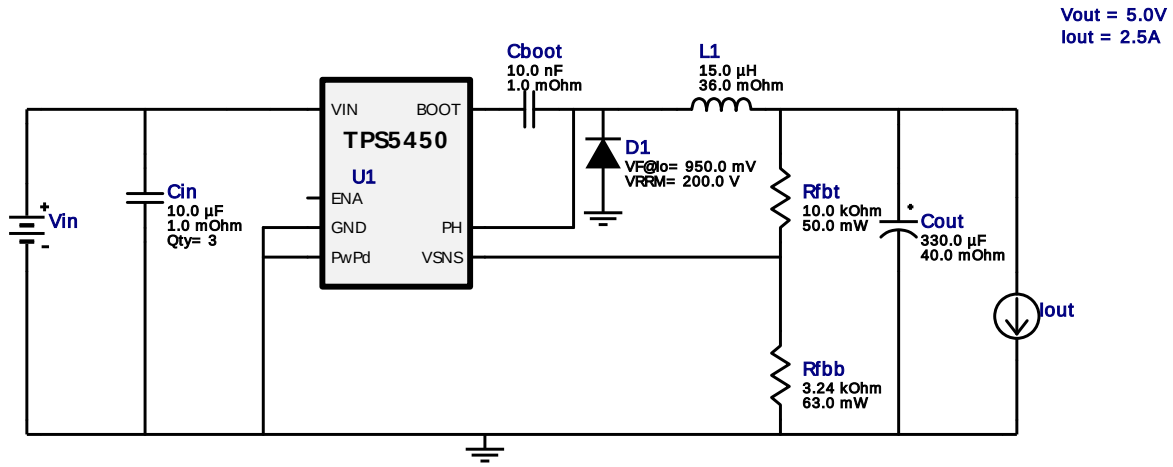
# WEBENCH® Design Report

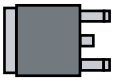
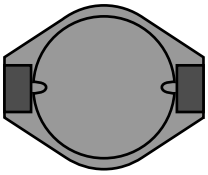
VinMin = 10.0V
VinMax = 19.0V
Vout = 5.0V
Iout = 2.5A

Device = TPS5450DDAR
Topology = Buck
Created = 2020-02-11 18:44:57.499
BOM Cost = $3.84
BOM Count = 10
Total Pd = 2.29W

