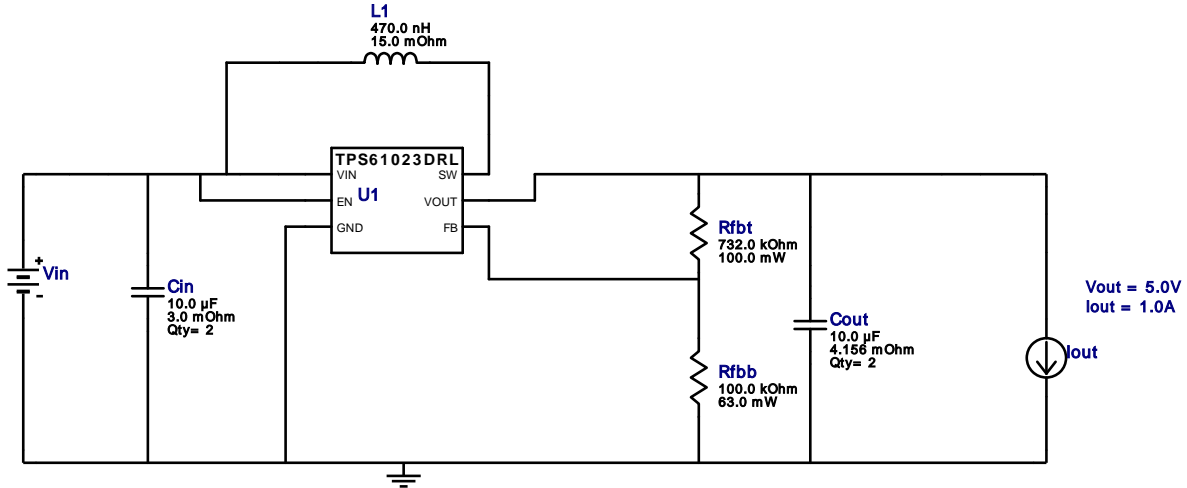


VinMin = 2.8V
VinMax = 4.4V
Vout = 5.0V
Iout = 1.0A

Device = TPS61023DRLR
Topology = Boost_PassThrough
Created = 2024-03-14 15:18:31.987
BOM Cost = \$1.16
BOM Count = 8
Total Pd = 0.5W

