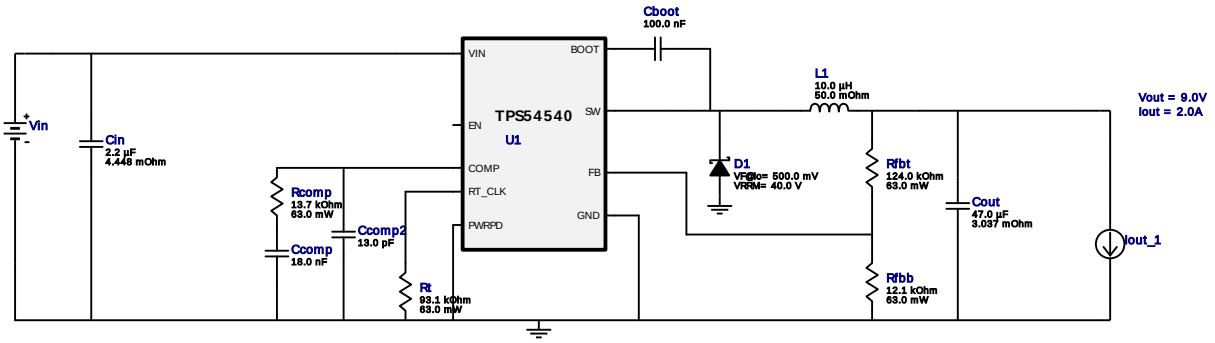
# WEBENCH® Design Report

VinMin = 15.0V
VinMax = 18.0V
Vout = 9.0V
Iout = 2.0A

Device = TPS54540DDAR
Topology = Buck
Created = 9/23/16 1:18:16 AM
BOM Cost = $2.64
BOM Count = 12
Total Pd = 1.07W

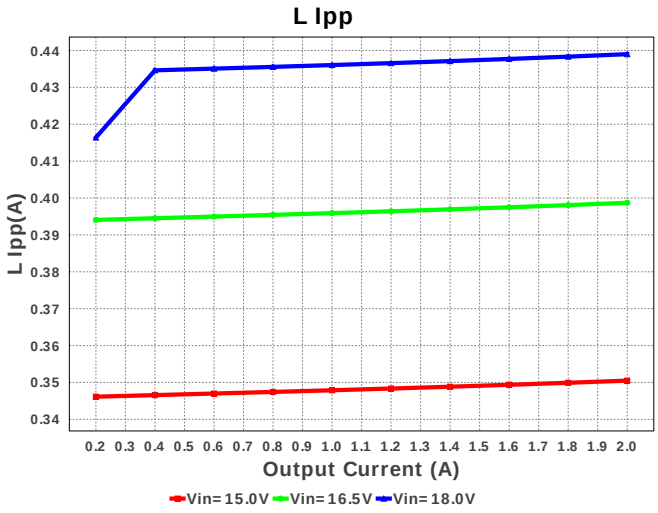
Design : 4801973/5 TPS54540DDAR
TPS54540DDAR 15.0V-18.0V to 9.00V @ 2.0A

