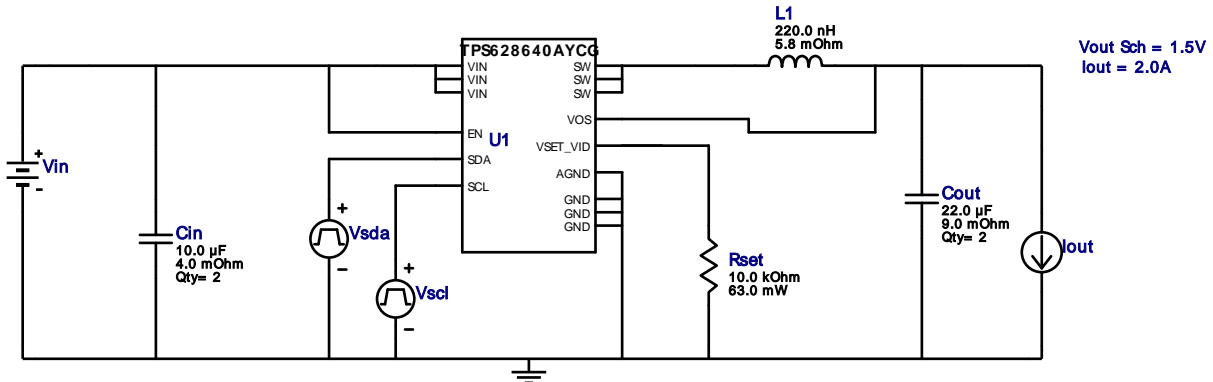


WEBENCH® Design Report

Design : 24 TPS628640AYCGR
TPS628640AYCGR 5V-5V to 1.50V @ 2A

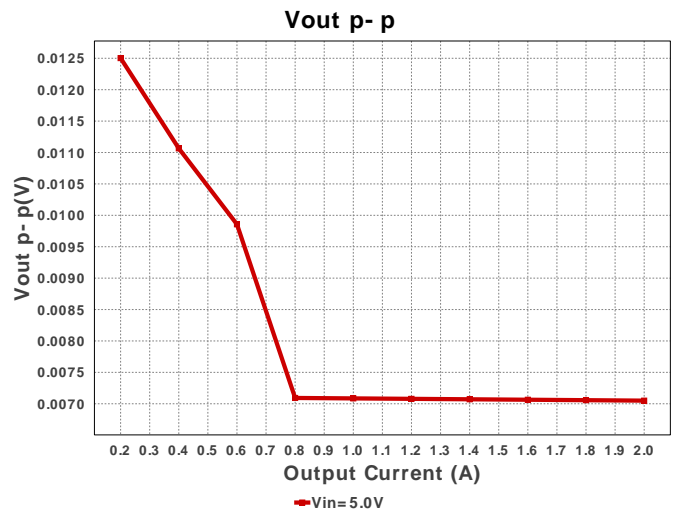
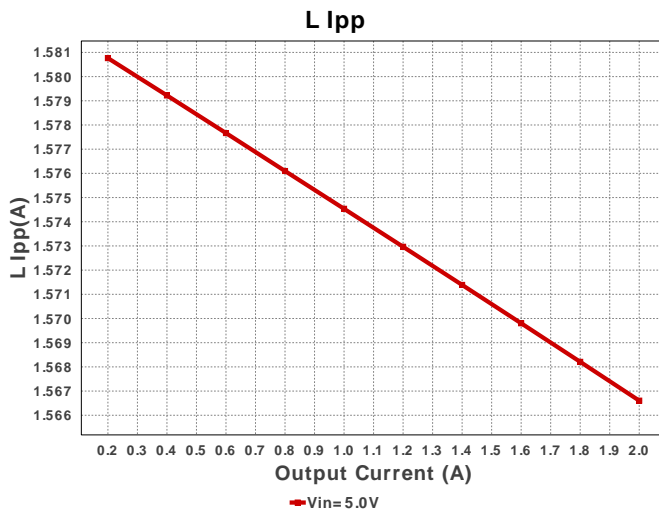
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VinMax = 5.0V
Vout = 1.5V
Vout Sch = 1.5V
Iout = 2.0A

