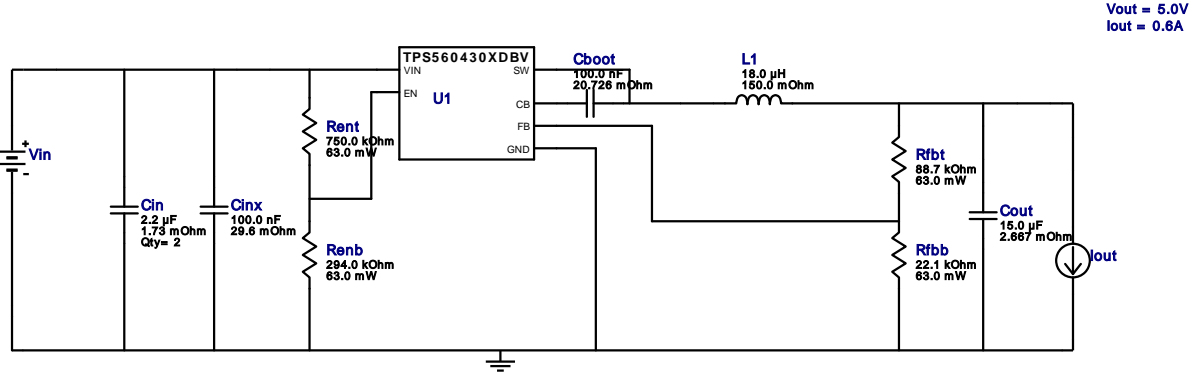


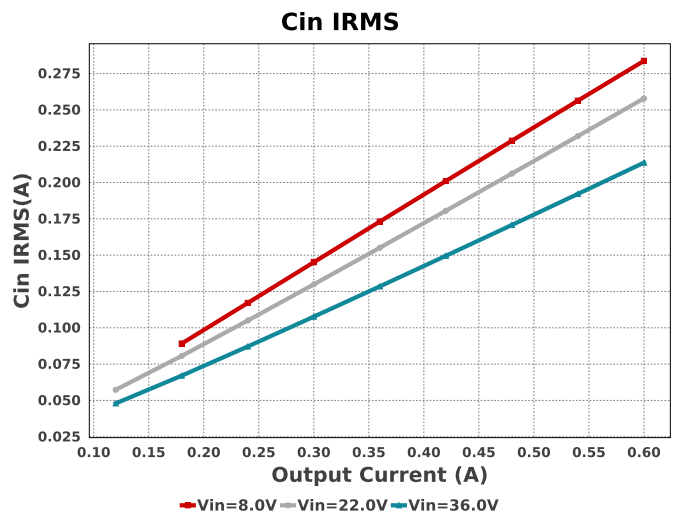
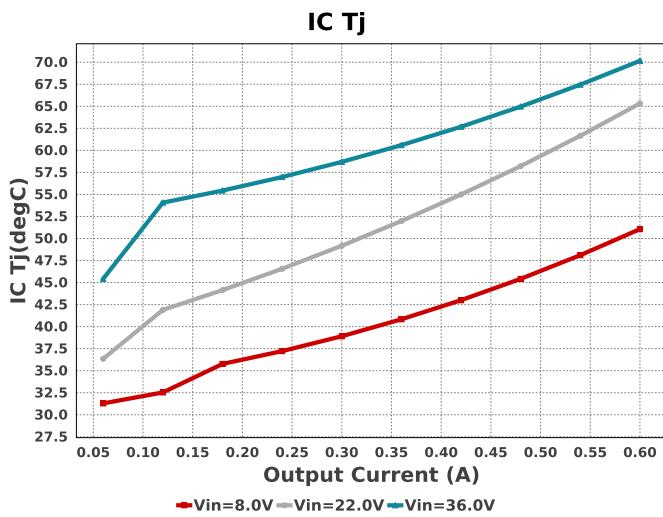
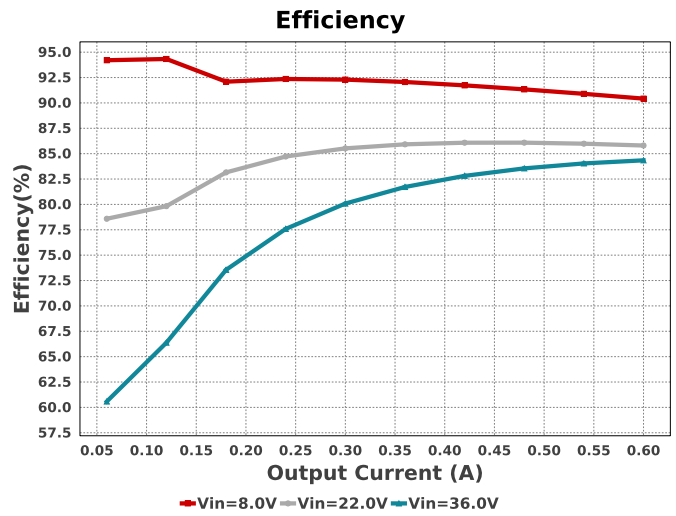
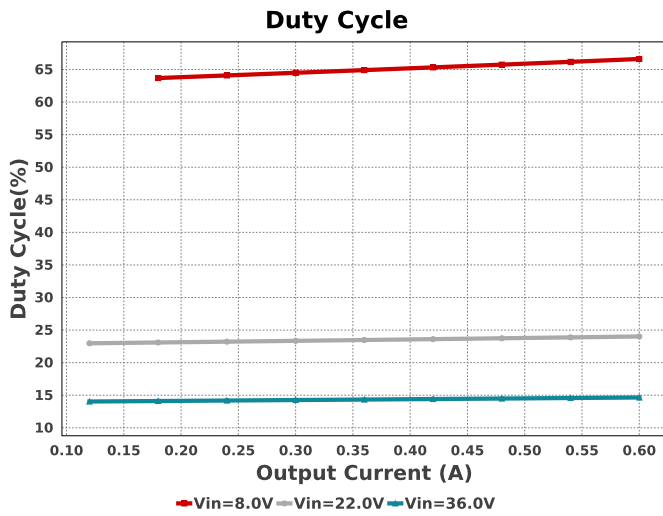
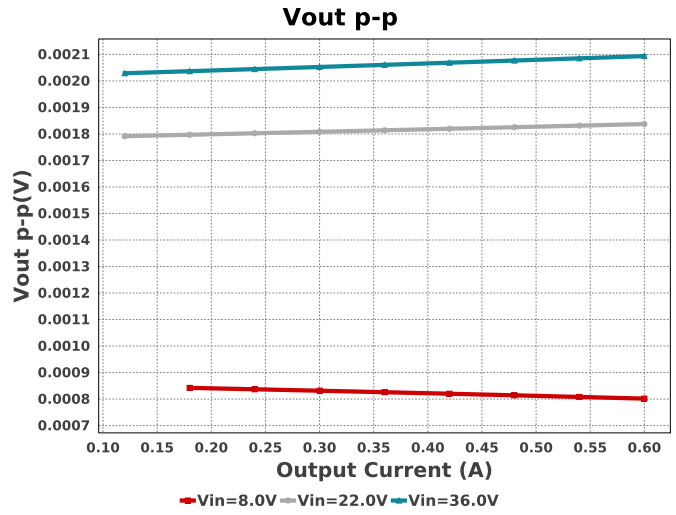
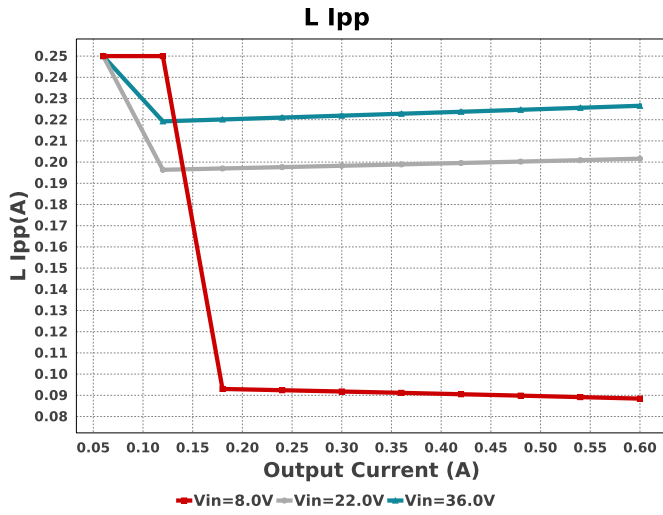
## WEBENCH® Design Report

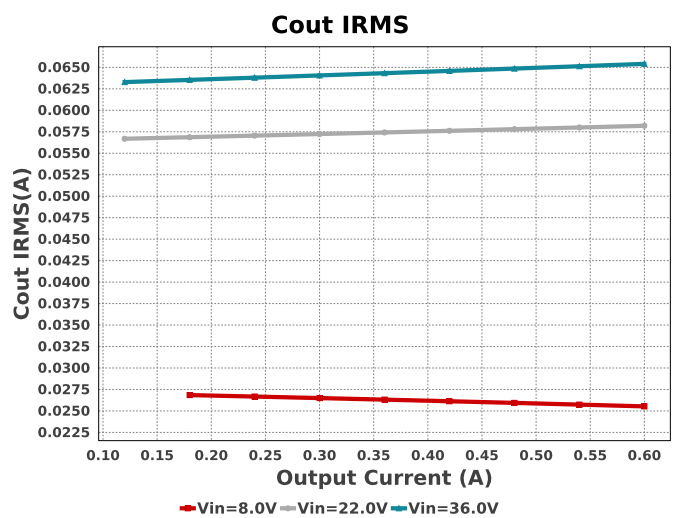
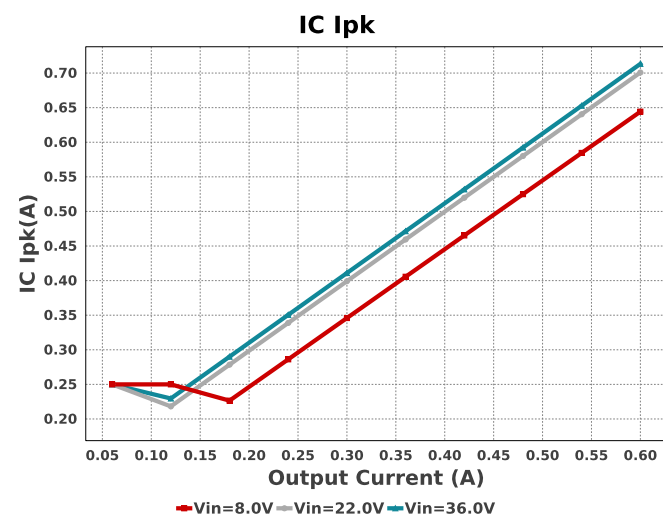
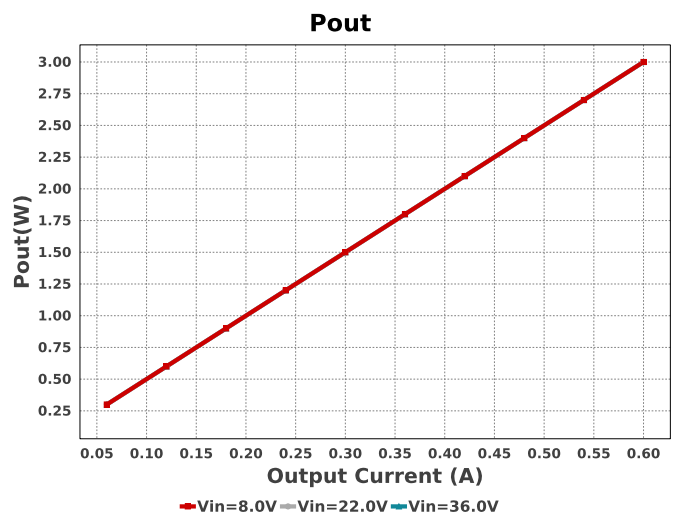
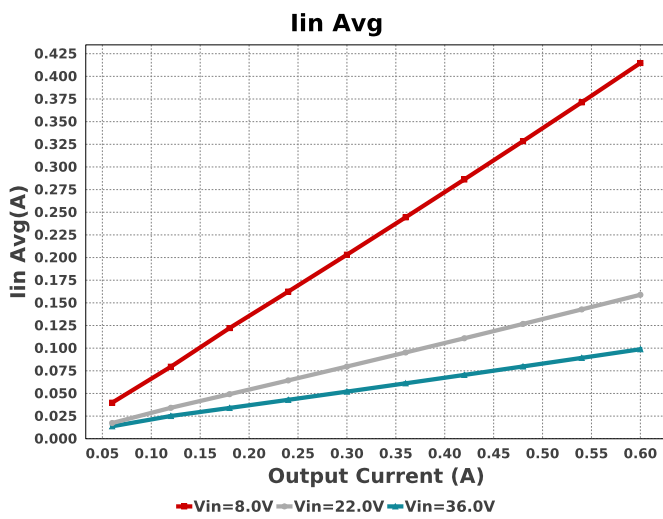
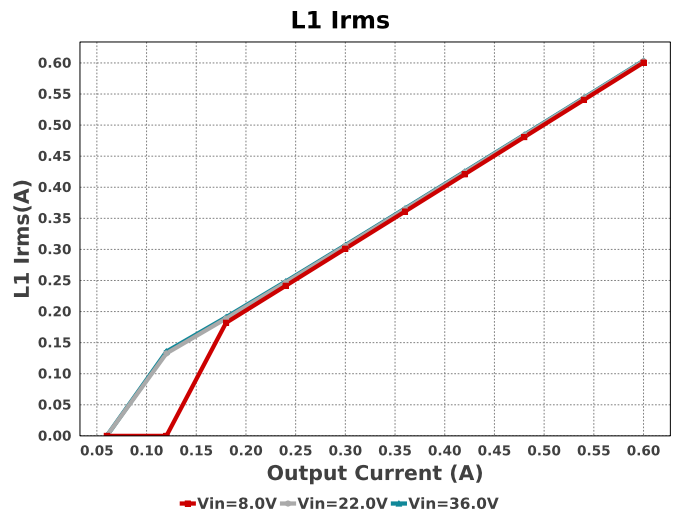
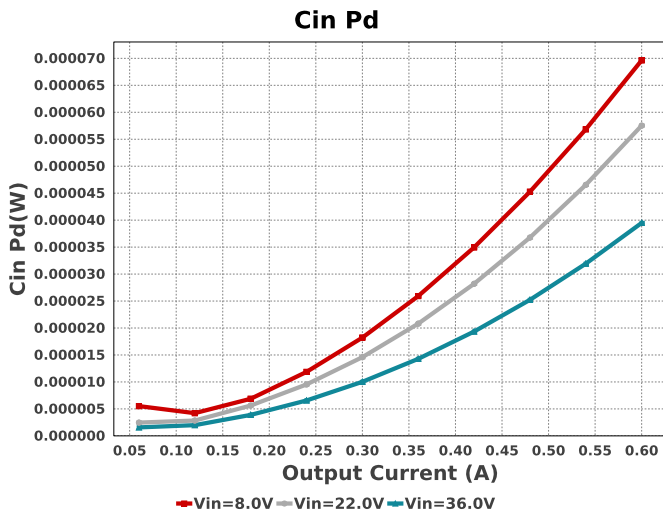
Design : 83 TPS560430XDBVR  
TPS560430XDBVR 8V-36V to 5.00V @ 0.6A

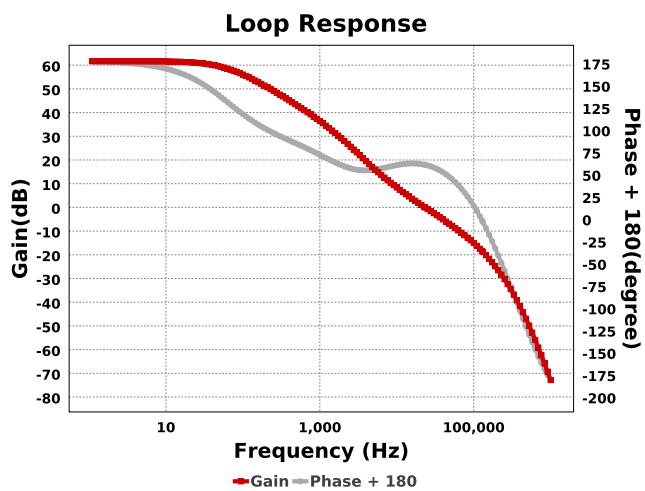
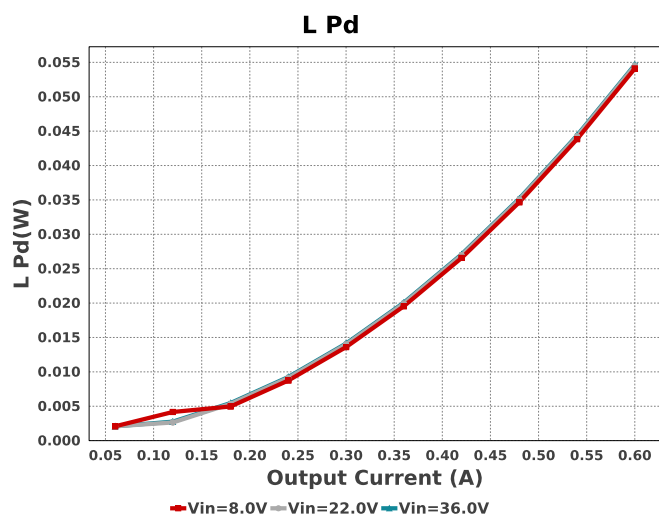
