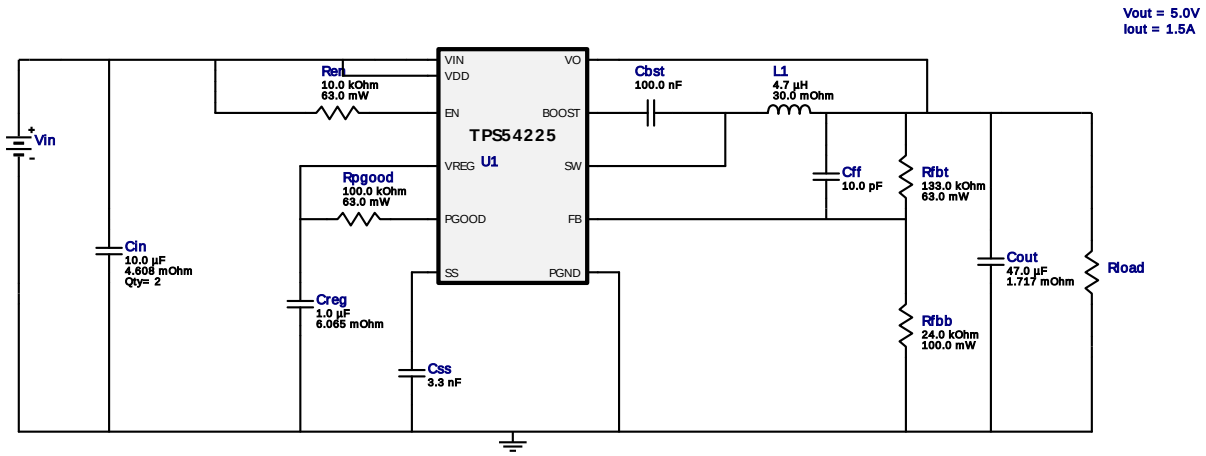
# WEBENCH® Design Report

VinMin = 10.0V
VinMax = 12.0V
Vout = 5.0V
Iout = 1.5A

Device = TPS54225PWPR
Topology = Buck
Created = 8/4/16 2:16:29 AM
BOM Cost = $1.65
BOM Count = 13
Total Pd = 0.54W

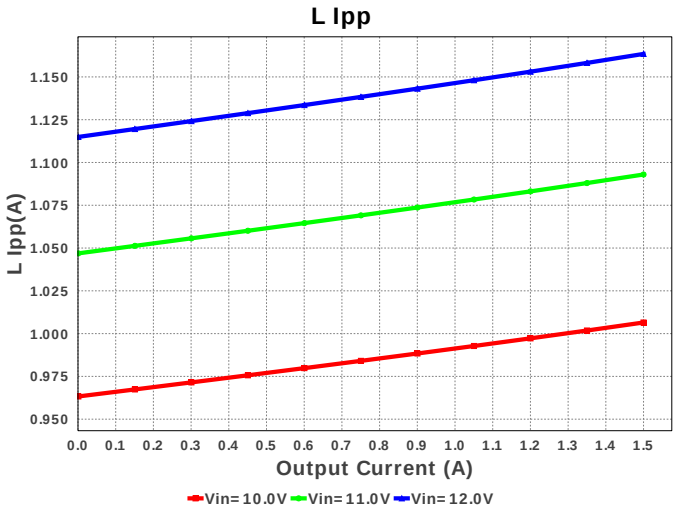
Design : 4737872/6 TPS54225PWPR
TPS54225PWPR 10.0V-12.0V to 5.00V @ 1.5A

