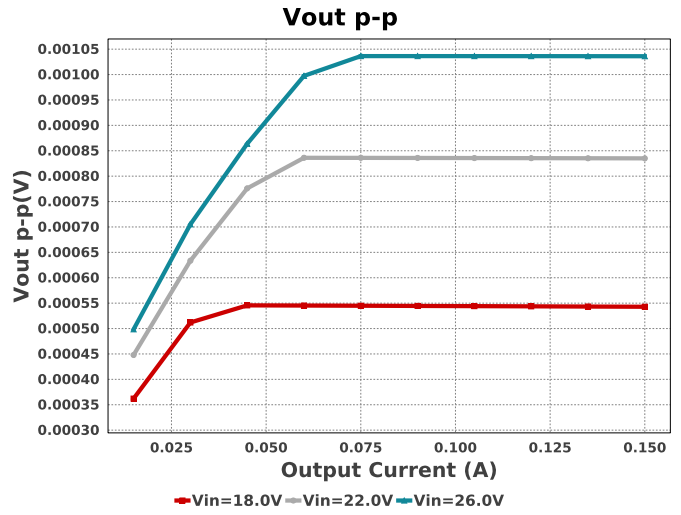
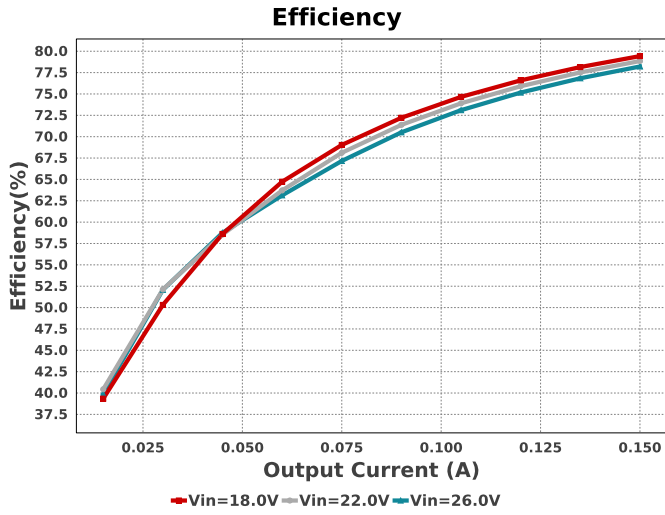