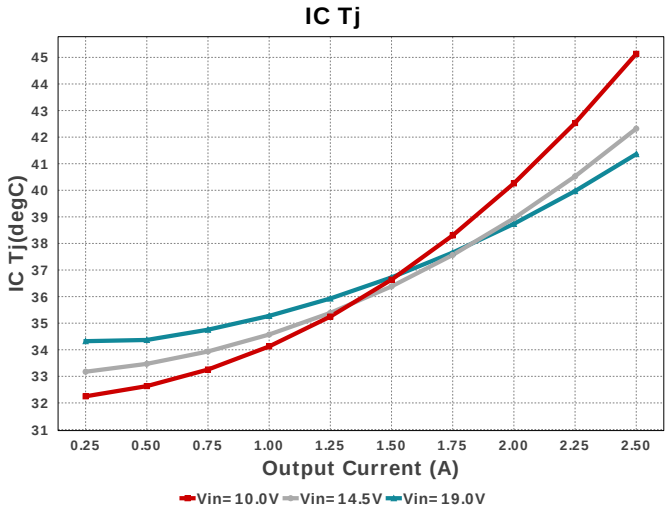
TPS5450DDAR 10V-19V to 5.00V @ 2.5A

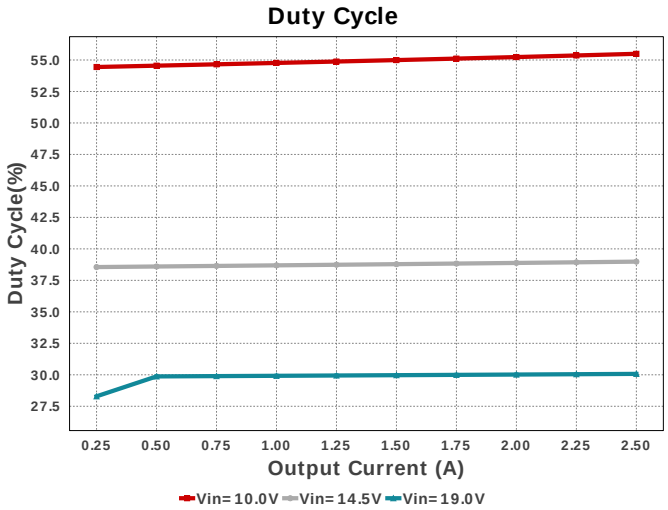


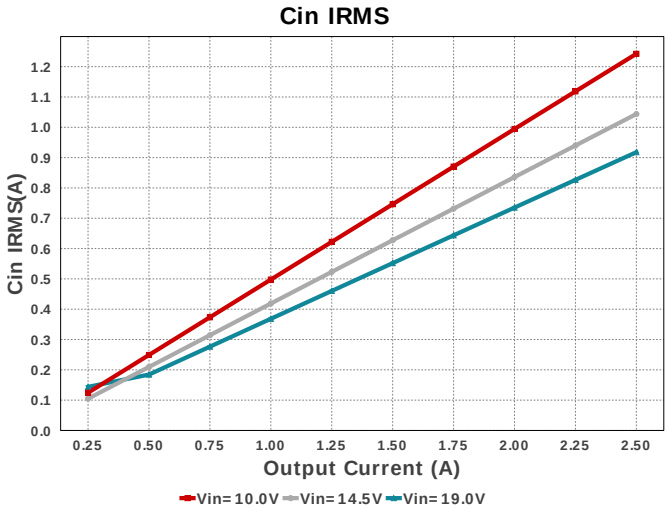

## Electrical BOM

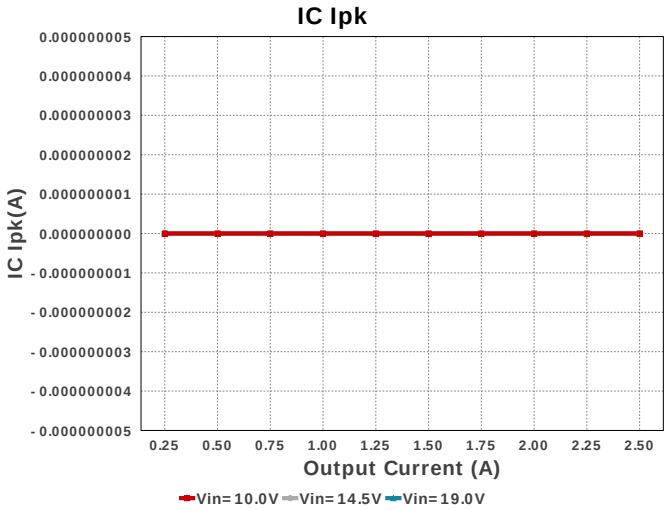
| # | Name | Manufacturer | Part Number | Properties | Qty | Price | Footprint |
|---|---|---|---|---|---|---|---|
| 1. | Cboot | Yageo | CC0805KRX7R9BB103<br>Series= X7R | Cap= 10.0 nF<br>ESR= 1.0 mOhm<br>VDC= 50.0 V<br>IRMS= 0.0 A | 1 | $0.01 | <br>0805 7 mm² |
| 2. | Cin | TDK | C3225X7R1H106M250AC<br>Series= X7R | Cap= 10.0 uF<br>ESR= 1.0 mOhm<br>VDC= 50.0 V<br>IRMS= 5.0 A | 3 | $0.28 |  <br>1210 15 mm² |
| 3. | Cout | Panasonic | 6TPC330MA<br>Series= TPC | Cap= 330.0 uF<br>ESR= 40.0 mOhm<br>VDC= 6.3 V<br>IRMS= 1.9 A | 1 | $0.50 |  <br>7343-20 59 mm² |
| 4. | D1 | SMC Diode Solutions | SBRD10200TR | VF@Io= 950.0 mV<br>VRRM= 200.0 V | 1 | $0.12 |  <br>DPAK 102 mm² |
| 5. | L1 | NIC Components | NPI52W150MTRF | L= 15.0 µH<br>DCR= 36.0 mOhm | 1 | $0.35 |  <br>IND_NPI52W 358 mm² |
| 6. | Rfbb | Vishay-Dale | CRCW04023K24FKED<br>Series= CRCW..e3 | Res= 3240.0Ohm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | <br>0402 3 mm² |
| 7. | Rfbt | Yageo | RC0201FR-0710KL<br>Series= ? | Res= 10000.0Ohm<br>Power= 50.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | <br>0201 2 mm² |