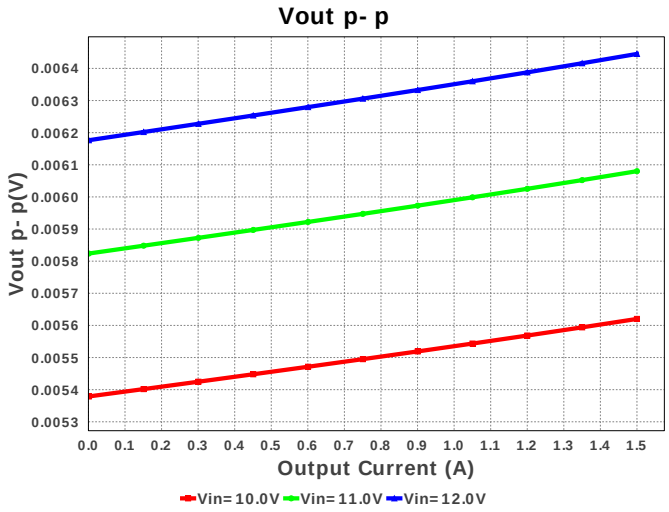


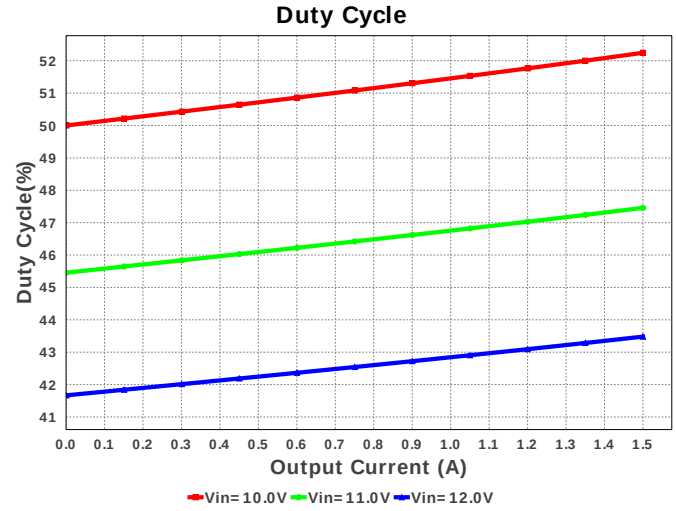

## Electrical BOM

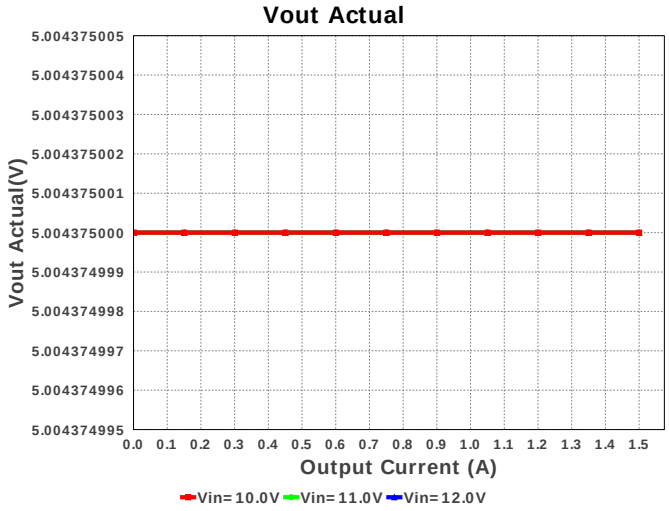
| # | Name | Manufacturer | Part Number | Properties | Qty | Price | Footprint |
|---|---|---|---|---|---|---|---|
| 1. | Cbst | MuRata | GRM155R61A104KA01D<br>Series= X5R | Cap= 100.0 nF<br>VDC= 10.0 V<br>IRMS= 0.0 A | 1 | $0.01 | 0402 3 mm² |
| 2. | Cff | Kemet | C0805C100M4GACTU<br>Series= C0G/NP0 | Cap= 10.0 pF<br>VDC= 16.0 V<br>IRMS= 0.0 A | 1 | $0.01 | 0805 7 mm² |
| 3. | Cin | MuRata | GRM319R61C106KE15D<br>Series= X5R | Cap= 10.0 uF<br>ESR= 4.608 mOhm<br>VDC= 16.0 V<br>IRMS= 2.54841 A | 2 | $0.04 | 1206 11 mm² |
| 4. | Cout | TDK | C3216JB1A476M<br>Series= JB | Cap= 47.0 uF<br>ESR= 1.717 mOhm<br>VDC= 10.0 V<br>IRMS= 0.0 A | 1 | $0.34 | 1206 11 mm² |
| 5. | Creg | MuRata | GRM188R61A105KA61D<br>Series= X5R | Cap= 1.0 uF<br>ESR= 6.065 mOhm<br>VDC= 10.0 V<br>IRMS= 1.30675 A | 1 | $0.01 | 0603 5 mm² |
| 6. | Css | MuRata | GRM216R71E332KA01D<br>Series= X7R | Cap= 3.3 nF<br>VDC= 25.0 V<br>IRMS= 0.0 A | 1 | $0.01 | 0805 7 mm² |
| 7. | L1 | TDK | CLF7045T-4R7N | L= 4.7 µH<br>DCR= 30.0 mOhm | 1 | $0.42 | CLF7045 86 mm² |
| 8. | Ren | Vishay-Dale | CRCW040210K0FKED<br>Series= CRCW..e3 | Res= 10.0 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | 0402 3 mm² |
| 9. | Rfbb | Yageo America | RC0603FR-0724KL<br>Series= ? | Res= 24.0 kOhm<br>Power= 100.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | 0603 5 mm² |
| 10. | Rfbt | Vishay-Dale | CRCW0402133KFKED<br>Series= CRCW..e3 | Res= 133.0 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | 0402 3 mm² |