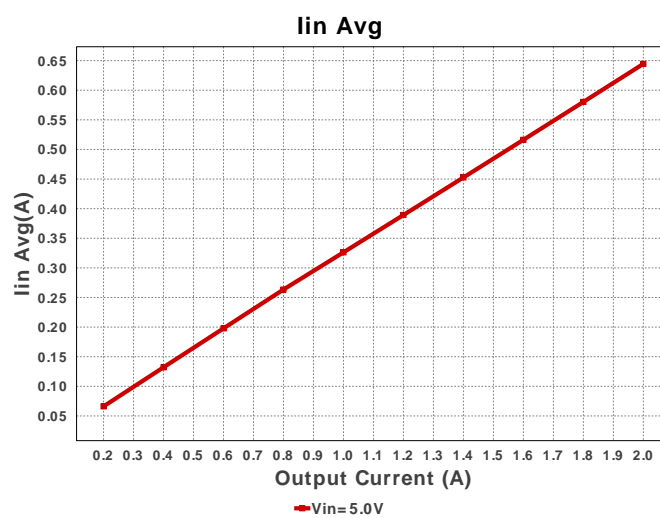
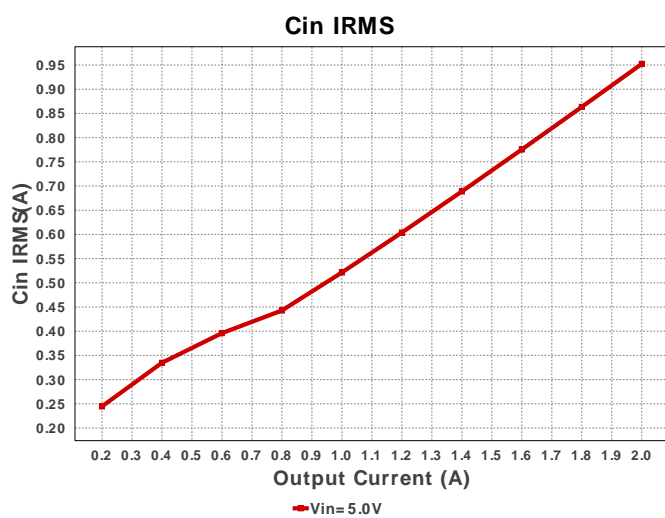
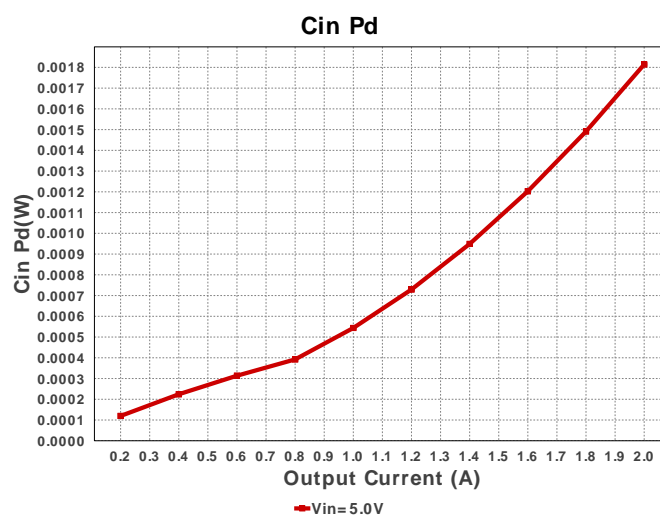
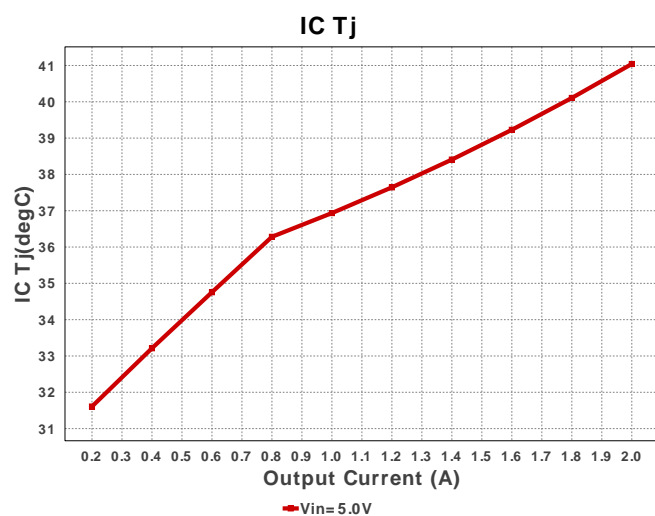
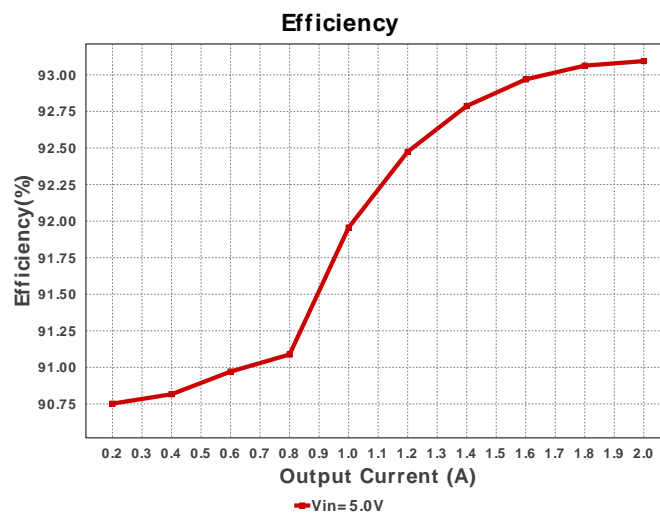