WEBENCH® Design Report

Design : 31 TPS61023DRLR
TPS61023DRLR 2.8V-4.4V to 5.00V @ 1A



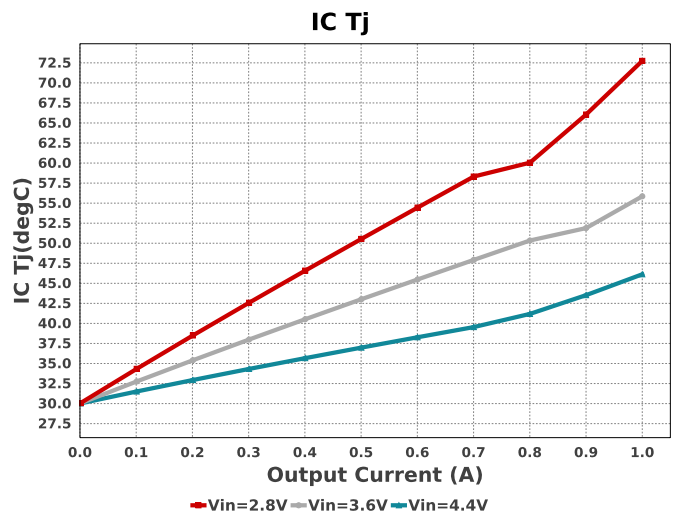
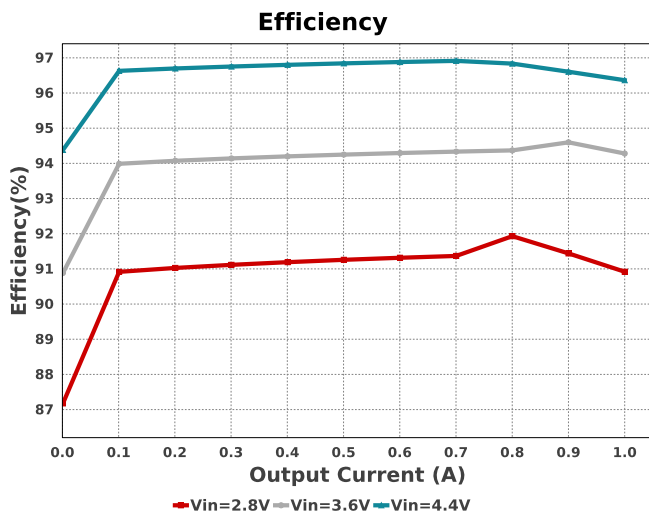
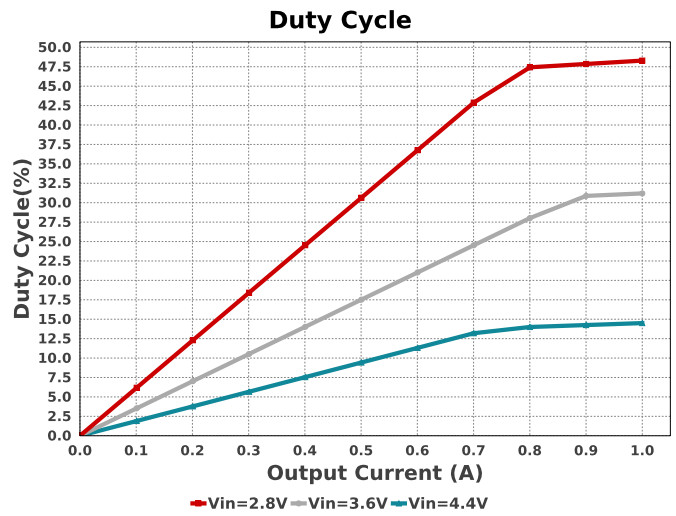
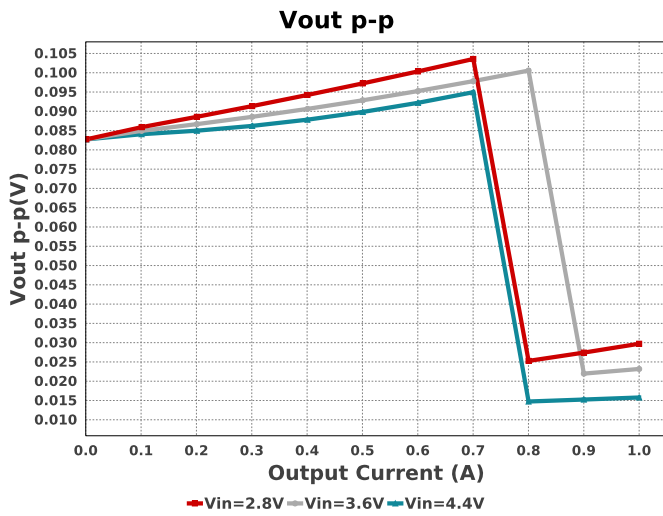
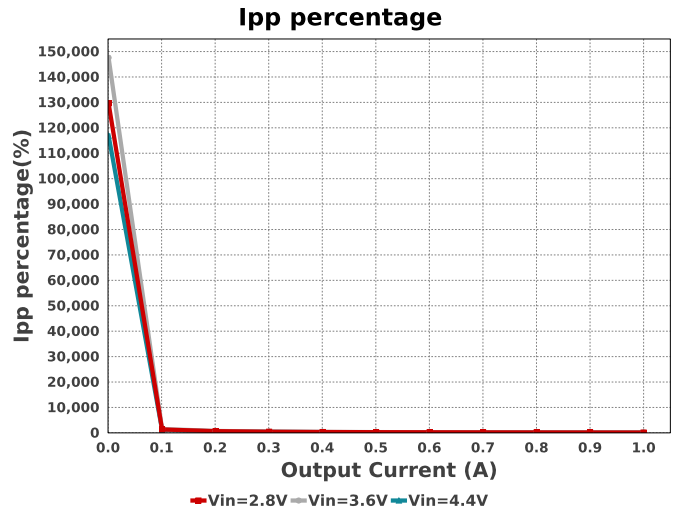
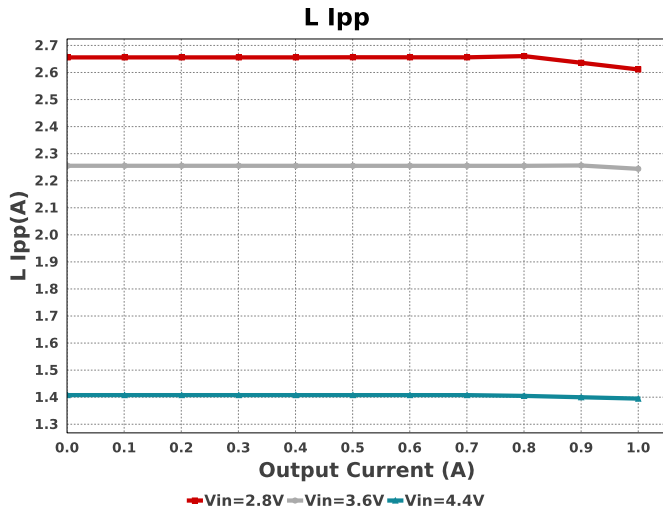
Design Alerts

