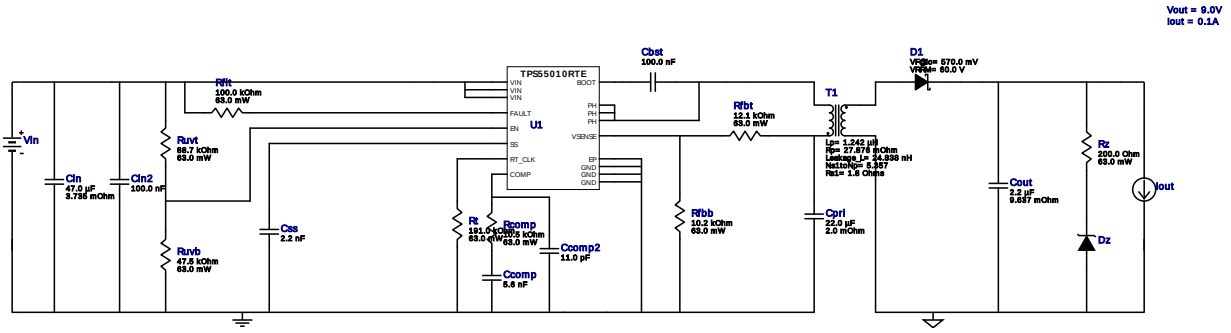
TEXAS INSTRUMENTS

# WEBENCH® Design Report

VinMin = 3.5V
VinMax = 4.2V
Vout = 9.0V
Iout = 0.1A

Device = TPS55010RTER
Topology = Flyback
Created = 8/10/16 5:28:28 PM
BOM Cost = $0.00
BOM Count = 20
Total Pd = 0.21W

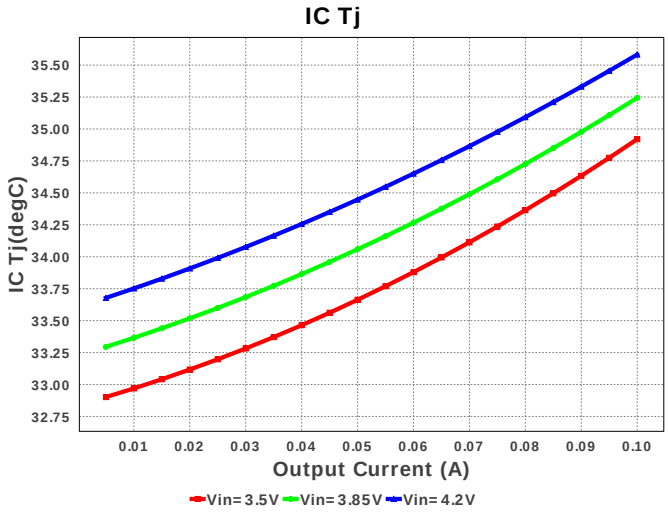
Design : 4759963/12 TPS55010RTER
TPS55010RTER 3.5V-4.2V to 9.00V @ 0.1A