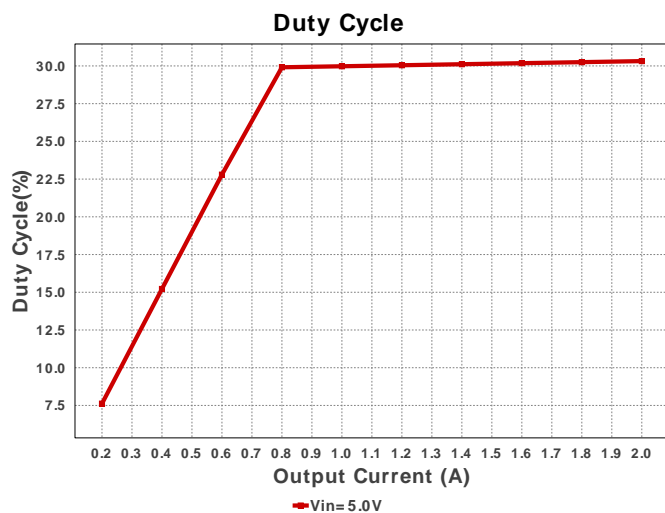
Device = TPS628640AYCGR
Topology = Buck
Created = 2020-10-28 10:15:43.808
BOM Cost = \$1.66
BOM Count = 7
Total Pd = 0.22W