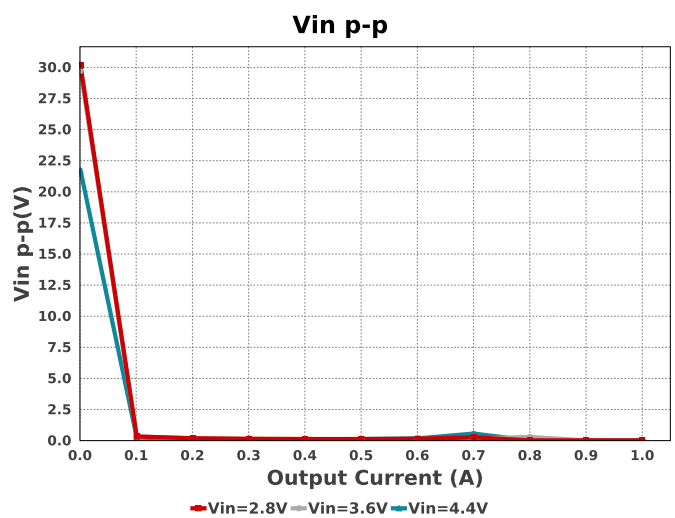
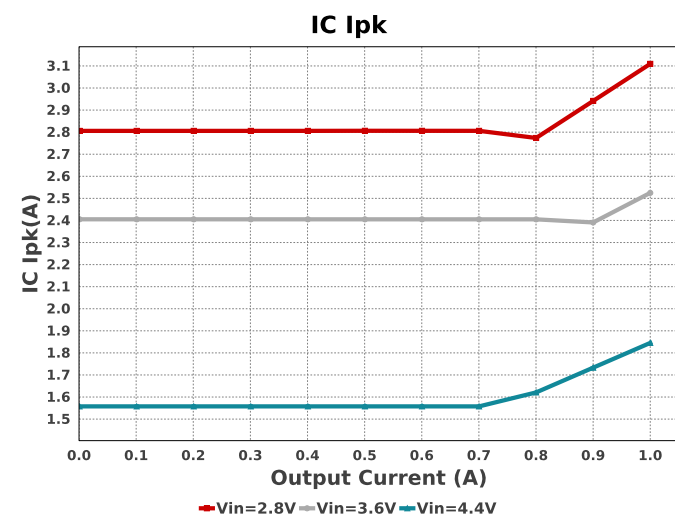
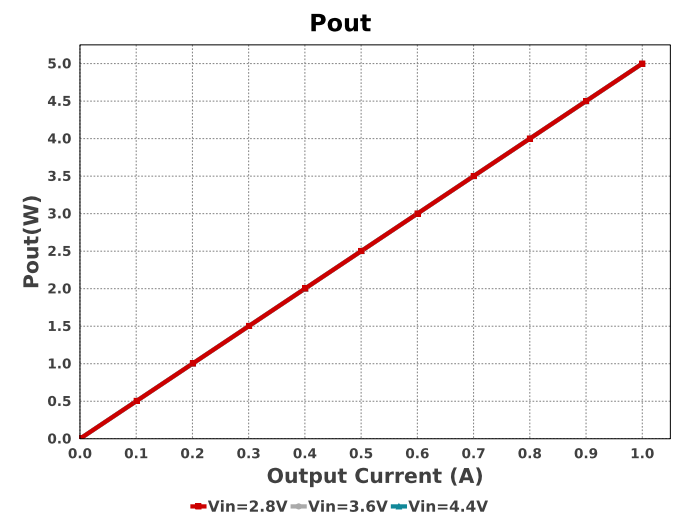