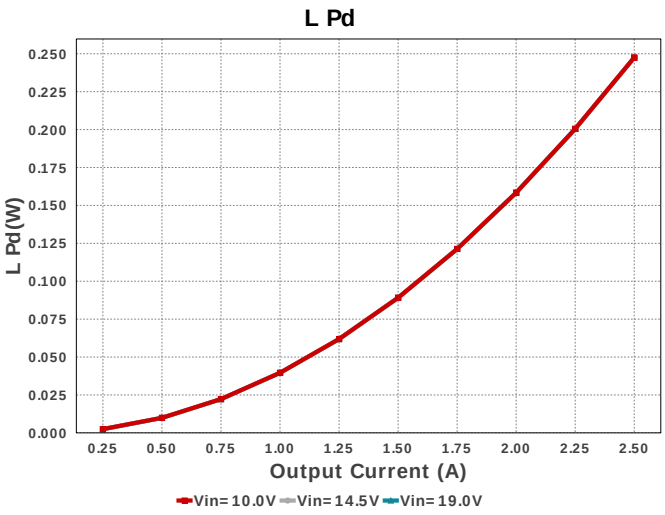
| # | Name | Manufacturer | Part Number | Properties | Qty | Price | Footprint |
|---|---|---|---|---|---|---|---|
| 8. | U1 | Texas Instruments | TPS5450DDAR | Switcher | 1 | $2.00 |  R-PDSO-G8 55 mm$^2$ |