| # | Name | Manufacturer | Part Number | Properties | Qty | Price | Footprint |
|---|---|---|---|---|---|---|---|
| 11. | Rpgood | Vishay-Dale | CRCW0402100KFKED<br>Series= CRCW..e3 | Res= 100.0 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | <br>0402 3 mm$^2$ |
| 12. | U1 | Texas Instruments | TPS54225PWPR | Switcher | 1 | $0.73 |  <br>R-PDSO-G14 61 mm$^2$ |

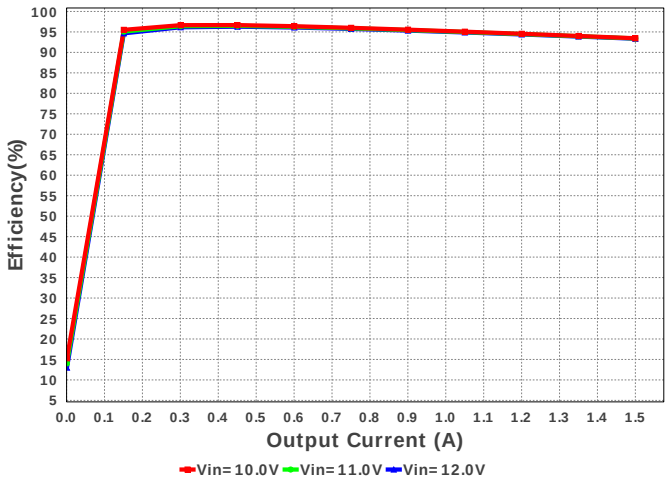


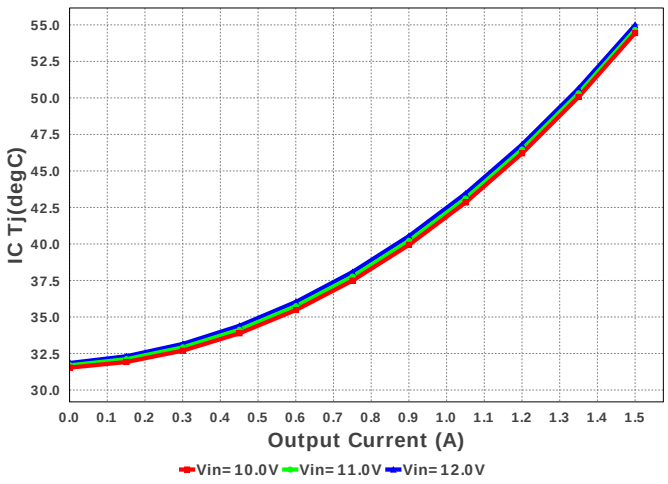



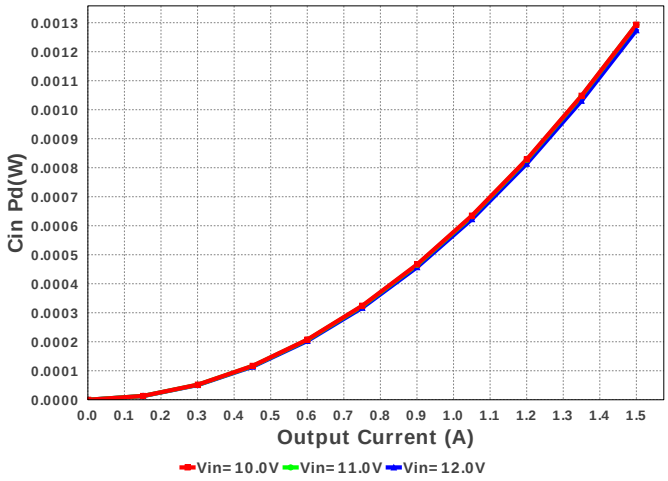
## Efficiency



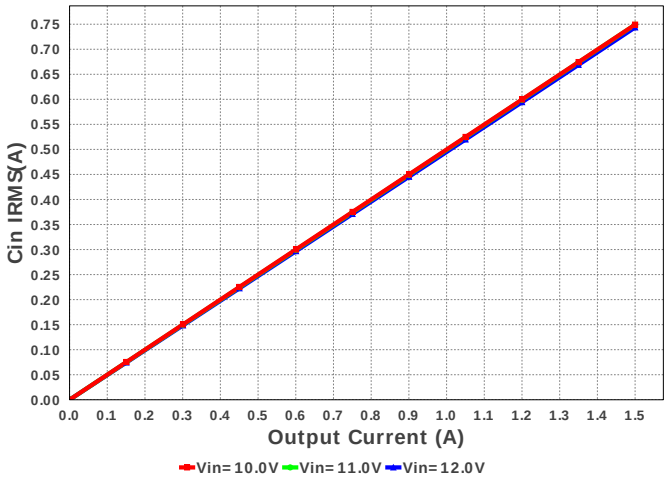

## IC Tj



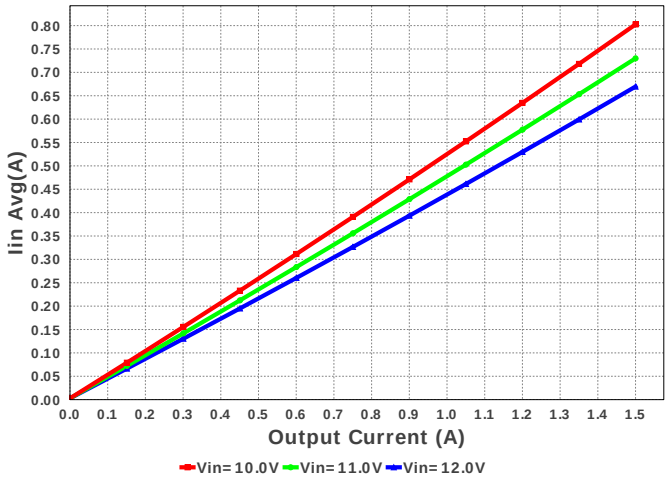

## Cin Pd



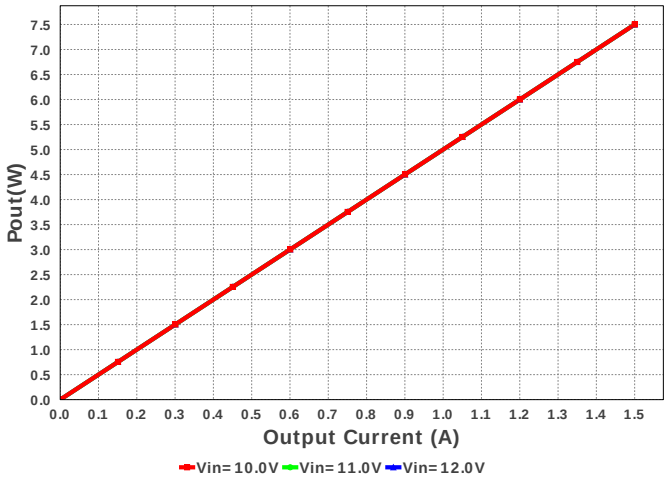