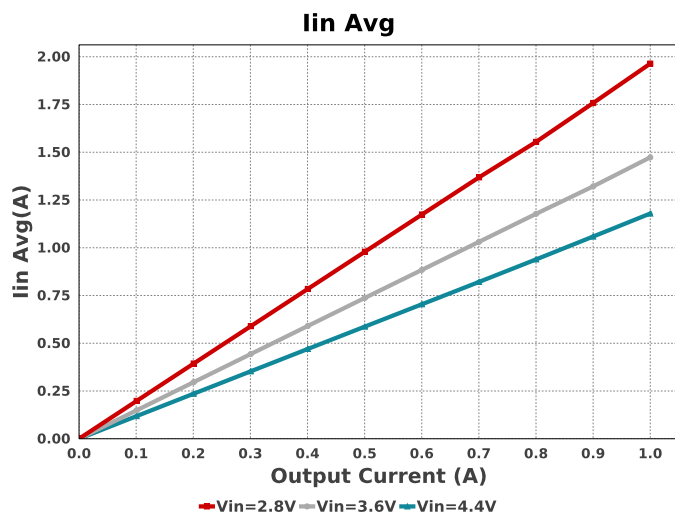
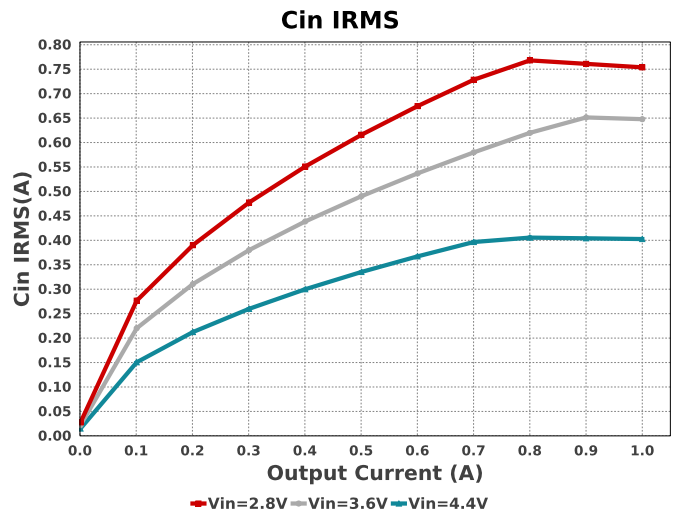
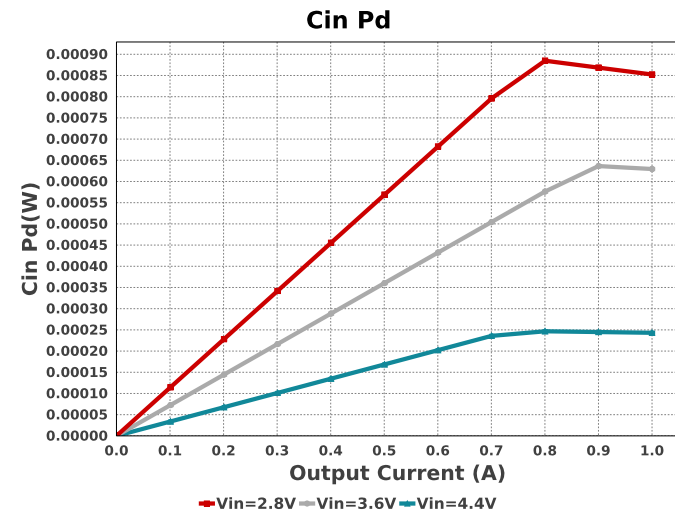
Component Selection Information