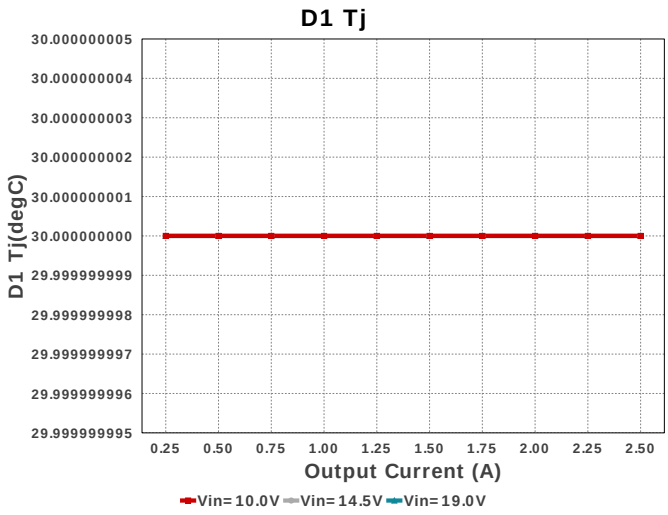


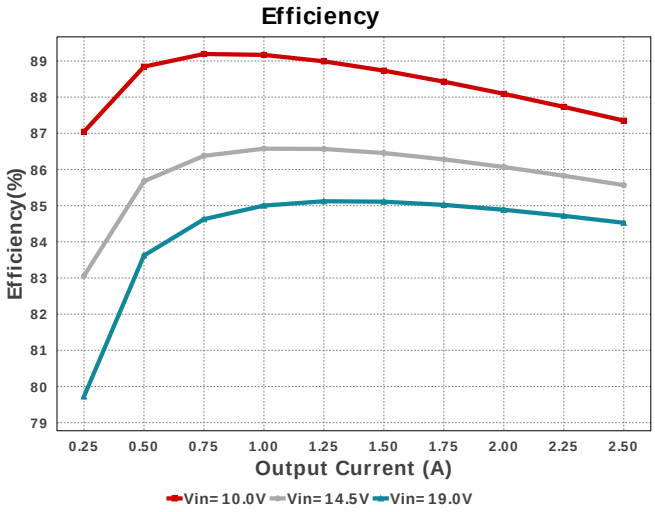



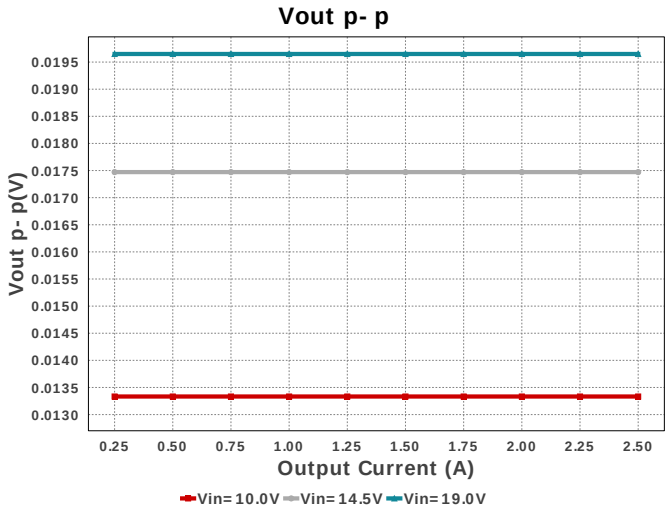



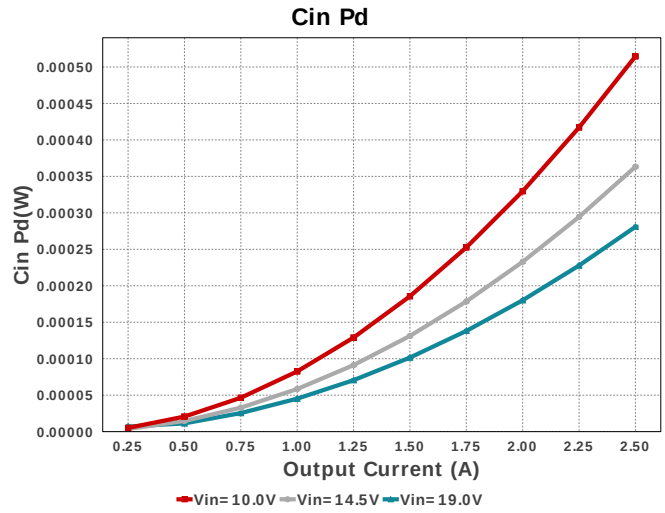



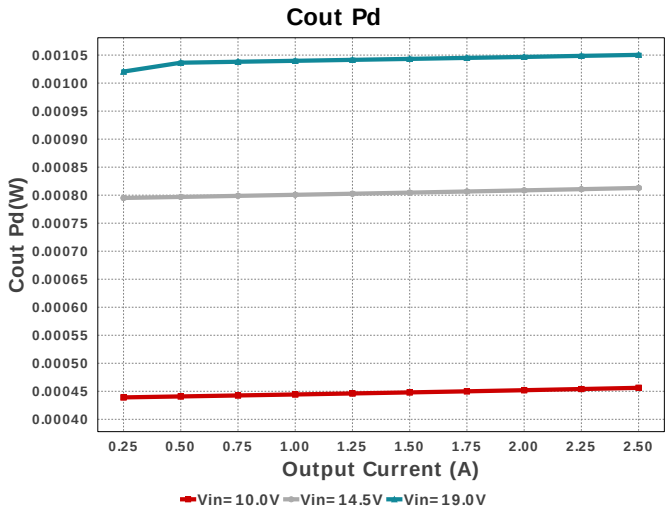


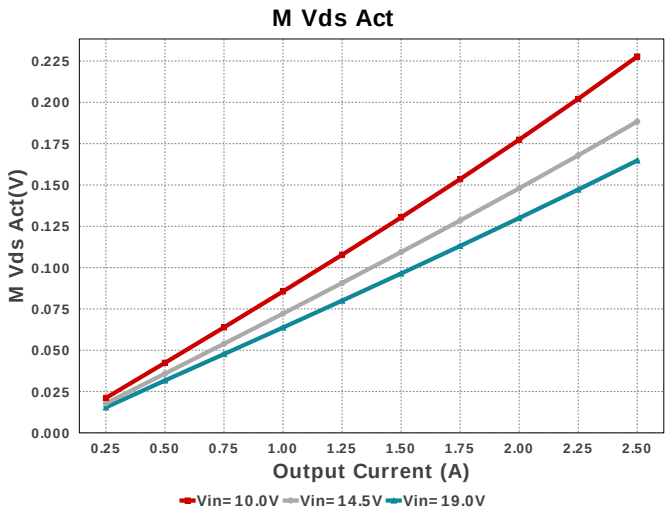



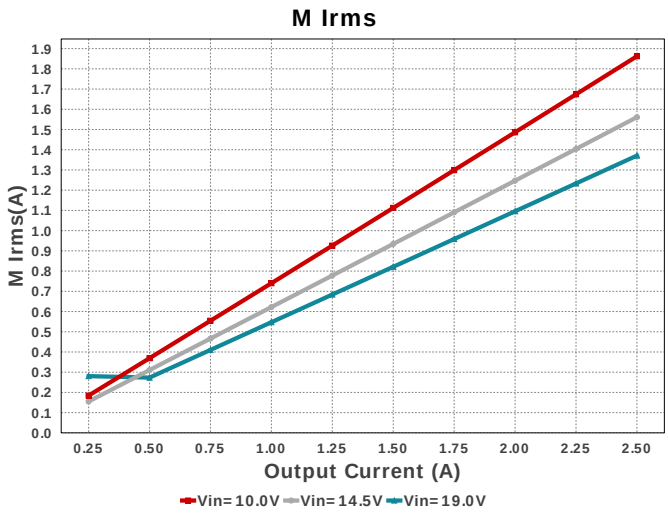



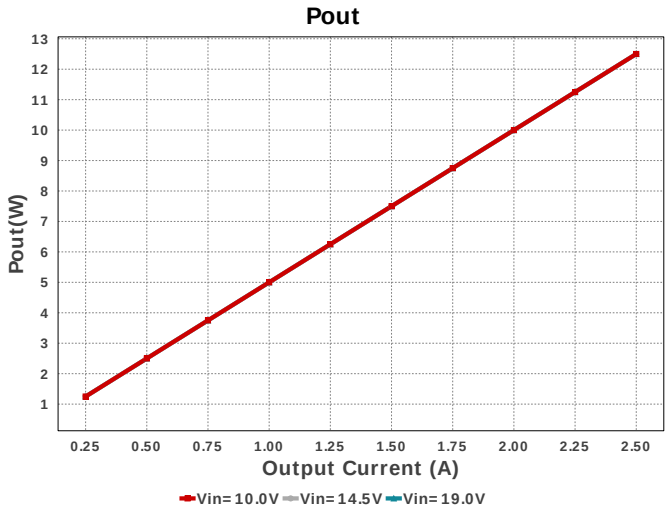



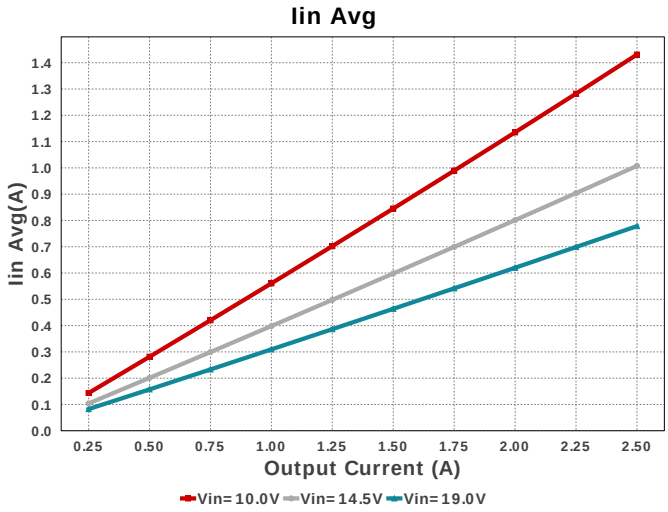



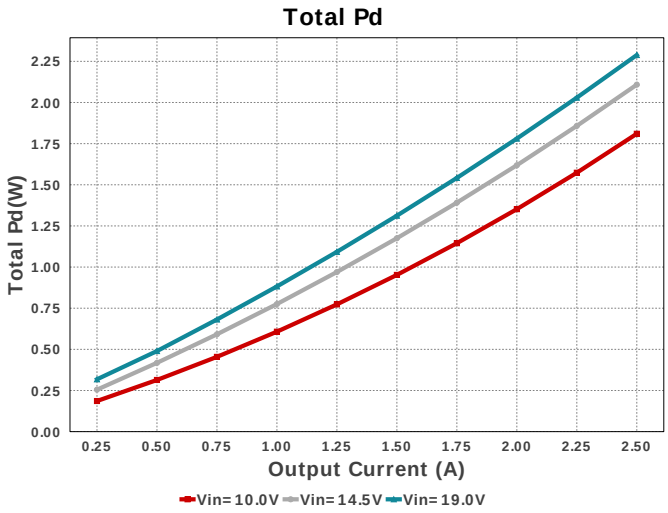



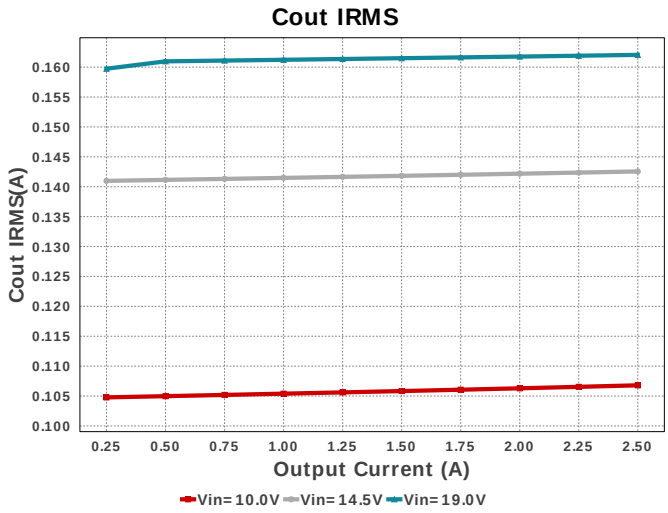


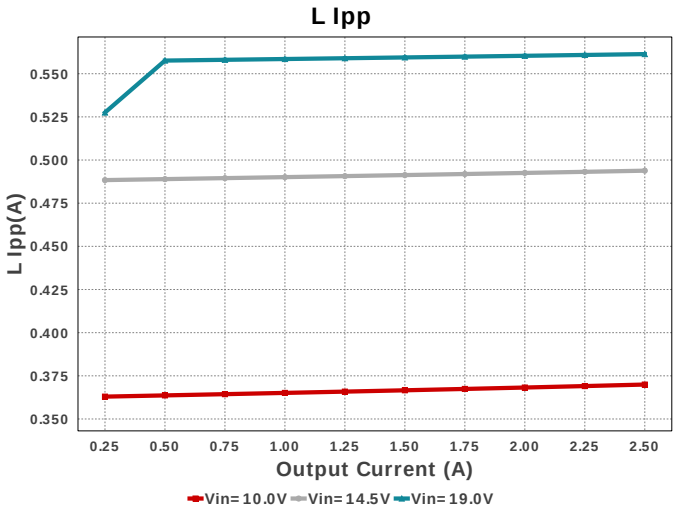



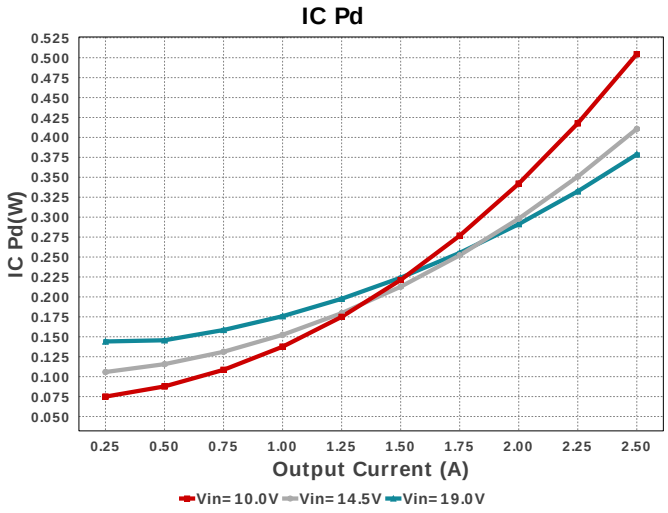



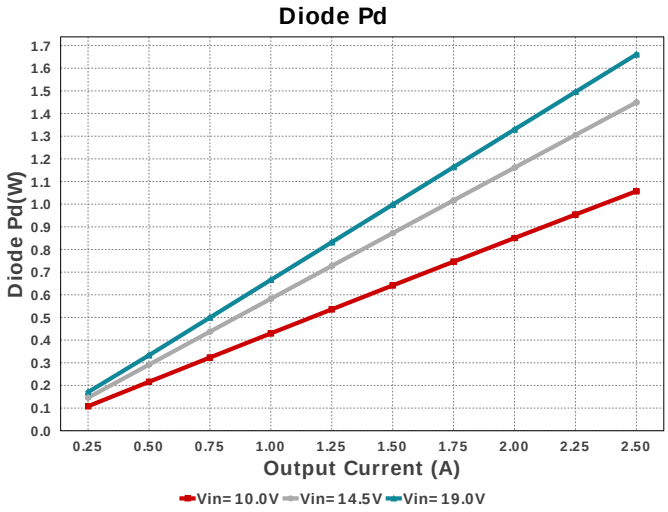



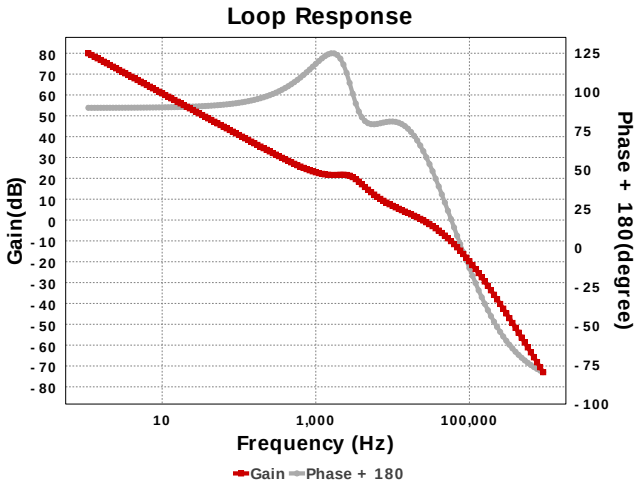






## Operating Values

| # | Name | Value | Category | Description |
|---|---|---|---|---|
| 1. | Cin IRMS | 917.956 mA | Capacitor | Input capacitor RMS ripple current |
