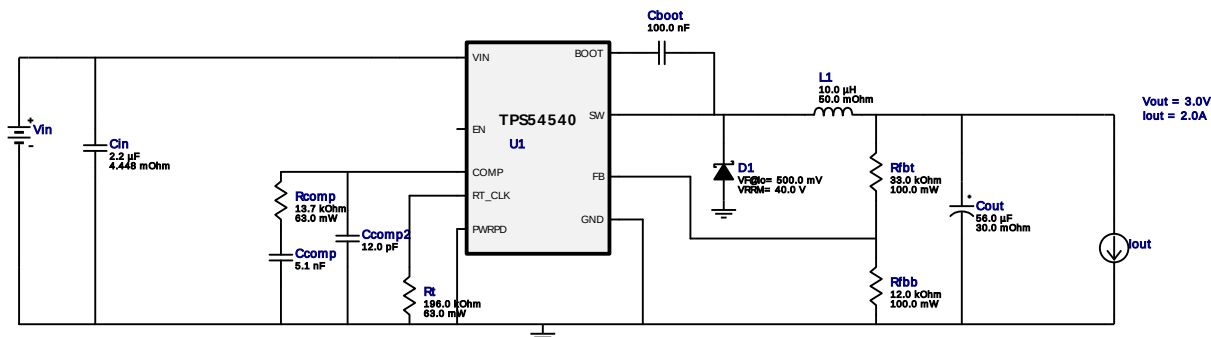


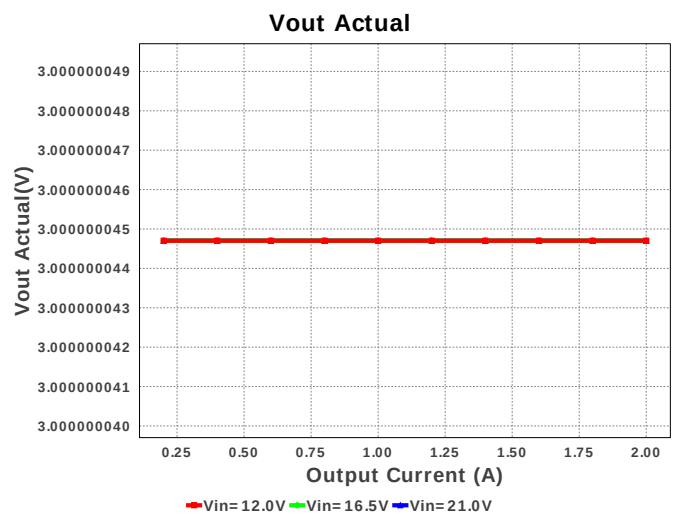
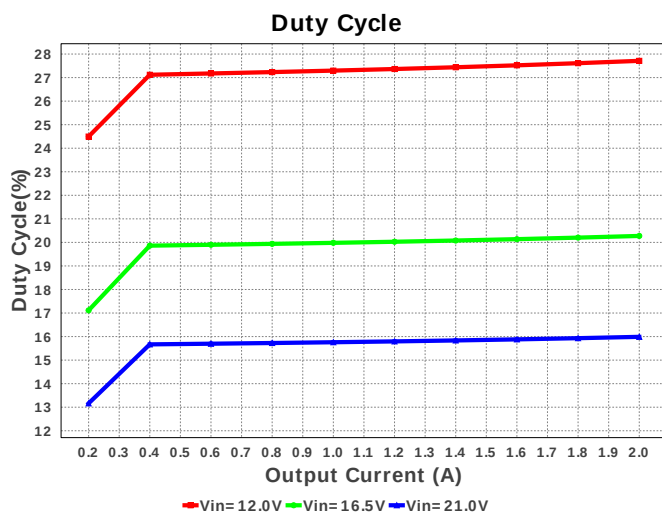
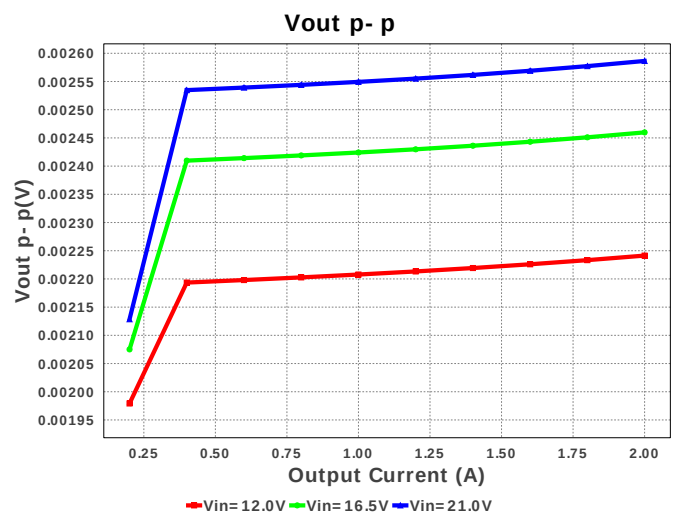
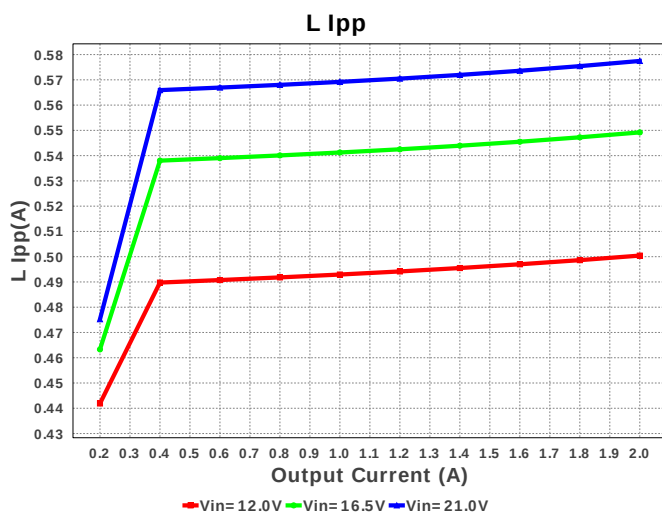
## WEBENCH® Design Report

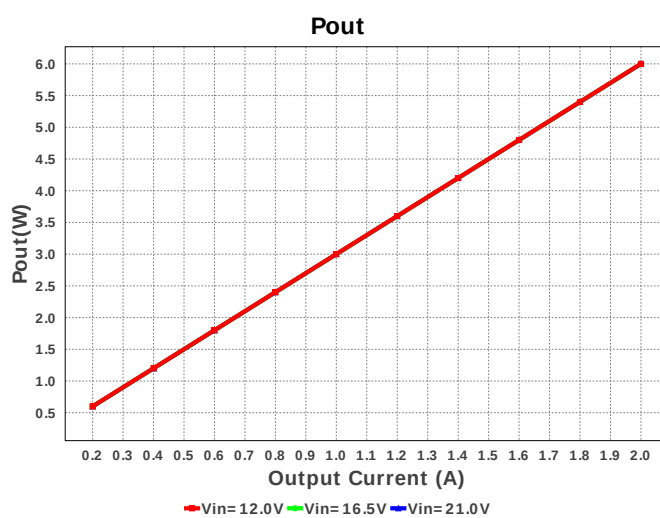
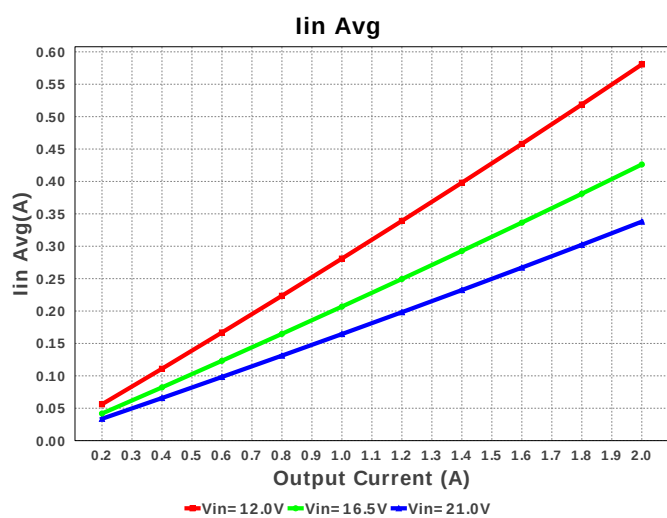
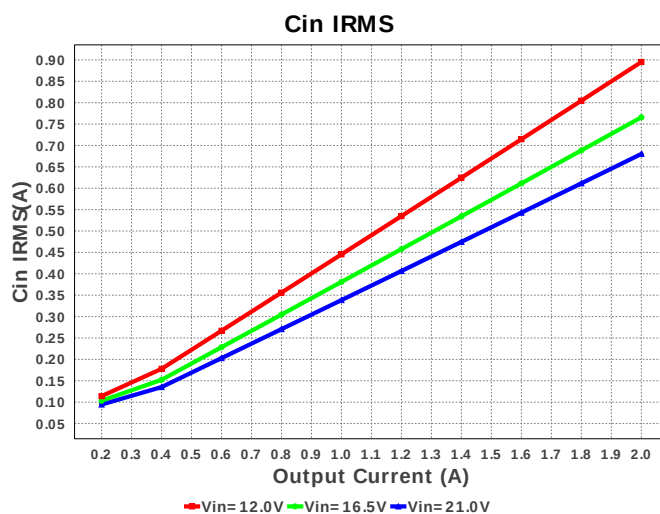
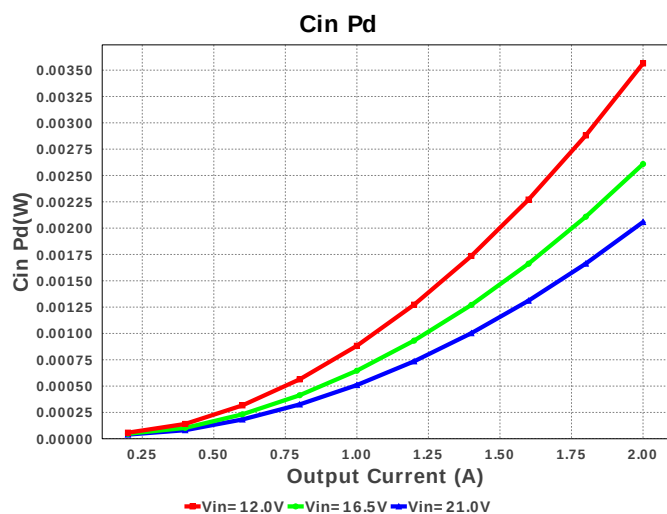
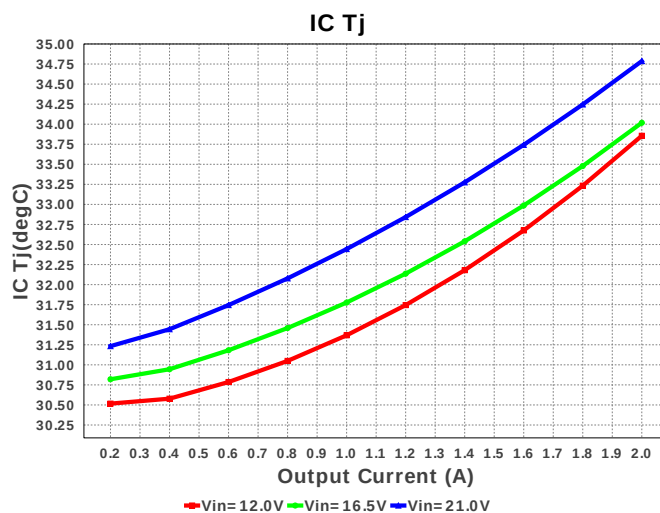
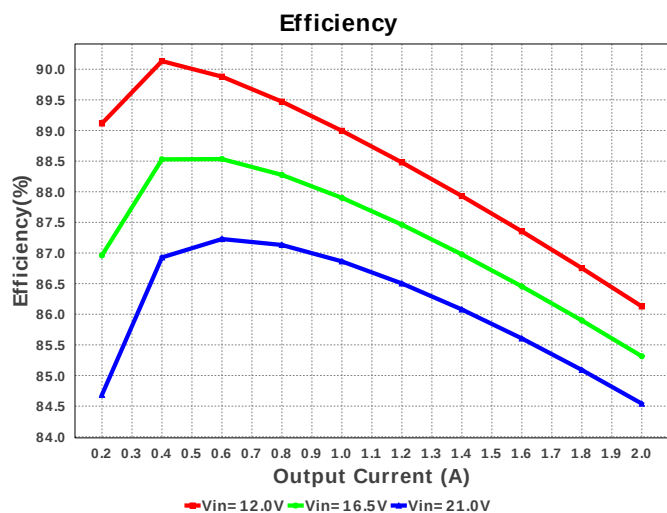
Design : 4648186/26 TPS54540DDAR  
TPS54540DDAR 12.0V-21.0V to 3.00V @ 2.0A


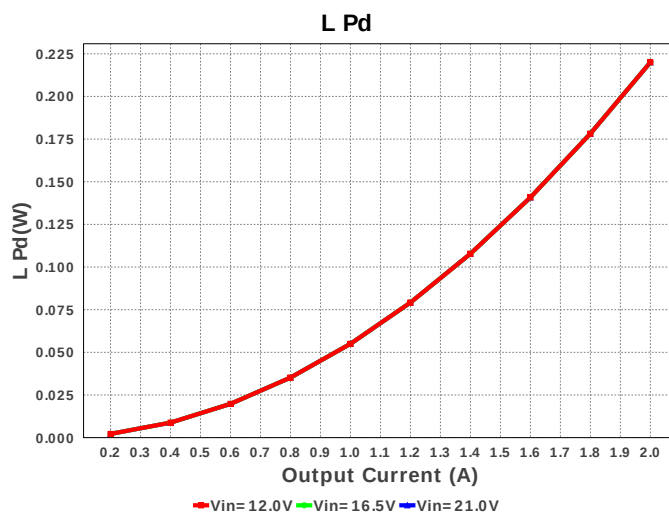
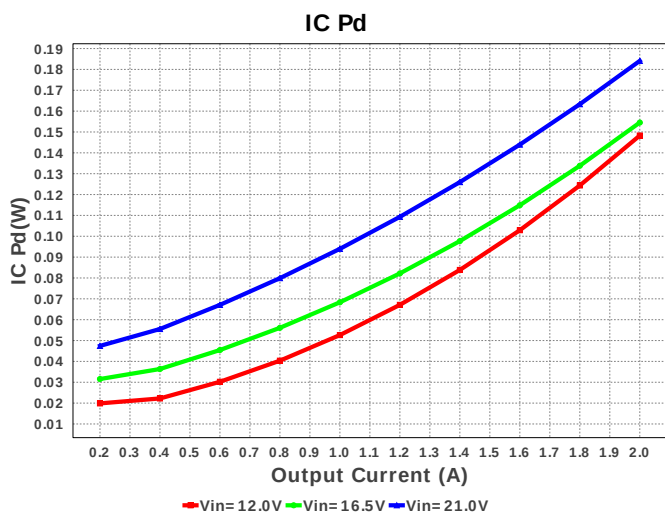
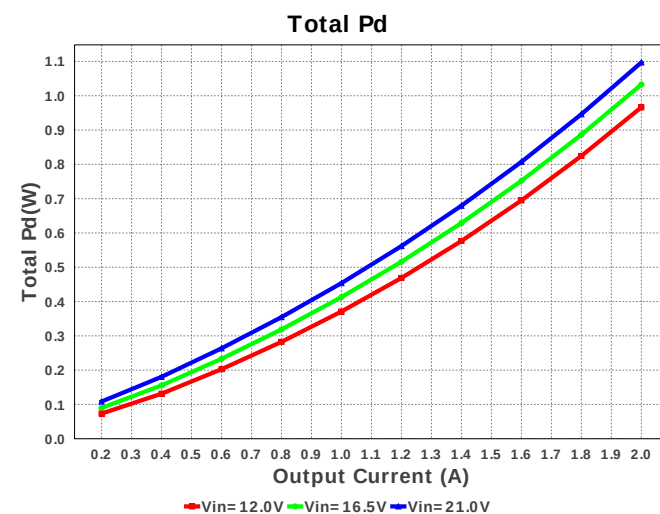
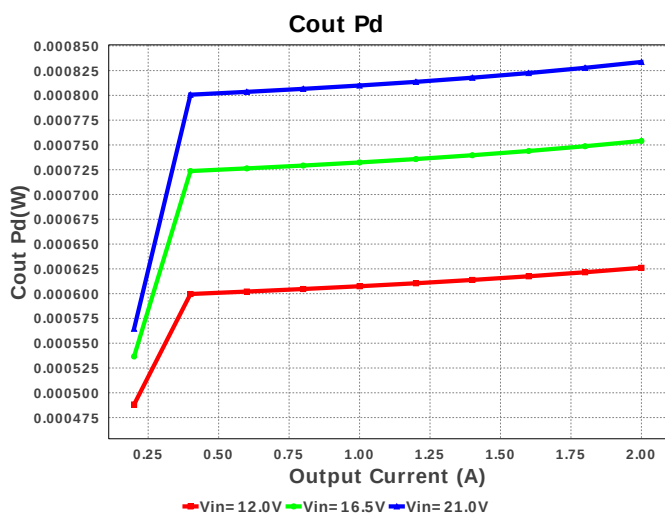
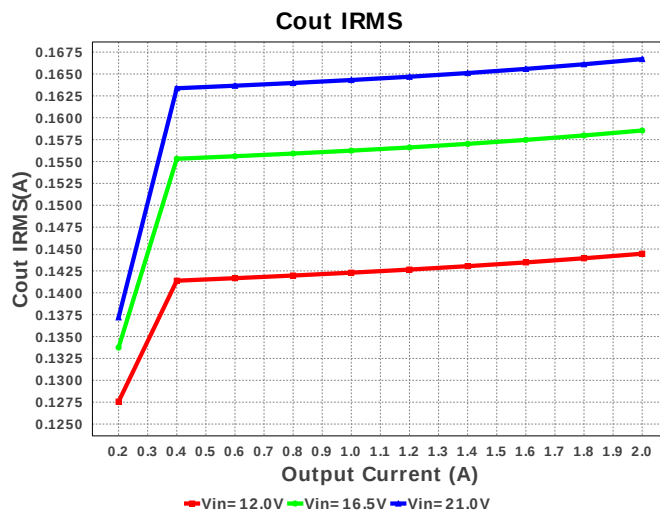
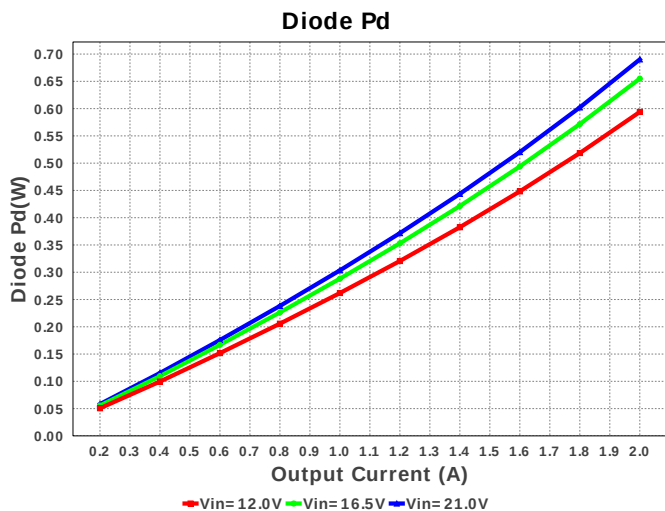
## Electrical BOM

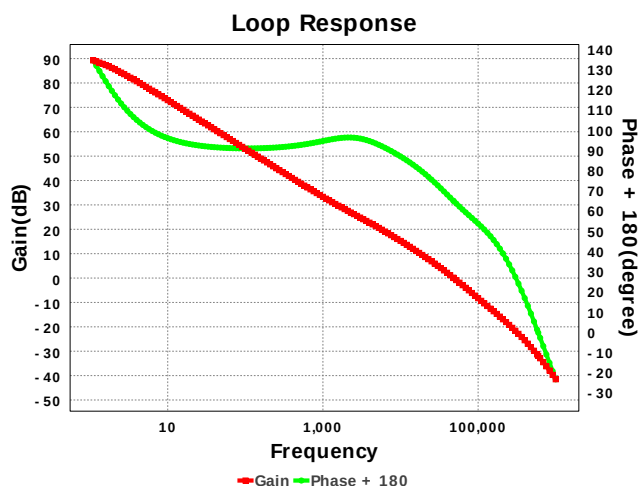
| #   | Name   | Manufacturer  | Part Number                           | Properties                                                      | Qty | Price  | Footprint                                                                                                              |
|-----|--------|---------------|---------------------------------------|-----------------------------------------------------------------|-----|--------|------------------------------------------------------------------------------------------------------------------------|