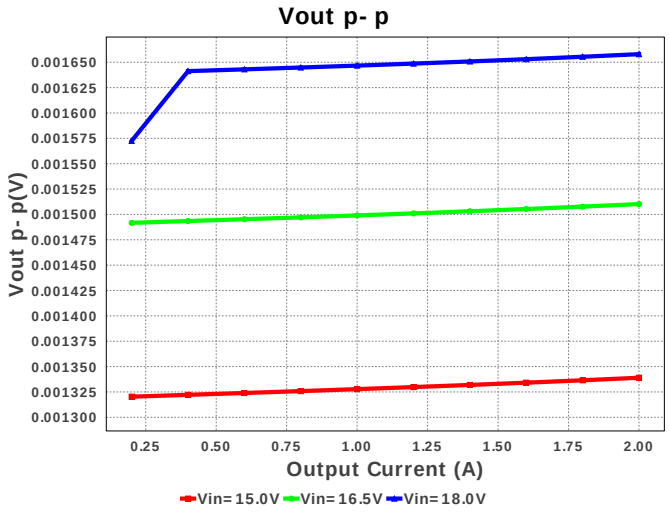


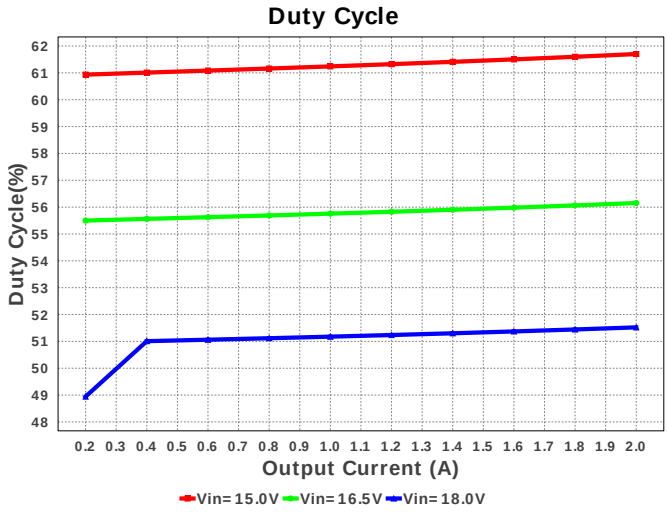

## Electrical BOM

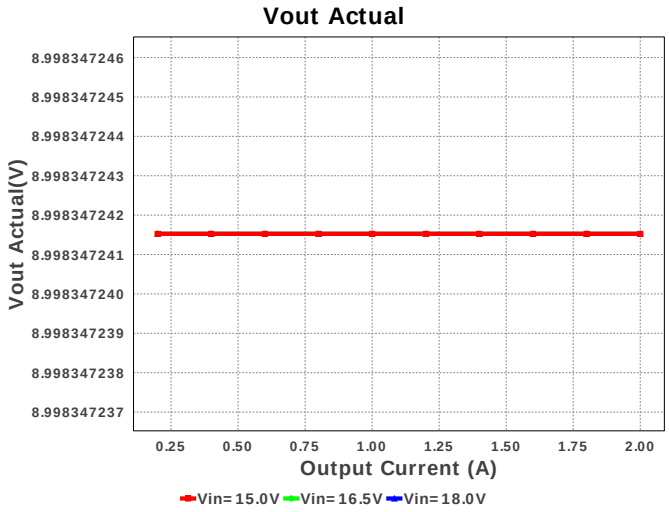
| # | Name | Manufacturer | Part Number | Properties | Qty | Price | Footprint |
|---|---|---|---|---|---|---|---|
| 1. | Cboot | MuRata | GRM155R61A104KA01D<br>Series= X5R | Cap= 100.0 nF<br>VDC= 10.0 V<br>IRMS= 0.0 A | 1 | $0.01 | 0402 3 mm² |
| 2. | Ccomp | Yageo America | CC0805KRX7R9BB183<br>Series= X7R | Cap= 18.0 nF<br>VDC= 50.0 V<br>IRMS= 0.0 A | 1 | $0.01 | 0805 7 mm² |
| 3. | Ccomp2 | Samsung Electro-Mechanics | CL21C130JBANNNC<br>Series= C0G/NP0 | Cap= 13.0 pF<br>VDC= 50.0 V<br>IRMS= 0.0 A | 1 | $0.01 | 0805 7 mm² |
| 4. | Cin | MuRata | GRM31CR71H225KA88L<br>Series= X7R | Cap= 2.2 uF<br>ESR= 4.448 mOhm<br>VDC= 50.0 V<br>IRMS= 2.2252 A | 1 | $0.05 | 1206_190 11 mm² |
| 5. | Cout | MuRata | GRM32ER61C476ME15L<br>Series= X5R | Cap= 47.0 uF<br>ESR= 3.037 mOhm<br>VDC= 16.0 V<br>IRMS= 4.59346 A | 1 | $0.24 | 1210_280 15 mm² |
| 6. | D1 | Diodes Inc. | B340A-13-F | VF@Io= 500.0 mV<br>VRRM= 40.0 V | 1 | $0.11 | SMA 37 mm² |
| 7. | L1 | Bourns | SRN8040-100M | L= 10.0 µH<br>DCR= 50.0 mOhm | 1 | $0.22 | SRN8040 100 mm² |
| 8. | Rcomp | Vishay-Dale | CRCW040213K7FKED<br>Series= CRCW..e3 | Res= 13.7 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | 0402 3 mm² |
| 9. | Rfbb | Vishay-Dale | CRCW040212K1FKED<br>Series= CRCW..e3 | Res= 12.1 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | 0402 3 mm² |
| 10. | Rfbt | Vishay-Dale | CRCW0402124KFKED<br>Series= CRCW..e3 | Res= 124.0 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | 0402 3 mm² |
| 11. | Rt | Vishay-Dale | CRCW040293K1FKED<br>Series= CRCW..e3 | Res= 93.1 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | 0402 3 mm² |