| 2. | Cin Pd | 280.88 µW | Capacitor | Input capacitor power dissipation |
| 3. | Cout IRMS | 162.051 mA | Capacitor | Output capacitor RMS ripple current |
| 4. | Cout Pd | 1.05 mW | Capacitor | Output capacitor power dissipation |
| 5. | D1 Tj | 30.0 degC | Diode | D1 junction temperature |
| 6. | Diode Pd | 1.661 W | Diode | Diode power dissipation |
| 7. | IC Ipk | 0.0 A | IC | Peak switch current in IC |
| 8. | IC Pd | 378.7 mW | IC | IC power dissipation |
| 9. | IC Tj | 41.361 degC | IC | IC junction temperature |
| 10. | IC Tolerance | 18.315 mV | IC | IC Feedback Tolerance |
| 11. | ICThetaJA | 30.0 degC/W | IC | IC junction-to-ambient thermal resistance |
| 12. | Iin Avg | 778.33 mA | IC | Average input current |
| 13. | L Ipp | 561.36 mA | Inductor | Peak-to-peak inductor ripple current |
| 14. | L Pd | 247.5 mW | Inductor | Inductor power dissipation |
| 15. | M Irms | 1.371 A | Mosfet | MOSFET RMS ripple current |
| 16. | M Vds Act | 164.781 mV | Mosfet | Voltage drop across the MosFET |
| 17. | Cin Pd | 280.88 µW | Power | Input capacitor power dissipation |
| 18. | Cout Pd | 1.05 mW | Power | Output capacitor power dissipation |
| 19. | Diode Pd | 1.661 W | Power | Diode power dissipation |
| 20. | IC Pd | 378.7 mW | Power | IC power dissipation |
| 21. | L Pd | 247.5 mW | Power | Inductor power dissipation |
| 22. | Total Pd | 2.288 W | Power | Total Power Dissipation |
| 23. | BOM Count | 10 | System Information | Total Design BOM count |
| 24. | Cross Freq | 24.523 kHz | System Information | Bode plot crossover frequency |
| 25. | Duty Cycle | 30.073 % | System Information | Duty cycle |
| 26. | Efficiency | 84.526 % | System Information | Steady state efficiency |
