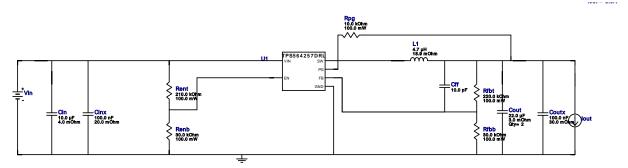


WEBENCH® Design Report

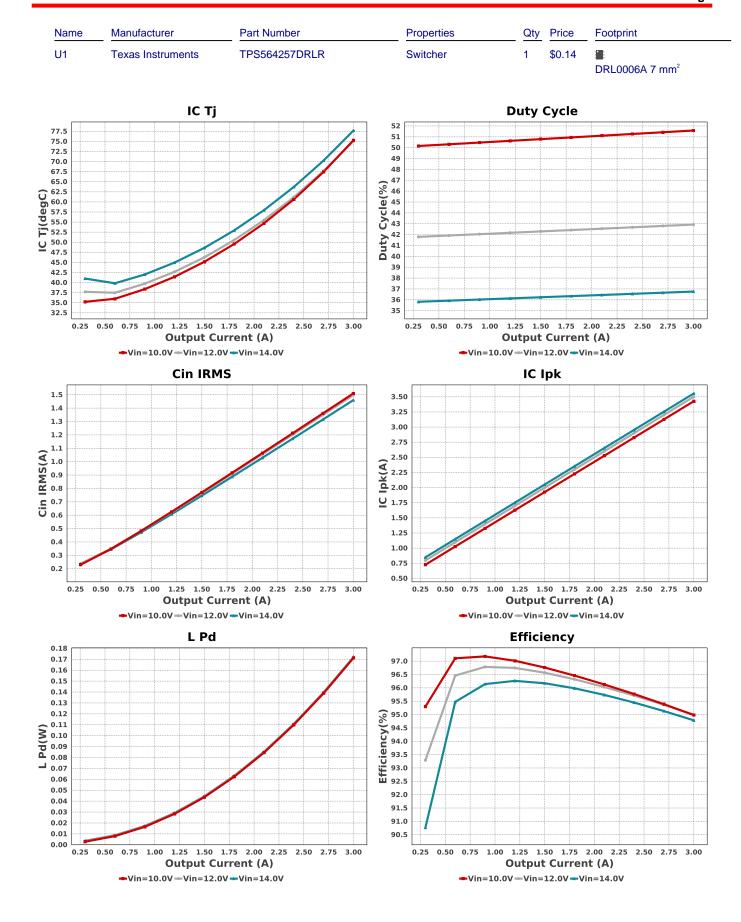
VinMin = 10.0V VinMax = 14.0V Vout = 5.0V Iout = 3.0A Device = TPS564257DRLR Topology = Buck Created = 2025-05-11 18:59:32.469 BOM Cost = \$0.94 BOM Count = 13 Total Pd = 0.83W

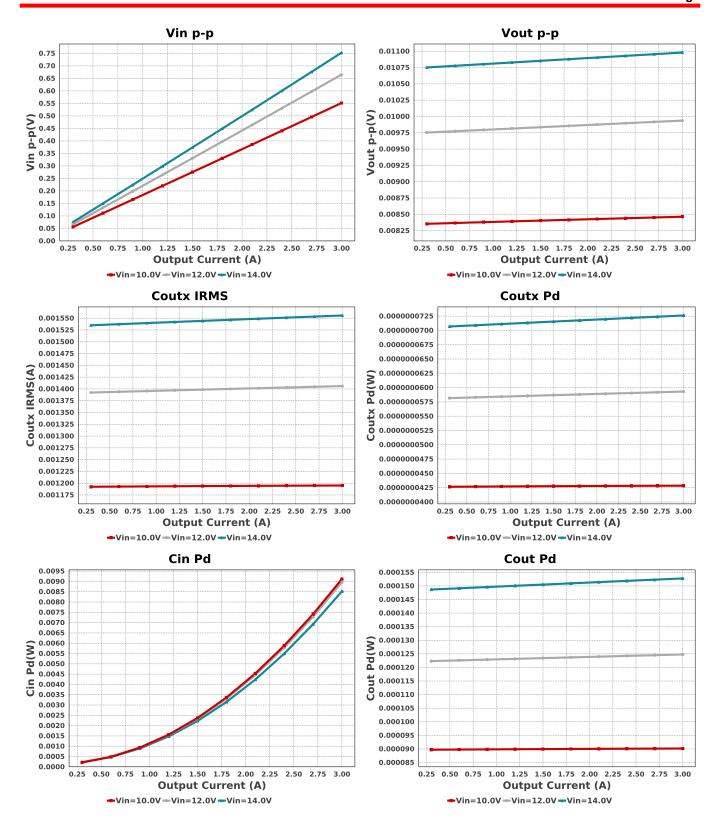
Design: 5 TPS564257DRLR TPS564257DRLR 10V-14V to 5.00V @ 3A