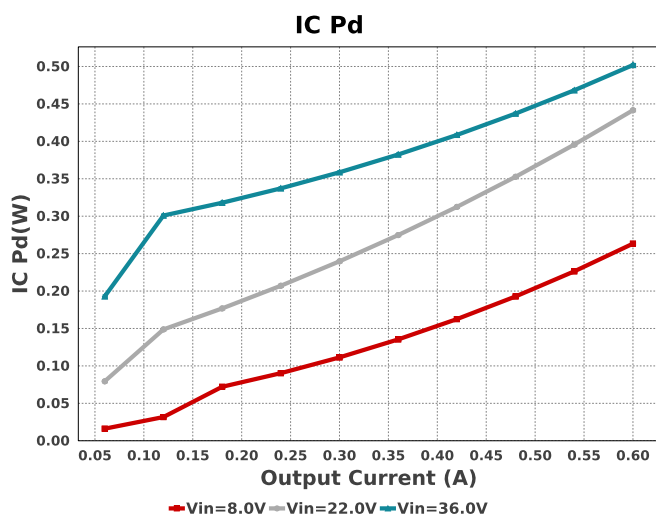
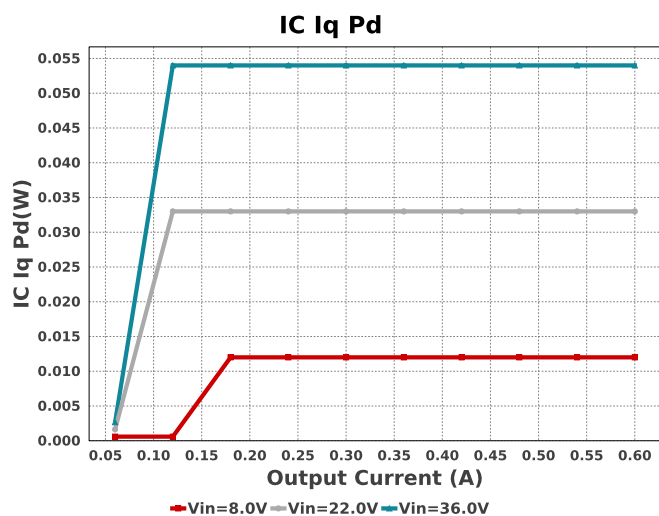
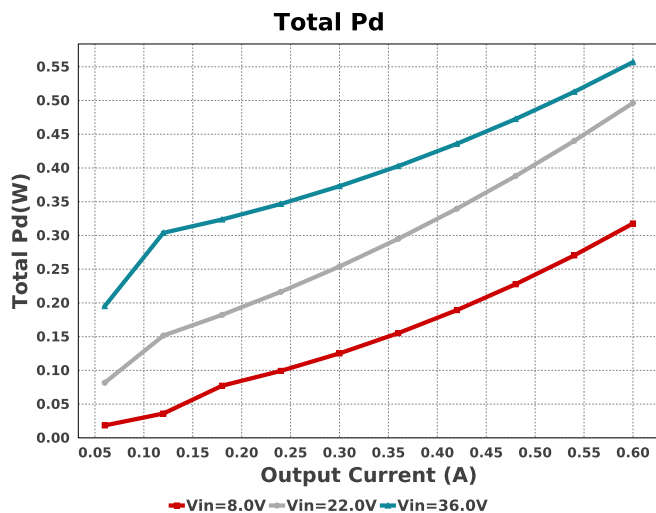
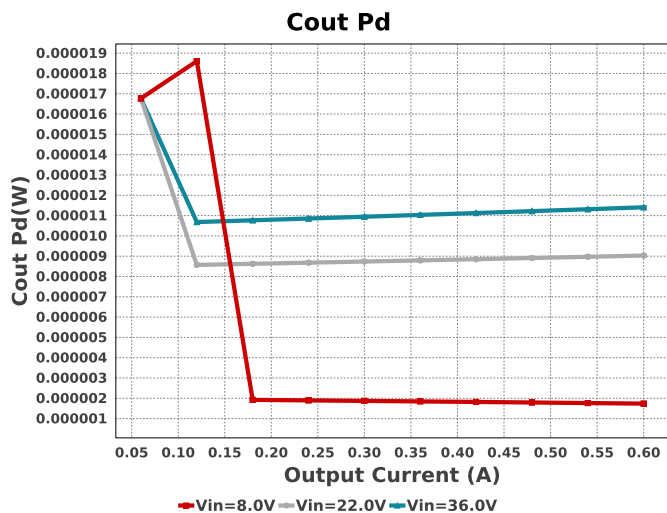


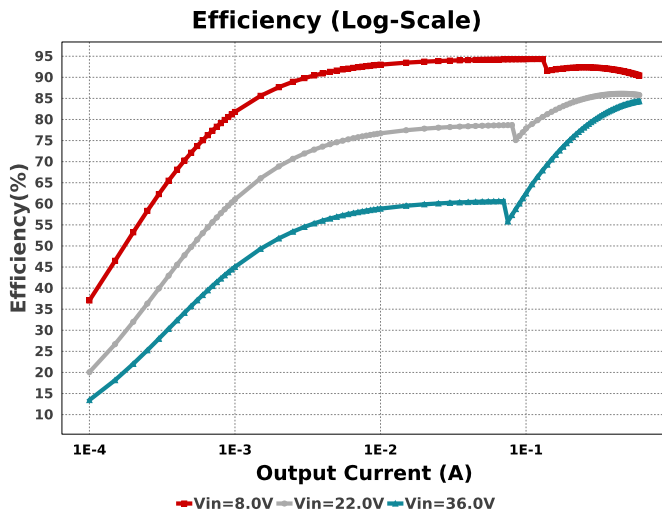
## Electrical BOM

Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cboot	TDK	C2012X7R2A104K125AA Series= X7R	Cap= 100.0 nF ESR= 20.726 mOhm VDC= 100.0 V IRMS= 1.456 A	1	\$0.03	 0805 7 mm <sup>2</sup>
Cin	TDK	C3225X7R2A225K230AB Series= X7R	Cap= 2.2 uF ESR= 1.73 mOhm VDC= 100.0 V IRMS= 5.5932 A	2	\$0.21	 1210_250 15 mm <sup>2</sup>
Cinx	TDK	CGA3E2X7R1H104K080AA Series= X7R	Cap= 100.0 nF ESR= 29.6 mOhm VDC= 50.0 V IRMS= 971.99 mA	1	\$0.01	 0603 5 mm <sup>2</sup>