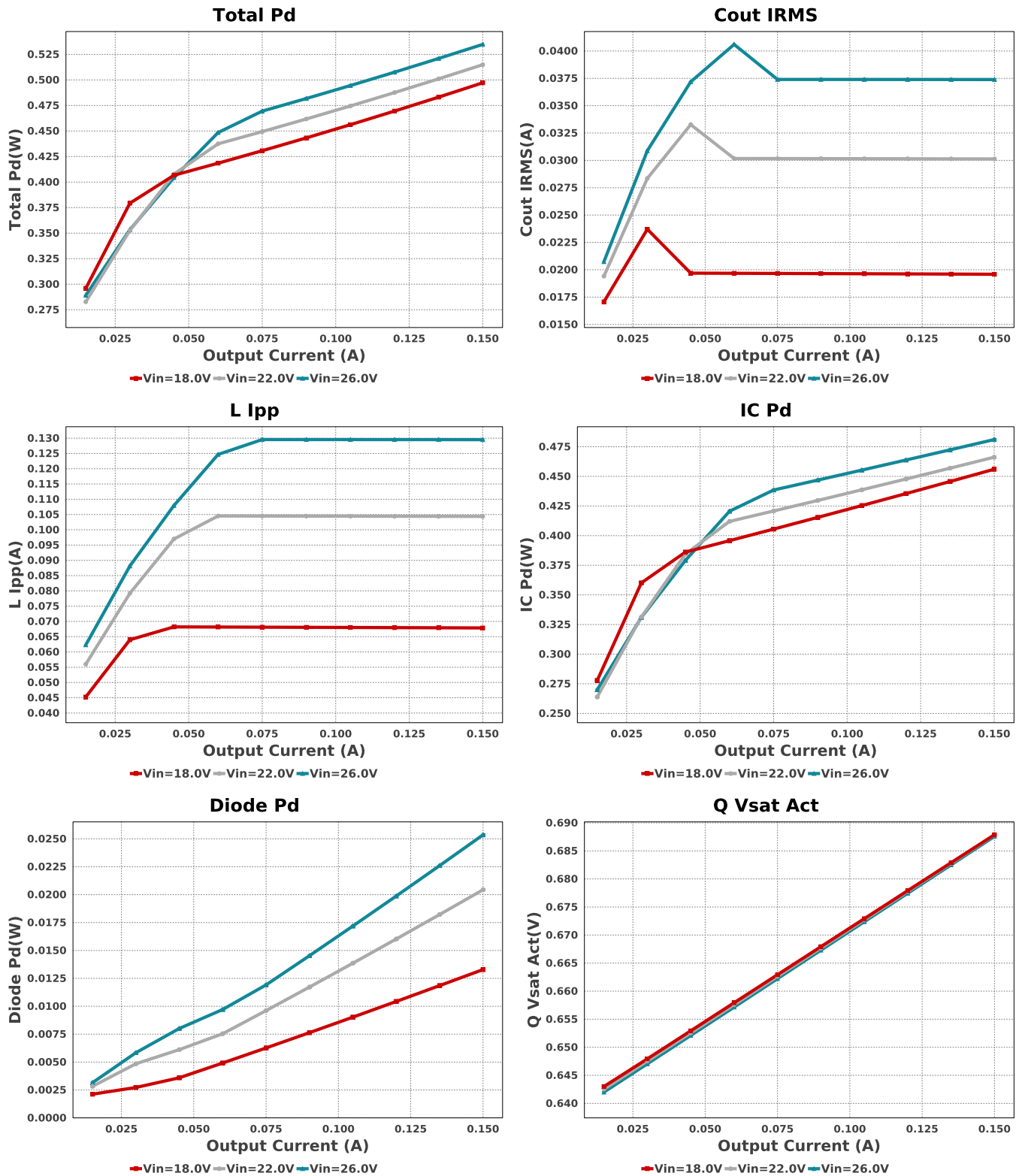
### Electrical BOM

Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cf	CUSTOM	CUSTOM Series= C0G/NP0	Cap= 22.0 nF VDC= 50.0 V IRMS= 0.0 A	1	NA	 0402 0 mm²
Cin	Nichicon	UUD1V680MCL1GS Series= uD	Cap= 68.0 uF ESR= 340.0 mOhm VDC= 35.0 V IRMS= 280.0 mA	1	\$0.10	 SM_RADIAL_6.3BMM 80 mm²
Cout	CUSTOM	CUSTOM Series= uD	Cap= 2.2 mF ESR= 8.0 mOhm VDC= 25.0 V IRMS= 230.0 mA	1	NA	 SM_RADIAL_6.3AMM 0 mm²
D1	Nexperia	PMEG6010CEH,115	VF@Io= 570.0 mV VRRM= 60.0 V	1	\$0.04	 SOD-123F 12 mm²
L1	CUSTOM	CUSTOM	L= 330.0 µH 426.7 mOhm	1	NA	 IND_NPI73C 0 mm²
Rfb1	Vishay-Dale	CRCW04021K00FKED Series= CRCW...e3	Res= 1000.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
Rfb2	Vishay-Dale	CRCW04029K31FKED Series= CRCW...e3	Res= 9.31 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²

Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
U1	Texas Instruments	LM2595SX-ADJ/NOPB	Switcher	1	\$1.76	 TS5B 199 mm <sup>2</sup>







## Operating Values

#	Name	Value	Category	Description
1.	BOM Count	8		Total Design BOM count
2.	Total BOM	NA		Total BOM Cost
3.	Cin IRMS	74.977 mA	Capacitor	Input capacitor RMS ripple current
4.	Cin Pd	1.911 mW	Capacitor	Input capacitor power dissipation
5.	Cout IRMS	37.387 mA	Capacitor	Output capacitor RMS ripple current
6.	Cout Pd	11.182 $\mu$ W	Capacitor	Output capacitor power dissipation
7.	Diode Pd	25.359 mW	Diode	Diode power dissipation
8.	IC Ipk	214.756 mA	IC	Peak switch current in IC
9.	IC Pd	481.05 mW	IC	IC power dissipation
10.	IC Tj	44.431 degC	IC	IC junction temperature
11.	IC Tolerance	0.0 V	IC	IC Feedback Tolerance