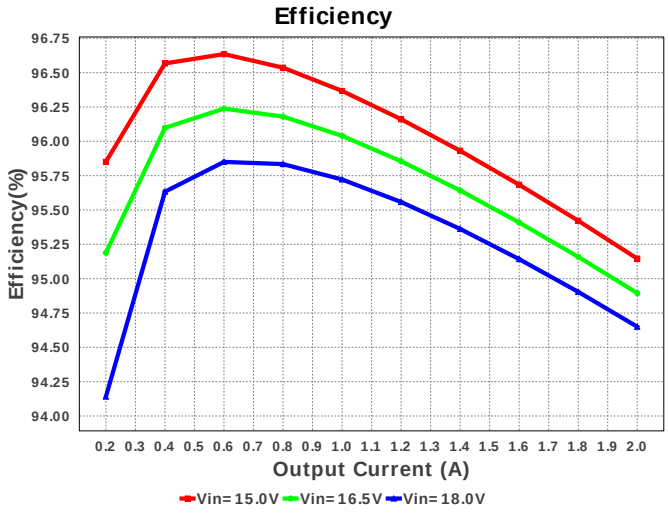
| # | Name | Manufacturer | Part Number | Properties | Qty | Price | Footprint |
|---|---|---|---|---|---|---|---|
| 12. | U1 | Texas Instruments | TPS54540DDAR | Switcher | 1 | $1.95 |  R-PDSO-G8 55 mm$^2$ |