## Cin IRMS

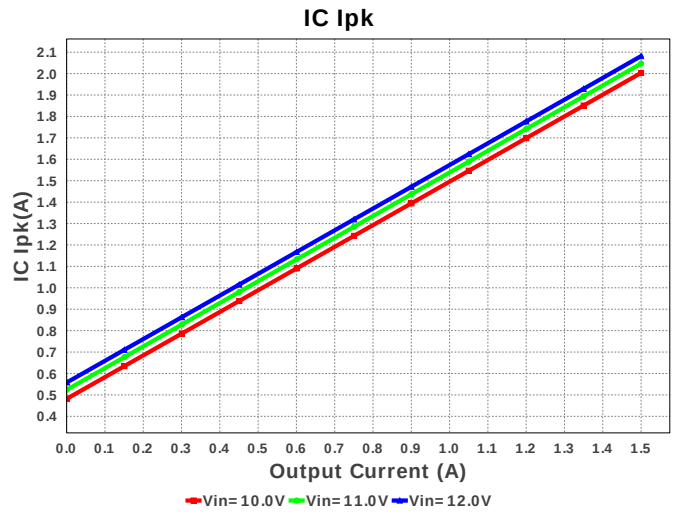


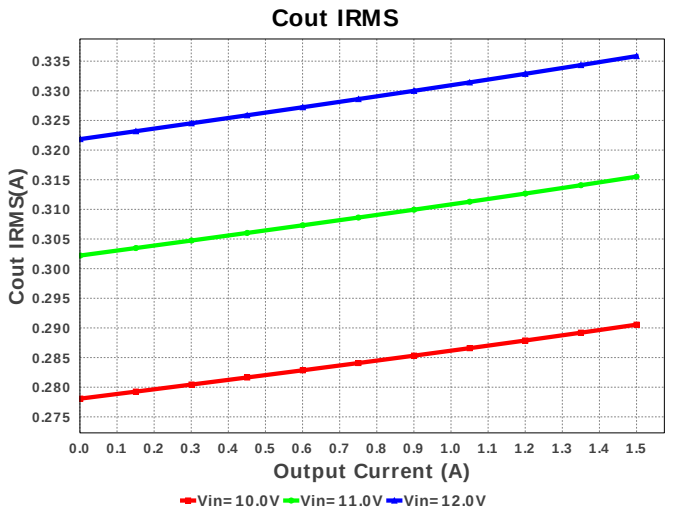

## Iin Avg

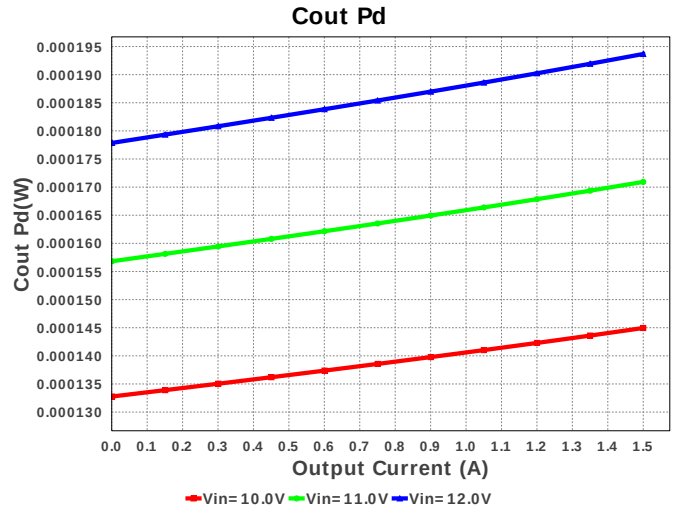


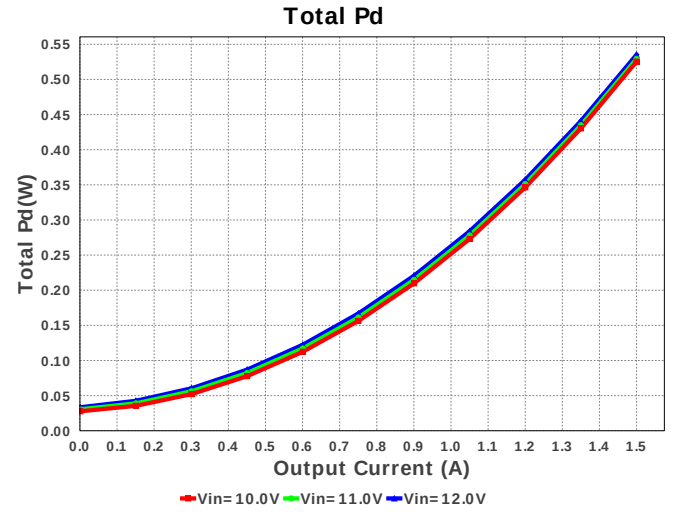

## Pout

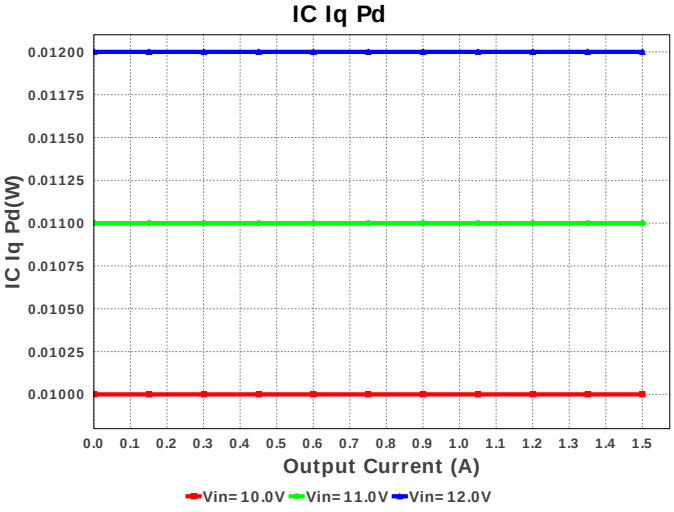


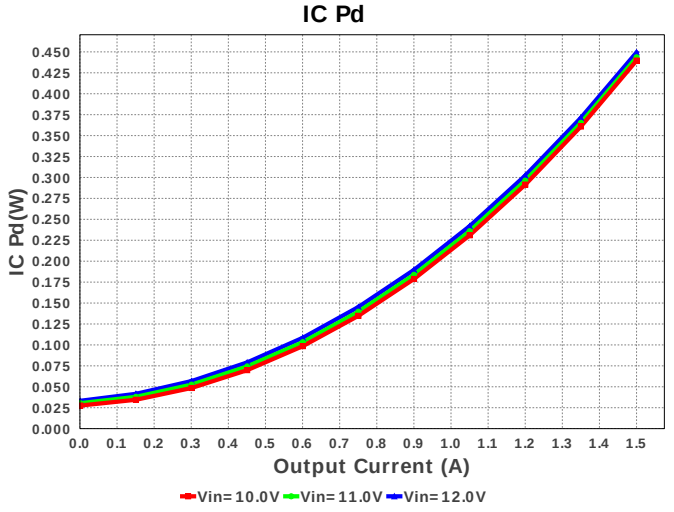


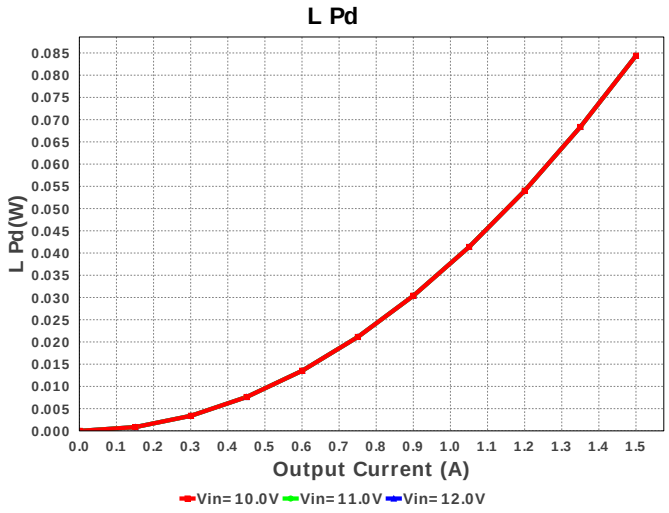






## Operating Values

| # | Name | Value | Category | Description |
|---|---|---|---|---|
| 1. | Cin IRMS | 743.598 mA | Current | Input capacitor RMS ripple current |
| 2. | Cout IRMS | 335.859 mA | Current | Output capacitor RMS ripple current |
| 3. | IC Ipk | 2.082 A | Current | Peak switch current in IC |
| 4. | Iin Avg | 669.85 mA | Current | Average input current |