| 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 mm <sup>2</sup>             |
| 2.  | Ccomp  | MuRata        | GRM2195C1H512JA01D<br>Series= C0G/NP0 | Cap= 5.1 nF<br>VDC= 50.0 V<br>IRMS= 0.0 A                       | 1   | \$0.04 |  0805 7 mm <sup>2</sup>           |
| 3.  | Ccomp2 | Yageo America | CC0805JRNPO9BN120<br>Series= C0G/NP0  | Cap= 12.0 pF<br>VDC= 50.0 V<br>IRMS= 0.0 A                      | 1   | \$0.01 |  0805 7 mm <sup>2</sup>           |
| 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 mm <sup>2</sup>      |
| 5.  | Cout   | Panasonic     | 20SVPF56MX<br>Series= ?               | Cap= 56.0 uF<br>ESR= 30.0 mOhm<br>VDC= 20.0 V<br>IRMS= 2.8 A    | 1   | \$0.35 |  CAPSMT_62_E61 53 mm <sup>2</sup> |
| 6.  | D1     | Diodes Inc.   | B340A-13-F                            | Vf@Io= 500.0 mV<br>VRRM= 40.0 V                                 | 1   | \$0.11 |  SMA 37 mm <sup>2</sup>           |
| 7.  | L1     | Bourns        | SRN8040-100M                          | L= 10.0 uH<br>DCR= 50.0 mOhm                                    | 1   | \$0.22 |  SRN8040 100 mm <sup>2</sup>      |
| 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 mm <sup>2</sup>           |
| 9.  | Rfbb   | Yageo America | RC0603FR-0712KL<br>Series= ?          | Res= 12.0 kOhm<br>Power= 100.0 mW<br>Tolerance= 1.0%            | 1   | \$0.01 |  0603 5 mm <sup>2</sup>           |