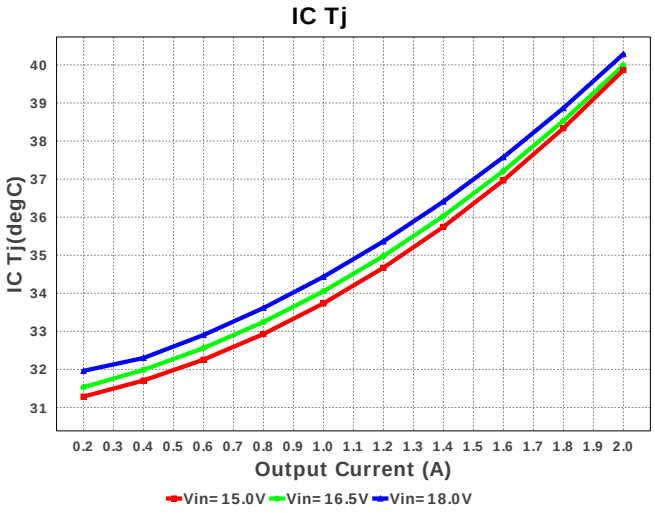


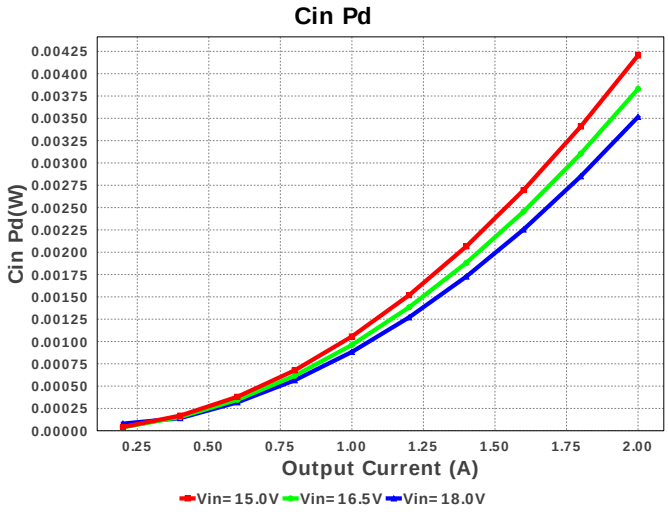



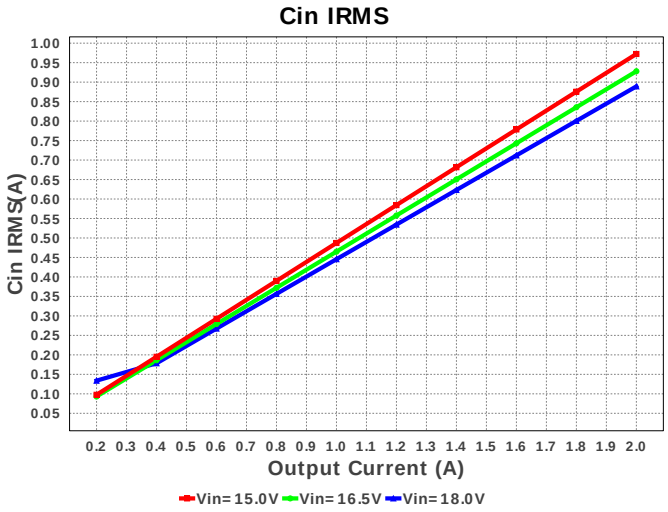



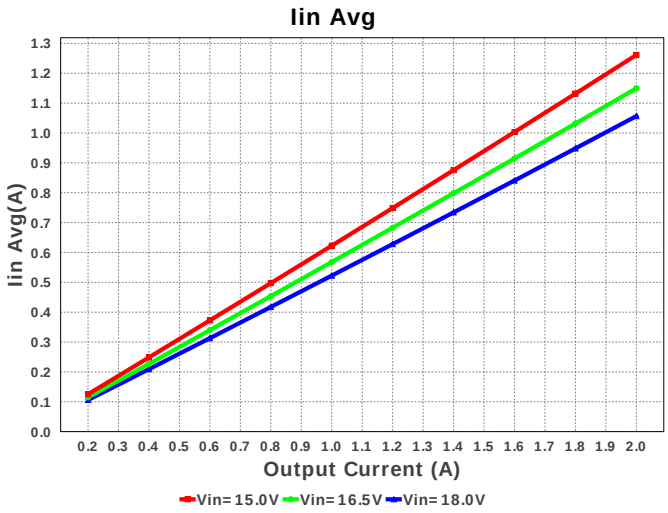



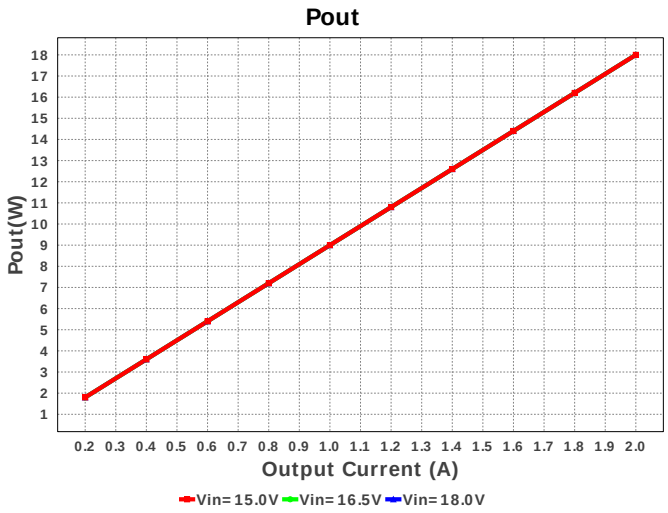


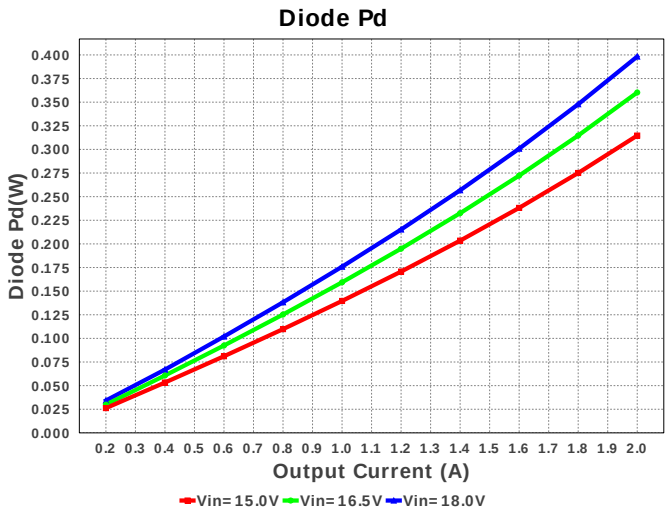



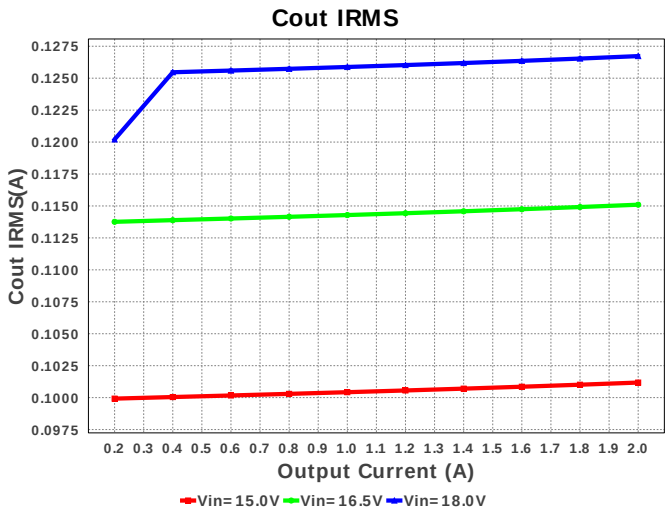



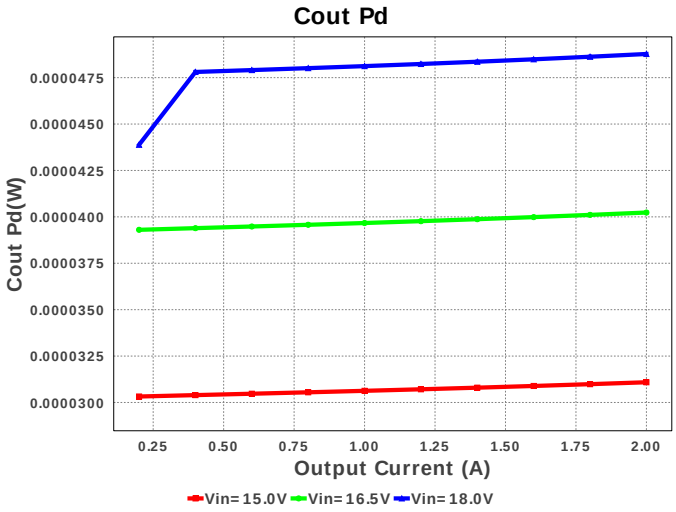



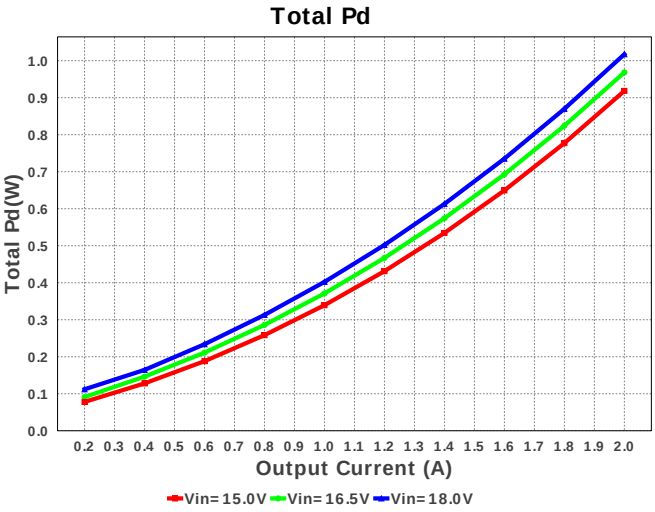



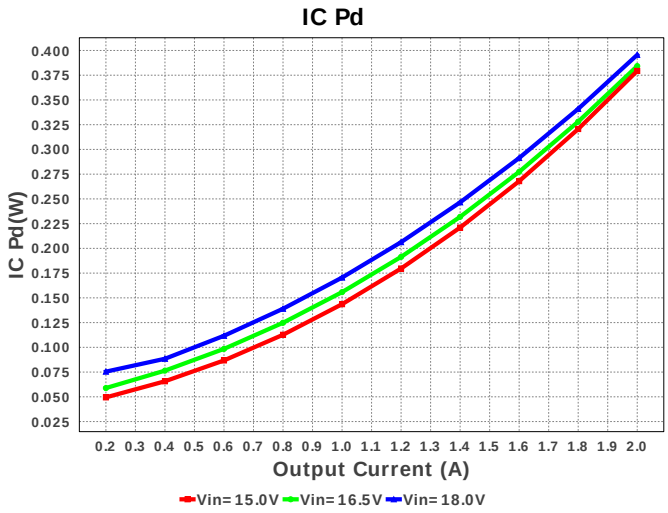



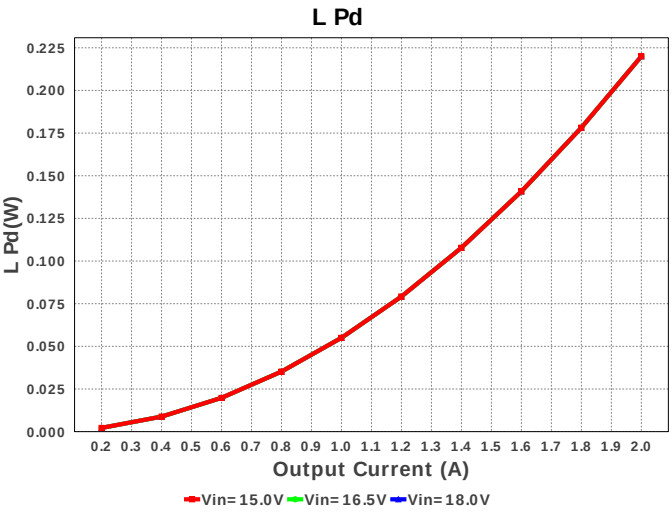


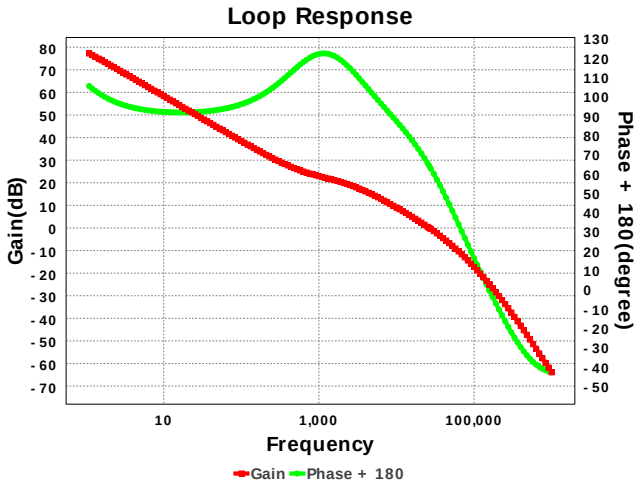






## Operating Values

| # | Name | Value | Category | Description |
|---|---|---|---|---|
| 1. | Cin IRMS | 888.728 mA | Current | Input capacitor RMS ripple current |
| 2. | Cout IRMS | 127.058 mA | Current | Output capacitor RMS ripple current |
| 3. | Iin Avg | 1.059 A | Current | Average input current |