| 27. | FootPrint | 630.0 $mm^2$ | System Information | Total Foot Print Area of BOM components |

| # | Name | Value | Category | Description |
|---|---|---|---|---|
| 28. | Frequency | 500.0 kHz | System Information | Switching frequency |
| 29. | Iout | 2.5 A | System Information | Iout operating point |
| 30. | Mode | CCM | System Information | Conduction Mode |
| 31. | Phase Marg | 63.191 deg | System Information | Bode Plot Phase Margin |
| 32. | Pout | 12.5 W | System Information | Total output power |
| 33. | Total BOM | $3.84 | System Information | Total BOM Cost |
| 34. | Vin | 19.0 V | System Information | Vin operating point |
| 35. | Vout | 5.0 V | System Information | Operational Output Voltage |
| 36. | Vout Actual | 4.99 V | System Information | Vout Actual calculated based on selected voltage divider resistors |
| 37. | Vout Tolerance | 3.049 % | System Information | Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable |
| 38. | Vout p-p | 19.649 mV | System Information | Peak-to-peak output ripple voltage |

## Design Inputs

| # | Name | Value | Description |
|---|---|---|---|
| 1. | Iout | 2.5 | Maximum Output Current |
| 2. | VinMax | 19.0 | Maximum input voltage |
| 3. | VinMin | 10.0 | Minimum input voltage |
| 4. | Vout | 5.0 | Output Voltage |
| 5. | acFrequency | 60.0 | AC Frequency |
| 6. | base_pn | TPS5450 | Base Product Number |
| 7. | source | DC | Input Source Type |
| 8. | Ta | 30.0 | Ambient temperature |

## Design Assistance

1. Feature Highlights: 5A, 500kHz Fixed Switching Frequency, Internal Compensation
2. **TPS5450** Product Folder : http://www.ti.com/product/TPS5450 : contains the data sheet and other resources.