| 10. | Rfbb   | Yageo America | RC0603FR-0733KL<br>Series= ?          | Res= 33.0 kOhm<br>Power= 100.0 mW<br>Tolerance= 1.0%            | 1   | \$0.01 |  0603 5 mm <sup>2</sup>           |
| 11. | Rt     | Vishay-Dale   | CRCW0402196KFKED<br>Series= CRCW..e3  | Res= 196.0 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0%            | 1   | \$0.01 |  0402 3 mm <sup>2</sup>           |

| #   | Name | Manufacturer      | Part Number  | Properties | Qty | Price  | Footprint |
|-----|------|-------------------|--------------|------------|-----|--------|-----------|
| 12. | U1   | Texas Instruments | TPS54540DDAR | Switcher   | 1   | \$1.95 |           |

R-PDSO-G8 57 mm<sup>2</sup>







## Operating Values

| #   | Name                | Value                 | Category | Description                                                                                |
|-----|---------------------|-----------------------|----------|--------------------------------------------------------------------------------------------|
| 1.  | Cin IRMS            | 683.0 mA              | Current  | Input capacitor RMS ripple current                                                         |
| 2.  | Cout IRMS           | 168.767 mA            | Current  | Output capacitor RMS ripple current                                                        |
| 3.  | Iin Avg             | 341.94 mA             | Current  | Average input current                                                                      |