Cout	TDK	C3216X5R1V156M160AC Series= X5R	Cap= 15.0 uF ESR= 2.667 mOhm VDC= 35.0 V IRMS= 4.4429 A	1	\$0.34	 1206_180 11 mm <sup>2</sup>
L1	NIC Components	NPI54C180MTRF	L= 18.0 µH 150.0 mOhm	1	\$0.09	 IND_NPI54C 61 mm <sup>2</sup>
Renb	Vishay-Dale	CRCW0402294KFKED Series= CRCW..e3	Res= 294.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm <sup>2</sup>
Rent	Vishay-Dale	CRCW0402750KFKED Series= CRCW..e3	Res= 750.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm <sup>2</sup>
Rfbb	Vishay-Dale	CRCW040222K1FKED Series= CRCW..e3	Res= 22.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm <sup>2</sup>
Rfbt	Vishay-Dale	CRCW040288K7FKED Series= CRCW..e3	Res= 88.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm <sup>2</sup>
U1	Texas Instruments	TPS560430XDBVR	Switcher	1	\$0.32	 DBV0006A 15 mm <sup>2</sup>









## Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	213.651 mA	Capacitor	Input capacitor RMS ripple current
2.	Cin Pd	39.484 $\mu$ W	Capacitor	Input capacitor power dissipation
3.	Cout IRMS	65.406 mA	Capacitor	Output capacitor RMS ripple current
4.	Cout Pd	11.409 $\mu$ W	Capacitor	Output capacitor power dissipation
5.	IC Ipk	713.287 mA	IC	Peak switch current in IC
6.	IC Iq Pd	54.0 mW	IC	IC Iq Pd
7.	IC Pd	501.93 mW	IC	IC power dissipation
8.	IC Tj	70.154 degC	IC	IC junction temperature
9.	ICThetaJA Effective	80.0 degC/W	IC	Effective IC Junction-to-Ambient Thermal Resistance
10.	Iin Avg	98.801 mA	IC	Average input current