#	Name	Value	Category	Description
12.	ICThetaJA	30.0 degC/W	IC	IC junction-to-ambient thermal resistance
13.	Iin Avg	94.415 mA	IC	Average input current
14.	L Ipp	129.512 mA	Inductor	Peak-to-peak inductor ripple current
15.	L Pd	10.561 mW	Inductor	Inductor power dissipation
16.	Q Iavg	76.854 mA	Mosfet	Q Iavg
17.	Cin Pd	1.911 mW	Power	Input capacitor power dissipation
18.	Cout Pd	11.182 $\mu$ W	Power	Output capacitor power dissipation
19.	Diode Pd	25.359 mW	Power	Diode power dissipation
20.	IC Pd	481.05 mW	Power	IC power dissipation
21.	L Pd	10.561 mW	Power	Inductor power dissipation
22.	Total Pd	534.776 mW	Power	Total Power Dissipation
23.	Cross Freq	3.02 kHz	System Information	Bode plot crossover frequency
24.	Duty Cycle	51.236 %	System Information	Duty cycle
25.	Efficiency	78.215 %	System Information	Steady state efficiency
26.	FootPrint	473.0 mm <sup>2</sup>	System Information	Total Foot Print Area of BOM components
27.	Frequency	150.0 kHz	System Information	Switching frequency
28.	Iout	150.0 mA	System Information	Iout operating point
29.	Mode	CCM	System Information	Conduction Mode
30.	Phase Marg	64.229 deg	System Information	Bode Plot Phase Margin
31.	Pout	1.92 W	System Information	Total output power
32.	Vin	26.0 V	System Information	Vin operating point
33.	Vout Actual	12.681 V	System Information	Vout Actual calculated based on selected voltage divider resistors
34.	Vout Tolerance	1.824 %	System Information	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
35.	Vout p-p	1.036 mV	System Information	Peak-to-peak output ripple voltage
36.	Q Vsat Act	687.577 mV	Transistor	Q Vsat

## Design Inputs

Name	Value	Description
Iout	150.0 m	Maximum Output Current
VinMax	26.0	Maximum input voltage
VinMin	18.0	Minimum input voltage
VinTyp	24.0	Typical input voltage
Vout	12.8	Output Voltage
base_pn	LM2595	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  $C_{in}$  and  $C_{out}$ , 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

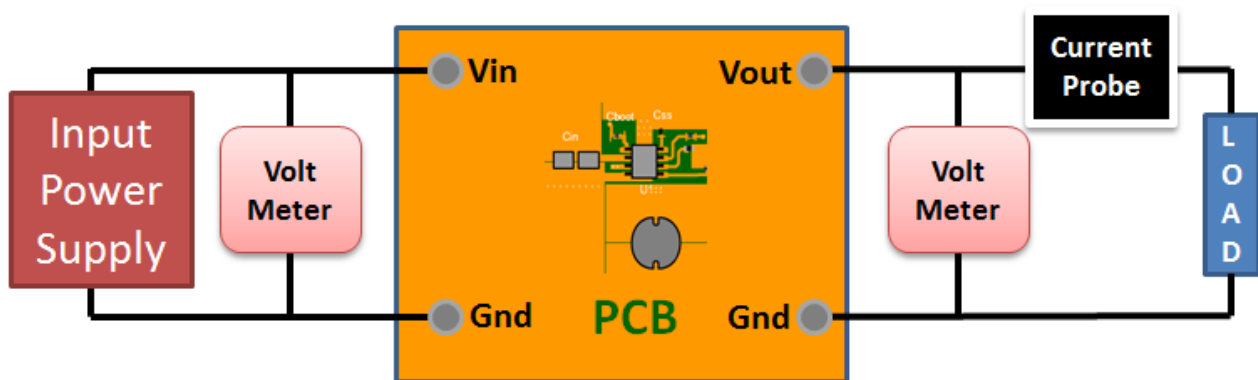
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. To solder the tab down 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  $V_{in}$  and GND. Connect a digital volt meter and a load if needed to set the minimum load of the design from  $V_{out}$  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  $V_{in}$  and GND, a load is connected between  $V_{out}$  and GND and a current meter is connected in series between  $V_{out}$  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 : AF34874385A8BFF3[v1]
2. **LM2595** Product Folder : <http://www.ti.com/product/LM2595> : contains the data sheet and other resources.

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