| 4.  | L Ipp               | 584.63 mA             | Current  | Peak-to-peak inductor ripple current                                                       |
| 5.  | BOM Count           | 12                    | General  | Total Design BOM count                                                                     |
| 6.  | FootPrint           | 291.0 mm <sup>2</sup> | General  | Total Foot Print Area of BOM components                                                    |
| 7.  | Frequency           | 498.372 kHz           | General  | Switching frequency                                                                        |
| 8.  | Pout                | 6.0 W                 | General  | Total output power                                                                         |
| 9.  | Total BOM           | \$2.78                | General  | Total BOM Cost                                                                             |
| 10. | ICThetaJA Effective | 26.0 degC/W           | Op_Point | Effective IC Junction-to-Ambient Thermal Resistance                                        |
| 11. | Low Freq Gain       | 89.24 dB              | Op_Point | Gain at 10Hz                                                                               |
| 12. | Vout Actual         | 3.0 V                 | Op_Point | Vout Actual calculated based on selected voltage divider resistors                         |
| 13. | Vout OP             | 3.0 V                 | Op_Point | Operational Output Voltage                                                                 |
| 14. | Cross Freq          | 48.644 kHz            | Op_point | Bode plot crossover frequency                                                              |
| 15. | Duty Cycle          | 16.187 %              | Op_point | Duty cycle                                                                                 |
| 16. | Efficiency          | 83.557 %              | Op_point | Steady state efficiency                                                                    |
| 17. | Gain Marg           | -31.915 dB            | Op_point | Bode Plot Gain Margin                                                                      |
| 18. | IC Tj               | 34.807 degC           | Op_point | IC junction temperature                                                                    |
| 19. | IOUT_OP             | 2.0 A                 | Op_point | Iout operating point                                                                       |
| 20. | Phase Marg          | 65.068 deg            | Op_point | Bode Plot Phase Margin                                                                     |
| 21. | VIN_OP              | 21.0 V                | Op_point | Vin operating point                                                                        |