11.	L Ipp	226.57 mA	Inductor	Peak-to-peak inductor ripple current
12.	L Pd	54.642 mW	Inductor	Inductor power dissipation
13.	L1 Irms	603.554 mA	Inductor	Inductor ripple current
14.	Cin Pd	39.484 $\mu$ W	Power	Input capacitor power dissipation
15.	Cout Pd	11.409 $\mu$ W	Power	Output capacitor power dissipation
16.	IC Pd	501.93 mW	Power	IC power dissipation
17.	L Pd	54.642 mW	Power	Inductor power dissipation
18.	Total Pd	556.858 mW	Power	Total Power Dissipation
19.	BOM Count	11	System	Total Design BOM count
20.	Cross Freq	23.3 kHz	Information System	Bode plot crossover frequency
21.	Duty Cycle	14.652 %	Information System	Duty cycle
22.	Efficiency	84.344 %	Information System	Steady state efficiency
23.	FootPrint	139.0 mm <sup>2</sup>	Information System	Total Foot Print Area of BOM components
24.	Frequency	1.1 MHz	Information System	Switching frequency
25.	Gain Marg	-18.416 dB	Information System	Bode Plot Gain Margin
26.	Iout	600.0 mA	Information System	Iout operating point
27.	Low Freq Gain	61.665 dB	Information System	Gain at 1Hz
28.	Mode	CCM	Information System	PWM/PFM Mode
29.	Phase Marg	62.574 deg	Information System	Bode Plot Phase Margin
30.	Pout	3.0 W	Information System	Total output power
31.	Total BOM	\$1.25	Information System	Total BOM Cost
32.	Vin	36.0 V	Information System	Vin operating point
33.	Vout Actual	5.014 V	Information System	Vout Actual calculated based on selected voltage divider resistors
34.	Vout Tolerance	1.617 %	Information System	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
35.	Vout p-p	2.094 mV	Information System	Peak-to-peak output ripple voltage

Design Inputs

Name	Value	Description
Iout	600.0 m	Maximum Output Current
VinMax	36.0	Maximum input voltage
VinMin	8.0	Minimum input voltage
Vout	5.0	Output Voltage
base_pn	TPS560430X	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 8.0V 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 : F83D4279EB7FCBF5[v1]
2. **TPS560430X** Product Folder : <http://www.ti.com/product/TPS560430> : contains the data sheet and other resources.

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