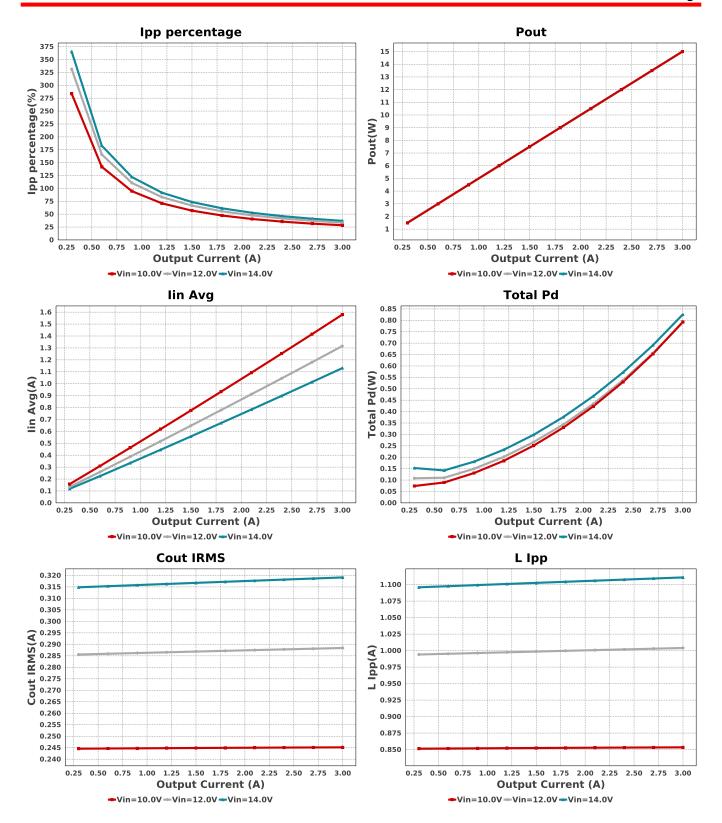


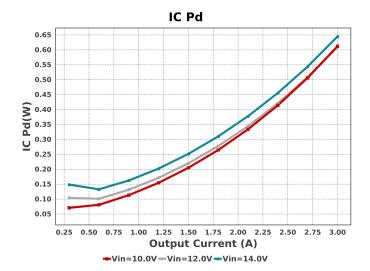
Electrical BOM

| Name | Manufacturer | Part Number | Properties | Qty | Price | Footprint |
|-------|--------------|---------------------------------------|--|-----|--------|------------------------------|
| Cff | MuRata | GRM1555C1H100GA01D Series= C0G/NP0 | Cap= 10.0 pF VDC= 50.0 V IRMS= 0.0 A | 1 | \$0.01 | 0402 3 mm ² |
| Cin | MuRata | GRM21BR61E106MA73L Series= X5R | Cap= 10.0 uF ESR= 4.0 mOhm VDC= 25.0 V IRMS= 2.8 A | 1 | \$0.04 | 0805 7 mm ² |
| Cinx | MuRata | GRM188R71H104KA93D Series= X7R | Cap= 100.0 nF ESR= 20.0 mOhm VDC= 50.0 V IRMS= 3.8 A | 1 | \$0.02 | 0603 5 mm ² |
| Cout | MuRata | GRM21BR61A226ME44L Series= X5R | Cap= 22.0 uF ESR= 3.0 mOhm VDC= 10.0 V IRMS= 3.84 A | 2 | \$0.09 | 0805 7 mm ² |
| Coutx | MuRata | GRM188R71E104KA01D Series= X7R | Cap= 100.0 nF ESR= 30.0 mOhm VDC= 25.0 V IRMS= 1.51 A | 1 | \$0.01 | 0603 5 mm ² |
| L1 | TDK | CLF10040T-4R7N | L= 4.7 μH 18.9 mOhm | 1 | \$0.49 | CLF10040 148 mm ² |
| Renb | Yageo | RC0603FR-0730KL Series= ? | Res= 30.0 kOhm Power= 100.0 mW Tolerance= 1.0% | 1 | \$0.01 | 0603 5 mm ² |
| Rent | Vishay-Dale | CRCW0603210KFKEA Series= CRCWe3 | Res= 210.0 kOhm Power= 100.0 mW Tolerance= 1.0% | 1 | \$0.01 | 0603 5 mm ² |
| Rfbb | Yageo | RC0603FR-0730KL Series= ? | Res= 30.0 kOhm Power= 100.0 mW Tolerance= 1.0% | 1 | \$0.01 | 0603 5 mm ² |
| Rfbt | Yageo | RC0603FR-07220KL Series= ? | Res= 220.0 kOhm Power= 100.0 mW Tolerance= 1.0% | 1 | \$0.01 | 0603 5 mm ² |
| Rpg | Vishay-Dale | CRCW060310K0FKEA Series= CRCWe3 | Res= 10.0 kOhm Power= 100.0 mW Tolerance= 1.0% | 1 | \$0.01 | 0603 5 mm ² |









Operating Values

| - | raining valuoo | | | |
|-----|---------------------|-----------------------|-------------|--|
| # | Name | Value | Category | Description |
| 1. | BOM Count | 13 | | Total Design BOM count |
| 2. | Total BOM | \$0.94 | | Total BOM Cost |
| 3. | Cin IRMS | 1.459 A | Capacitor | Input capacitor RMS ripple current |
| 4. | Cin Pd | 8.52 mW | Capacitor | Input capacitor power dissipation |
| 5. | Cout IRMS | 319.121 mA | Capacitor | Output capacitor RMS ripple current |
| 6. | Cout Pd | 152.76 μW | Capacitor | Output capacitor power dissipation |
| 7. | Coutx IRMS | 1.556 mA | Capacitor | Output capacitor_x RMS ripple current |
| 8. | Coutx Pd | 72.612 nW | Capacitor | Output capacitor_x power loss |
| 9. | IC lpk | 3.555 A | IC ' | Peak switch current in IC |
| 10. | IC Pd | 644.63 mW | IC | IC power dissipation |
| 11. | IC Ti | 77.703 degC | IC | IC junction temperature |
| 12. | IC Tolerance | 6.0 mV | IC | IC Feedback Tolerance |