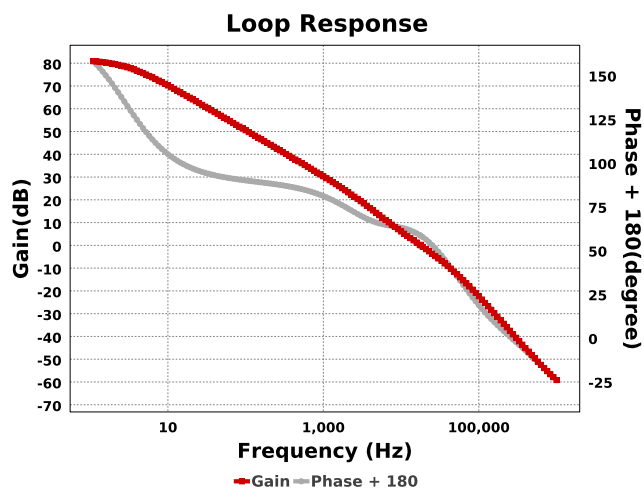
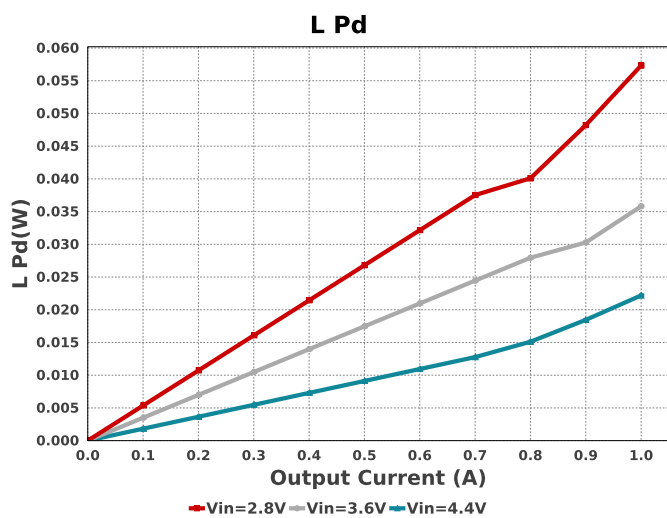
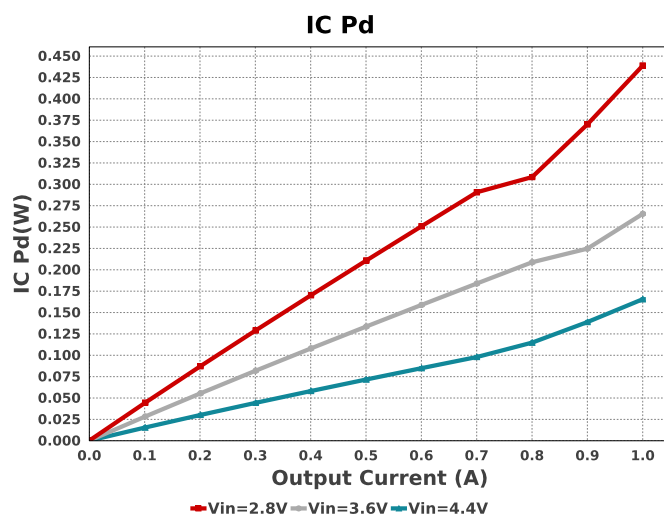
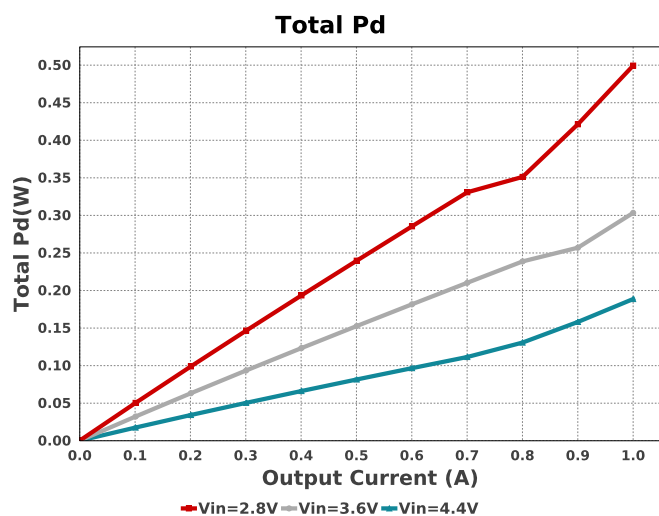
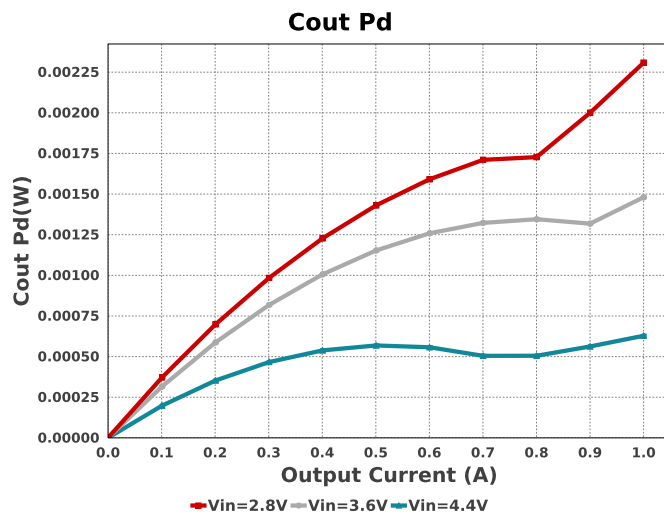
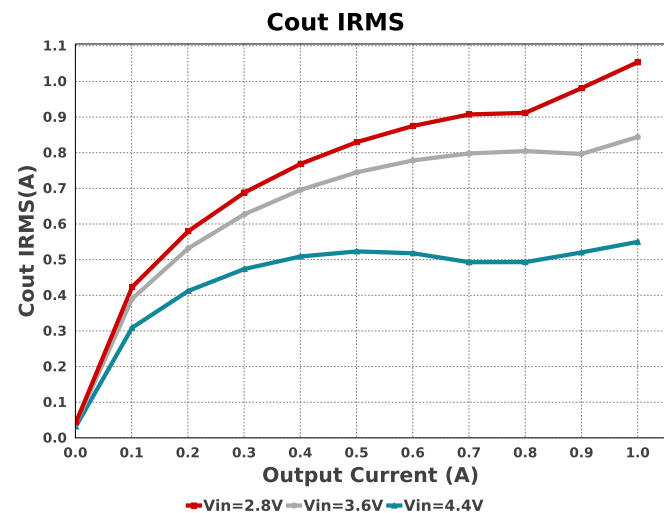
1. The TPS61023 Device will operate in Pass-Through mode when Vin is greater than Vout. In Pass-Through mode, Vout is not regulated to the set Vout, instead Vout is Vin with the drop across the FETs on-resistance and the DCR of the inductor. 2. This is a Boost Converter with 0.5V ultra-low input voltage.