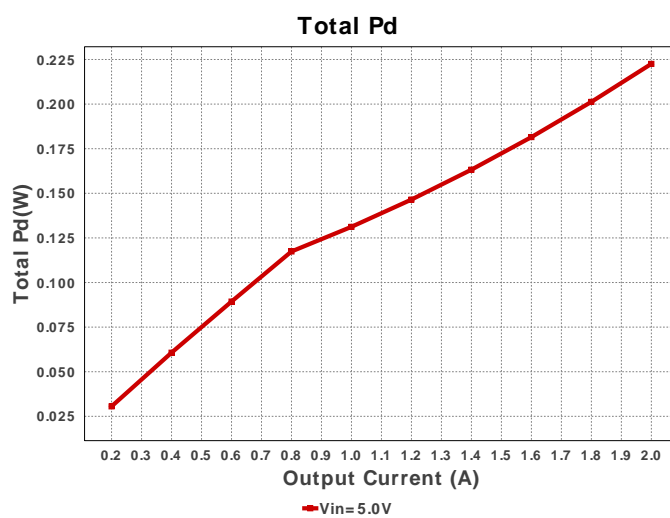
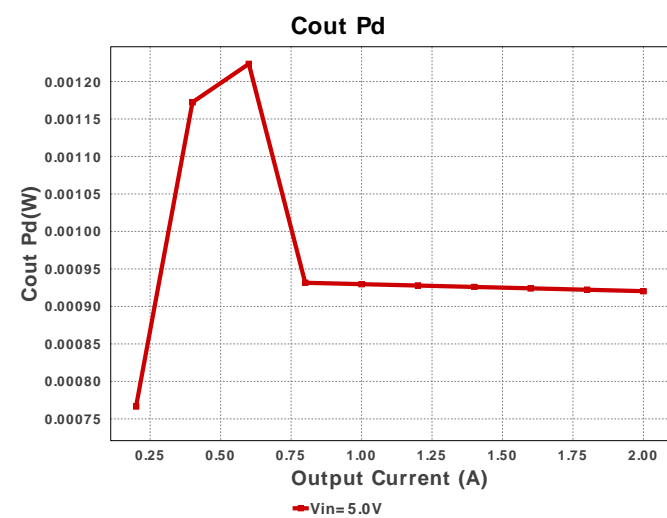
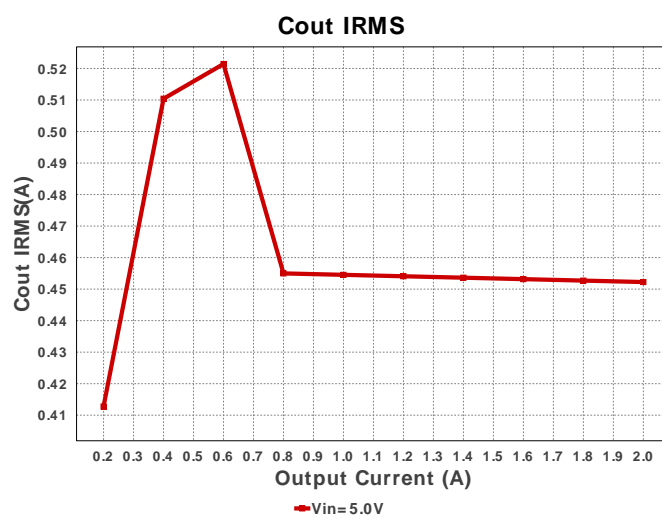
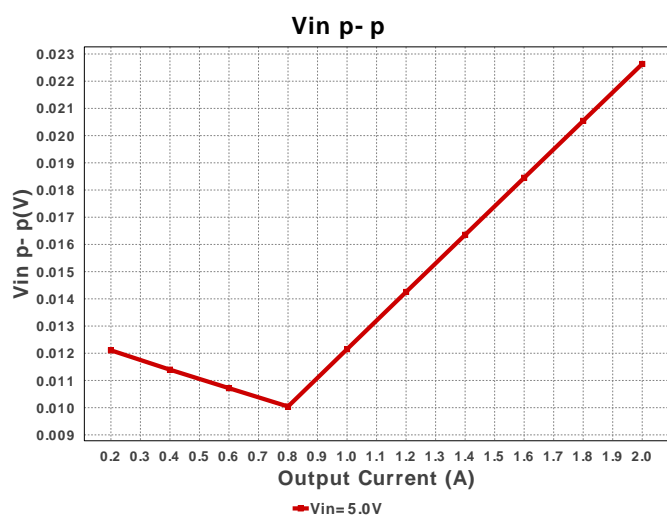
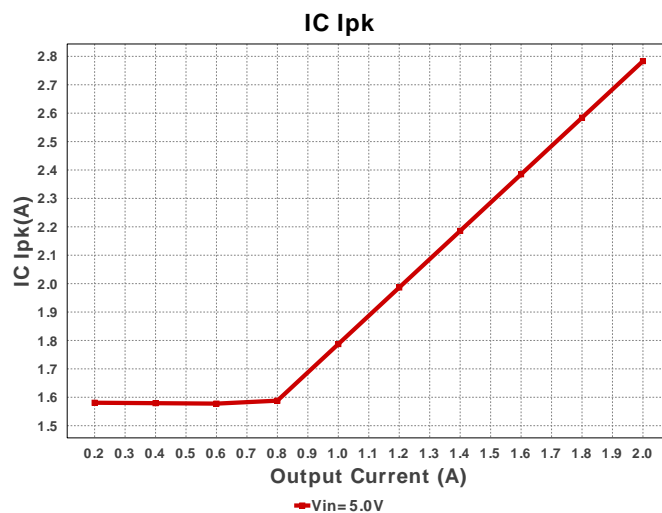
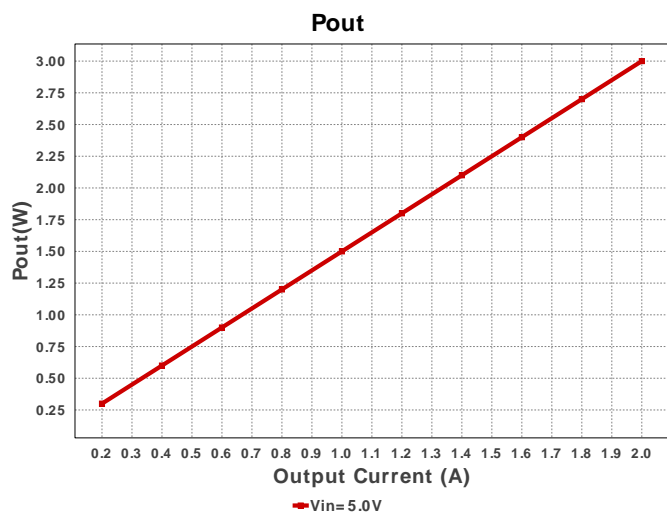