| 13. | ICThetaJA Effective | 74.0 degC/W | IC | IC junction-to-ambient thermal resistance with TI EVM |
| 14. | | 1.13 A | IC | Average input current |
| 15. | lpp percentage | 37.029 % | Inductor | Inductor ripple current percentage (with respect to average inductor |
| | 11. 1 | | | current) |
| 16. | L lpp | 1.111 A | Inductor | Peak-to-peak inductor ripple current |
| | L Pd | 172.04 mW | Inductor | Inductor power dissipation |
| | Cin Pd | 8.52 mW | Power | Input capacitor power dissipation |
| | Cout Pd | 152.76 μW | Power | Output capacitor power dissipation |
| | Coutx Pd | 72.612 nW | Power | Output capacitor_x power loss |
| | IC Pd | 644.63 mW | Power | IC power dissipation |
| | L Pd | 172.04 mW | Power | Inductor power dissipation |
| 23. | Total Pd | 825.463 mW | Power | Total Power Dissipation |
| 24. | Duty Cycle | 36.758 % | System | Duty cycle |
| | zaty cycle | 33.733 73 | Information | 24, 0,00 |
| 25. | Efficiency | 94.784 % | System | Steady state efficiency |
| _0. | Zillololloy | 0 1.7 0 1 70 | Information | cloudy diale difficiency |
| 26. | FootPrint | 210.0 mm ² | System | Total Foot Print Area of BOM components |
| _0. | 7 0011 11111 | 210.0111111 | Information | Total Foot Fill Michigan Components |
| 27. | Frequency | 619.766 kHz | System | Switching frequency |
| | Troquonoy | 010.700 1412 | Information | Cintorning requestoy |
| 28. | lout | 3.0 A | System | lout operating point |
| _0. | | 0.071 | Information | .ou. opo.ug ponit |
| 29. | Mode | CCM | System | Conduction Mode |
| _0. | 540 | | Information | 5.1.665.011 MOGO |
| 30. | Pout | 15.0 W | System | Total output power |
| 50. | Tout | 10.0 VV | Information | Total output power |
| 31. | Vin | 14.0 V | System | Vin operating point |
| 51. | VIII | 14.0 V | Information | viii operating point |
| 32. | Vin p-p | 752.812 mV | System | Peak-to-peak input voltage |
| ٥٧. | VIII P P | 702.012 1117 | Information | T can to peak input voltage |
| 33 | Vout | 5.0 V | System | Operational Output Voltage |
| 55. | v Jul | 0.0 v | Information | Operational Output Voltage |
| 34. | Vout Actual | 5.0 V | System | Vout Actual calculated based on selected voltage divider resistors |
| 34. | vout Actual | 5.0 V | Information | Vout Actual calculated based on selected voltage divider resistors |
| 25 | Vout Toloropoo | 2 706 % | | Vout Talarance hand on IC Talarance (no load) and valence divide |
| 35. | Vout Tolerance | 2.796 % | System | Vout Tolerance based on IC Tolerance (no load) and voltage divide |
| 26 | Vout n. n | 10.00\/ | Information | resistors if applicable |
| 36. | Vout p-p | 10.98 mV | System | Peak-to-peak output ripple voltage |
| | | | Information | |