| 4. | L Ipp | 440.14 mA | Current | Peak-to-peak inductor ripple current |
| 5. | BOM Count | 12 | General | Total Design BOM count |
| 6. | FootPrint | 247.0 $mm^2$ | General | Total Foot Print Area of BOM components |
| 7. | Frequency | 1.056 MHz | General | Switching frequency |
| 8. | Mode | CCM | General | Conduction Mode |
| 9. | Pout | 18.0 W | General | Total output power |
| 10. | Total BOM | $2.64 | General | Total BOM Cost |
| 11. | ICThetaJA Effective | 26.0 degC/W | Op_Point | Effective IC Junction-to-Ambient Thermal Resistance |
| 12. | Low Freq Gain | 77.249 dB | Op_Point | Gain at 10Hz |
| 13. | Vout Actual | 8.998 V | Op_Point | Vout Actual calculated based on selected voltage divider resistors |
| 14. | Vout OP | 9.0 V | Op_Point | Operational Output Voltage |
| 15. | Cross Freq | 26.435 kHz | Op_point | Bode plot crossover frequency |
| 16. | Duty Cycle | 51.656 % | Op_point | Duty cycle |
| 17. | Efficiency | 94.411 % | Op_point | Steady state efficiency |
| 18. | Gain Marg | -24.926 dB | Op_point | Bode Plot Gain Margin |
| 19. | IC Tj | 40.299 degC | Op_point | IC junction temperature |
| 20. | IOUT_OP | 2.0 A | Op_point | Iout operating point |
| 21. | Phase Marg | 64.375 deg | Op_point | Bode Plot Phase Margin |
| 22. | VIN_OP | 18.0 V | Op_point | Vin operating point |
| 23. | Vout p-p | 1.662 mV | Op_point | Peak-to-peak output ripple voltage |
| 24. | Cin Pd | 3.513 mW | Power | Input capacitor power dissipation |
| 25. | Cout Pd | 49.028 µW | Power | Output capacitor power dissipation |
| 26. | Diode Pd | 445.829 mW | Power | Diode power dissipation |
| 27. | IC Pd | 396.11 mW | Power | IC power dissipation |
| 28. | L Pd | 220.0 mW | Power | Inductor power dissipation |
| 29. | Total Pd | 1.066 W | Power | Total Power Dissipation |
| 30. | Vout Tolerance | 2.859 % | | Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable |

## Design Inputs

| # | Name | Value | Description |
|---|---|---|---|
| 1. | Iout | 2.0 | Maximum Output Current |
| 2. | VinMax | 18.0 | Maximum input voltage |
| 3. | VinMin | 15.0 | Minimum input voltage |
| 4. | Vout | 9.0 | Output Voltage |
| 5. | base_pn | TPS54540 | Base Product Number |
| 6. | source | DC | Input Source Type |
| 7. | Ta | 30.0 | Ambient temperature |

## Design Assistance

1. **TPS54540** Product Folder : http://www.ti.com/product/TPS54540 : contains the data sheet and other resources.