| 5. | L Ipp | 1.163 A | Current | Peak-to-peak inductor ripple current |
| 6. | BOM Count | 13 | General | Total Design BOM count |
| 7. | FootPrint | 214.0 $mm^2$ | General | Total Foot Print Area of BOM components |
| 8. | Frequency | 556.611 kHz | General | Switching frequency |
| 9. | Pout | 7.5 W | General | Total output power |
| 10. | Total BOM | $1.65 | General | Total BOM Cost |
| 11. | Vout Actual | 5.004 V | Op_Point | Vout Actual calculated based on selected voltage divider resistors |
| 12. | Vout OP | 5.0 V | Op_Point | Operational Output Voltage |
| 13. | Duty Cycle | 43.481 % | Op_point | Duty cycle |
| 14. | Efficiency | 93.304 % | Op_point | Steady state efficiency |
| 15. | IC Tj | 55.154 degC | Op_point | IC junction temperature |
| 16. | ICThetaJA | 55.6 degC/W | Op_point | IC junction-to-ambient thermal resistance |
| 17. | IOUT_OP | 1.5 A | Op_point | Iout operating point |
| 18. | VIN_OP | 12.0 V | Op_point | Vin operating point |
| 19. | Vout p-p | 6.445 mV | Op_point | Peak-to-peak output ripple voltage |
| 20. | Cin Pd | 1.274 mW | Power | Input capacitor power dissipation |
| 21. | Cout Pd | 193.679 µW | Power | Output capacitor power dissipation |
| 22. | IC Iq Pd | 12.0 mW | Power | IC Iq Pd |
| 23. | IC Pd | 452.416 mW | Power | IC power dissipation |
| 24. | L Pd | 84.375 mW | Power | Inductor power dissipation |
| 25. | Total Pd | 538.238 mW | Power | Total Power Dissipation |
| 26. | Vout Tolerance | 2.775 % | | Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable |

## Design Inputs

| # | Name | Value | Description |
|---|---|---|---|
| 1. | Iout | 1.5 | Maximum Output Current |
| 2. | VinMax | 12.0 | Maximum input voltage |
| 3. | VinMin | 10.0 | Minimum input voltage |
| 4. | Vout | 5.0 | Output Voltage |
| 5. | base_pn | TPS54225 | Base Product Number |
| 6. | source | DC | Input Source Type |
| 7. | Ta | 30.0 | Ambient temperature |

## Design Assistance

1. **TPS54225** Product Folder : http://www.ti.com/product/TPS54225 : contains the data sheet and other resources.