Design Inputs

| Name | Value | Description | |
|---------|-----------|------------------------|--|
| lout | 3.0 | Maximum Output Current | |
| VinMax | 14.0 | Maximum input voltage | |
| VinMin | 10.0 | Minimum input voltage | |
| Vout | 5.0 | Output Voltage | |
| base_pn | TPS564257 | Base Product Number | |
| source | DC | Input Source Type | |
| Та | 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 10.0V 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 lout 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.

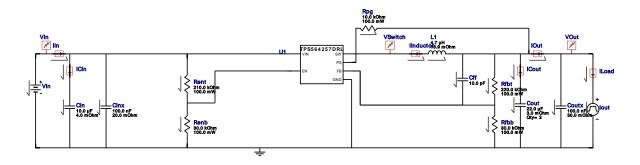


WEBENCH[®] Electrical Simulation Report

Design Id = 5

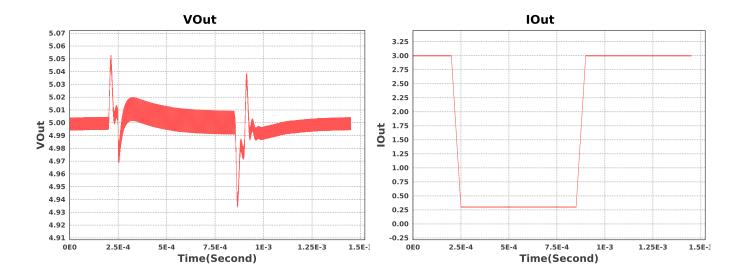
 $sim_id = 2$

Simulation Type = Load Transient



Simulation Parameters

| # | Name | Parameter Name | Description | Values 3.0 A | |
|----|------|----------------|----------------------|--------------|--|
| 1. | L1 | IC | Initial Current | | |
| 2. | Cout | IC | Initial Condition | 5.0 V | |
| 3. | lout | signal_type | Signal Type | PULSE | |
| | | 11 | Initial Load Current | 3.0 A | |
| | | 12 | Minimum Load Current | 0.3 A | |
| | | Td | Initial Time Delay | 200u s | |
| | | Tf | Fall Time | 50u s | |
| | | Tr | Rise Time | 50u s | |
| | | Pw | Pulse Width | 600u s | |



Design Assistance

- 1. Master key : 18FBDA0AEA9912E2E0CEDE85DFD76F26[v1]
- 2. TPS564257 Product Folder: https://www.ti.com/product/TPS564257: contains the data sheet and other resources.

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