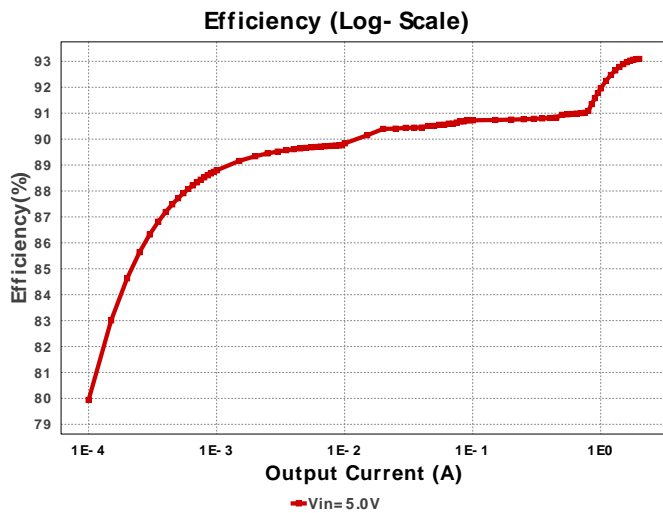
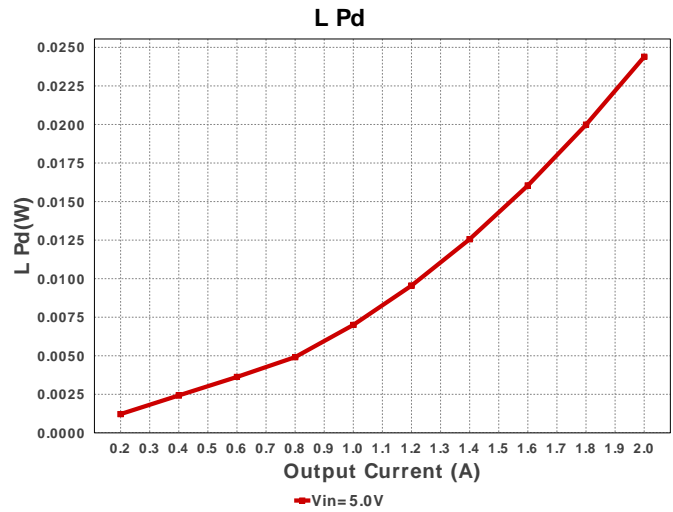
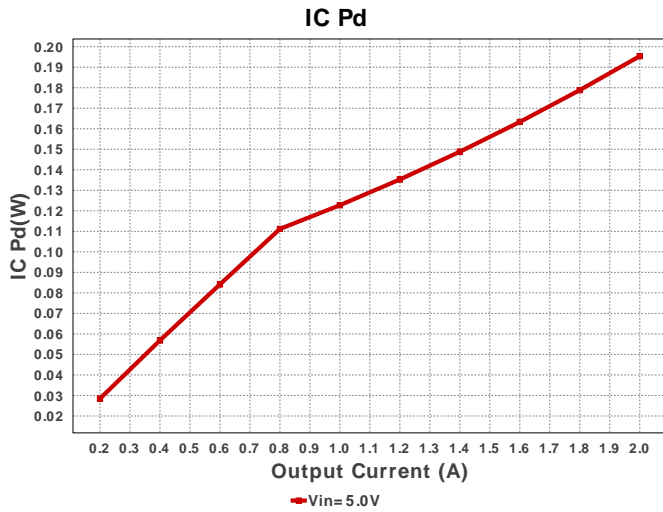
Electrical BOM