| 22. | Vout p-p            | 2.618 mV              | Op_point | Peak-to-peak output ripple voltage                                                         |
| 23. | Cin Pd              | 2.075 mW              | Power    | Input capacitor power dissipation                                                          |
| 24. | Cout Pd             | 854.468 $\mu$ W       | Power    | Output capacitor power dissipation                                                         |
| 25. | Diode Pd            | 772.924 mW            | Power    | Diode power dissipation                                                                    |
| 26. | IC Pd               | 184.881 mW            | Power    | IC power dissipation                                                                       |
| 27. | L Pd                | 220.0 mW              | Power    | Inductor power dissipation                                                                 |
| 28. | Total Pd            | 1.181 W               | Power    | Total Power Dissipation                                                                    |
| 29. | Vout Tolerance      | 2.496 %               |          | 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  | 21.0     | Maximum input voltage  |
| 3. | VinMin  | 12.0     | Minimum input voltage  |
| 4. | Vout    | 3.0      | 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.

Texas Instruments' WEBENCH simulation tools attempt to recreate the performance of a substantially equivalent physical implementation of the design. Simulations are created using Texas Instruments' published specifications as well as the published specifications of other device manufacturers. While Texas Instruments does update this information periodically, this information may not be current at the time the simulation is built. Texas Instruments does not warrant the accuracy or completeness of the specifications or any information contained therein. Texas Instruments does not warrant that any designs or recommended parts will meet the specifications you entered, will be suitable for your application or fit for any particular purpose, or will operate as shown in the simulation in a physical implementation. Texas Instruments does not warrant that the designs are production worthy.

**You should completely validate and test your design implementation to confirm the system functionality for your application prior to production.**

Use of Texas Instruments' WEBENCH simulation tools is subject to [Texas Instruments' Site Terms and Conditions of Use](#). Prototype boards based on WEBENCH created designs are provided AS IS without warranty of any kind for evaluation and testing purposes and are subject to the terms of the [Evaluation License Agreement](#).