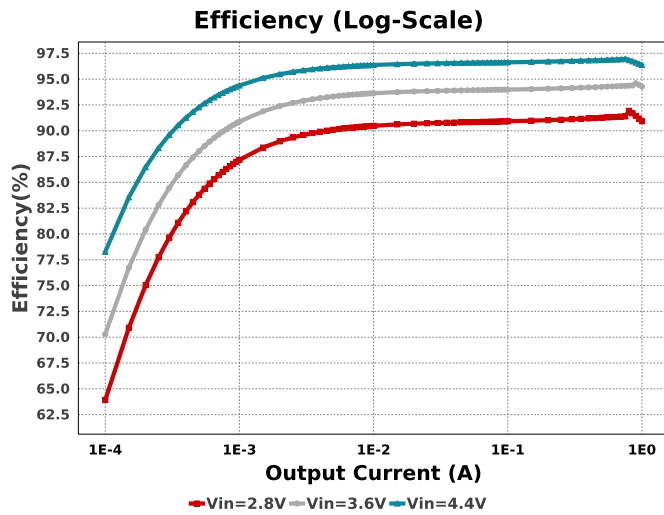
Electrical BOM

Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cin	Kemet	C0805C106K8PACTU Series= X5R	Cap= 10.0 uF ESR= 3.0 mOhm VDC= 10.0 V IRMS= 11.43 A	2	\$0.03	0805 7 mm ²
Cout	MuRata	GRM31CR71C106KAC7L Series= X7R	Cap= 10.0 uF ESR= 4.156 mOhm VDC= 16.0 V IRMS= 2.59073 A	2	\$0.08	1206_190 11 mm ²
L1	Vishay-Dale	IHLP1212AEERR47M11	L= 470.0 nH 15.0 mOhm	1	\$0.63	IHLP-1212AE 19 mm ²
Rfbb	Vishay-Dale	CRCW0402100KFKED Series= CRCW..e3	Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
Rfbt	Yageo	RC0603FR-07732KL Series= ?	Res= 732.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	0603 5 mm ²
U1	Texas Instruments	TPS61023DRLR	Switcher	1	\$0.29	DRL0006A 7 mm ²









Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	753.799 mA	Capacitor	Input capacitor RMS ripple current
2.	Cin Pd	852.32 μ W	Capacitor	Input capacitor power dissipation
3.	Cout IRMS	1.054 A	Capacitor	Output capacitor RMS ripple current
4.	Cout Pd	2.308 mW	Capacitor	Output capacitor power dissipation
5.	IC Ipk	3.109 A	IC	Peak switch current in IC
6.	IC Pd	438.88 mW	IC	IC power dissipation
7.	IC Tj	72.747 degC	IC	IC junction temperature
8.	IC Tolerance	19.0 mV	IC	IC Feedback Tolerance
9.	ICThetaJA	97.4 degC/W	IC	IC junction-to-ambient thermal resistance
10.	Iin Avg	1.964 A	IC	Average input current
11.	Ipp percentage	132.95 %	Inductor	Inductor ripple current percentage (with respect to average inductor current)
12.	L Ipp	2.611 A	Inductor	Peak-to-peak inductor ripple current
13.	L Pd	57.327 mW	Inductor	Inductor power dissipation
14.	Cin Pd	852.32 μ W	Power	Input capacitor power dissipation
15.	Cout Pd	2.308 mW	Power	Output capacitor power dissipation
16.	IC Pd	438.88 mW	Power	IC power dissipation
17.	L Pd	57.327 mW	Power	Inductor power dissipation
18.	Total Pd	499.408 mW	Power	Total Power Dissipation
19.	BOM Count	8	System	Total Design BOM count
20.	Cross Freq	11.777 kHz	System Information	Bode plot crossover frequency
21.	Duty Cycle	48.289 %	System Information	Duty cycle
22.	Efficiency	90.919 %	System Information	Steady state efficiency
23.	FootPrint	69.0 mm ²	System Information	Total Foot Print Area of BOM components
24.	Frequency	1.007 MHz	System Information	Switching frequency
25.	Gain Marg	-32.6 dB	System Information	Bode Plot Gain Margin
26.	Iout	1.0 A	System Information	Iout operating point
27.	Low Freq Gain	76.508 dB	System Information	Gain at 1Hz
28.	Mode	CCM	System Information	Conduction Mode
29.	Phase Marg	62.017 deg	System Information	Bode Plot Phase Margin
30.	Pout	5.0 W	System Information	Total output power
31.	Total BOM	\$1.16	System Information	Total BOM Cost
32.	Vin	2.8 V	System Information	Vin operating point
33.	Vin p-p	19.984 mV	System Information	Peak-to-peak input voltage
34.	Vout	5.0 V	System Information	Operational Output Voltage

#	Name	Value	Category	Description
35.	Vout Actual	4.992 V	System Information	Vout Actual calculated based on selected voltage divider resistors
36.	Vout Tolerance	5.0 %	System Information	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
37.	Vout p-p	29.718 mV	System Information	Peak-to-peak output ripple voltage

Design Inputs

Name	Value	Description
Iout	1.0	Maximum Output Current
VinMax	4.4	Maximum input voltage
VinMin	2.8	Minimum input voltage
Vout	5.0	Output Voltage
base_pn	TPS61023	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 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 2.8V 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 lout 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. Feature Highlights: 1. Device will operate in Pass-Through mode when V_{in} is greater than V_{out} . In Pass-Through mode, V_{out} is not regulated to the set V_{out} , instead V_{out} is V_{in} with the drop across the FET's $r_{DS(on)}$ and the DCR of the inductor. 2. Device will operate in PassThrough Mode When V_{in} is greater than V_{out}
2. Master key : 1CDCE4611E3710EC[v1]
3. **TPS61023** Product Folder : <http://www.ti.com/product/TPS61023> : contains the data sheet and other resources.

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