| Name | Manufacturer | Part Number | Properties | Qty | Price | Footprint |
|------|-------------------|--------------------------------------|--|-----|--------|-------------------------------|
| Cin | Kemet | C0603C106M9PACTU Series= X5R | Cap= 10.0 uF ESR= 4.0 mOhm VDC= 6.3 V IRMS= 8.9 A | 2 | \$0.10 | 0603 5 mm ² |
| Cout | MuRata | GRM21BR60J226ME39L Series= X5R | Cap= 22.0 uF ESR= 9.0 mOhm VDC= 6.3 V IRMS= 3.5 A | 2 | \$0.10 | 0805 7 mm ² |
| L1 | Coilcraft | XAL4020-221MEB | L= 220.0 nH 5.8 mOhm | 1 | \$0.60 | XAL4020 28 mm ² |
| Rset | Vishay-Dale | CRCW040210K0FKED Series= CRCW..e3 | Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0% | 1 | \$0.01 | 0402 3 mm ² |
| U1 | Texas Instruments | TPS628640AYCGR | Switcher | 1 | \$0.65 | YCG0015ACAC 6 mm ² |









Operating Values

| # | Name | Value | Category | Description |
|-----|---------------------|----------------------|-----------|---|
| 1. | BOM Count | 7 | | Total Design BOM count |
| 2. | Total BOM | \$1.661 | | Total BOM Cost |
| 3. | Cin IRMS | 952.411 mA | Capacitor | Input capacitor RMS ripple current |
| 4. | Cin Pd | 1.814 mW | Capacitor | Input capacitor power dissipation |
| 5. | Cout IRMS | 452.24 mA | Capacitor | Output capacitor RMS ripple current |
| 6. | Cout Pd | 920.34 μ W | Capacitor | Output capacitor power dissipation |
| 7. | IC Ipk | 2.783 A | IC | Peak switch current in IC |
| 8. | IC Pd | 195.42 mW | IC | IC power dissipation |
| 9. | IC Tj | 41.041 degC | IC | IC junction temperature |
| 10. | ICThetaJA Effective | 56.5 degC/W | IC | Effective IC Junction-to-Ambient Thermal Resistance |
| 11. | Iin Avg | 644.51 mA | IC | Average input current |
| 12. | L Ipp | 1.567 A | Inductor | Peak-to-peak inductor ripple current |
| 13. | L Pd | 24.386 mW | Inductor | Inductor power dissipation |
| 14. | Cin Pd | 1.814 mW | Power | Input capacitor power dissipation |
| 15. | Cout Pd | 920.34 μ W | Power | Output capacitor power dissipation |
| 16. | IC Pd | 195.42 mW | Power | IC power dissipation |
| 17. | L Pd | 24.386 mW | Power | Inductor power dissipation |
| 18. | Total Pd | 222.549 mW | Power | Total Power Dissipation |
| 19. | Duty Cycle | 30.32 % | System | Duty cycle |
| 20. | Efficiency | 93.094 % | System | Steady state efficiency |
| 21. | FootPrint | 60.0 mm ² | System | Total Foot Print Area of BOM components |
| 22. | Frequency | 3.048 MHz | System | Switching frequency |
| 23. | Iout | 2.0 A | System | Iout operating point |
| 24. | Mode | CCM | System | Conduction Mode |
| 25. | Pout | 3.0 W | System | Total output power |

| # | Name | Value | Category | Description |
|-----|----------------|-----------|--------------------|------------------------------------|
| 26. | Vin | 5.0 V | System Information | Vin operating point |
| 27. | Vin p-p | 22.633 mV | System Information | Peak-to-peak input voltage |
| 28. | Vout | 1.5 V | System Information | Operational Output Voltage |
| 29. | Vout Tolerance | 1.0 % | System Information | Vout Tolerance (no load, PWM mode) |
| 30. | Vout p-p | 7.05 mV | System Information | Peak-to-peak output ripple voltage |

Design Inputs

| | Name | Value | Description |
|----|----------|------------|-------------------------|
| | Iout | 2.0 | Maximum Output Current |
| | VinMax | 5.0 | Maximum input voltage |
| | VinMin | 5.0 | Minimum input voltage |
| | VinTyp | 5.0 | Typical input voltage |
| | Vout | 1.5 | Output Voltage |
| | base_pn | TPS628640A | Base Product Number |
| | source | DC | Input Source Type |
| | Ta | 30.0 | Ambient temperature |
| 1. | Vout Sch | 1.5 | Output voltage selected |

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 5.0V 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 : 24CF39F1B9722FBB[v1]
2. **TPS628640A** Product Folder : <http://www.ti.com/product/TPS62866> : contains the data sheet and other resources.

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