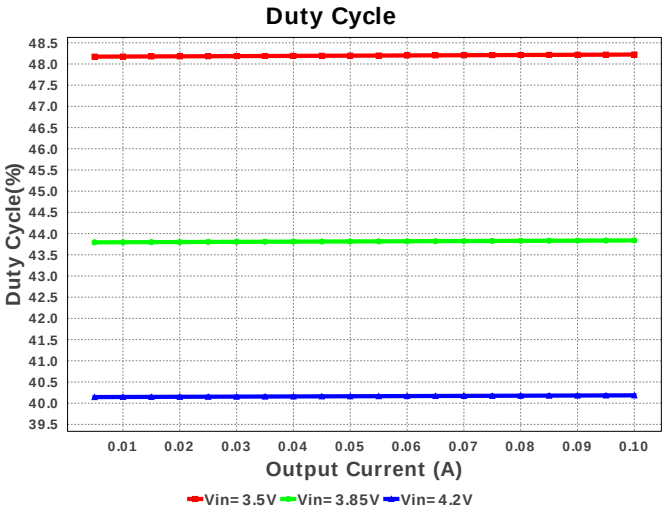


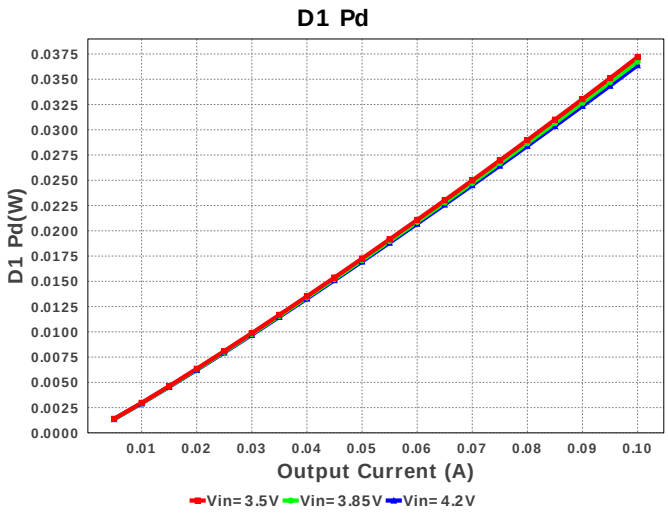

## Electrical BOM

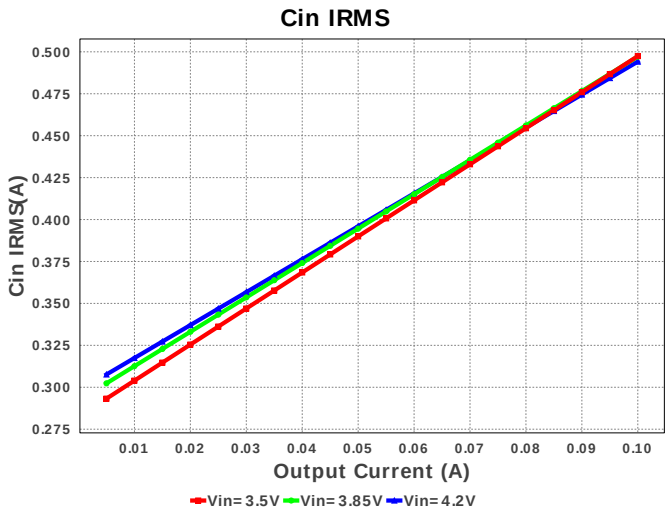
| # | Name | Manufacturer | Part Number | Properties | Qty | Price | Footprint |
|---|---|---|---|---|---|---|---|
| 1. | Cbst | MuRata | GRM155R61A104KA01D<br>Series= X5R | Cap= 100.0 nF<br>VDC= 10.0 V<br>IRMS= 0.0 A | 1 | $0.01 | 0402 3 mm² |
| 2. | Ccomp | Yageo America | CC0805KRX7R9BB562<br>Series= X7R | Cap= 5.6 nF<br>VDC= 50.0 V<br>IRMS= 0.0 A | 1 | $0.01 | 0805 7 mm² |
| 3. | Ccomp2 | TDK | C0603C0G1E110G<br>Series= C0G/NP0 | Cap= 11.0 pF<br>VDC= 25.0 V<br>IRMS= 0.0 A | 1 | $0.01 | 0201 2 mm² |
| 4. | Cin | MuRata | GRM31CC80J476KE18L<br>Series= X6S | Cap= 47.0 uF<br>ESR= 3.735 mOhm<br>VDC= 6.3 V<br>IRMS= 4.0522 A | 1 | $0.10 | 1206_190 11 mm² |
| 5. | Cin2 | MuRata | GRM155R60J104KA01D<br>Series= X5R | Cap= 100.0 nF<br>VDC= 6.3 V<br>IRMS= 0.0 A | 1 | $0.01 | 0402 3 mm² |
| 6. | Cout | MuRata | GRM188R61C225KE15D<br>Series= X5R | Cap= 2.2 uF<br>ESR= 9.637 mOhm<br>VDC= 16.0 V<br>IRMS= 1.20373 A | 1 | $0.02 | 0603 5 mm² |
| 7. | Cpri | MuRata | GRM32ER61C226ME20L<br>Series= X5R | Cap= 22.0 uF<br>ESR= 2.0 mOhm<br>VDC= 16.0 V<br>IRMS= 3.68 A | 1 | $0.12 | 1210 15 mm² |
| 8. | Css | Yageo America | CC0805KRX7R9BB222<br>Series= X7R | Cap= 2.2 nF<br>VDC= 50.0 V<br>IRMS= 0.0 A | 1 | $0.01 | 0805 7 mm² |
| 9. | D1 | NXP Semiconductor | PMEG6010CEH,115 | VF@Io= 570.0 mV<br>VRRM= 60.0 V | 1 | $0.04 | SOD-123F 12 mm² |
| 10. | Dz | Diodes Inc. | DFLZ10-7 | Zener | 1 | $0.13 | PowerDI123 13 mm² |
| 11. | Rcomp | Vishay-Dale | CRCW040210K5FKED<br>Series= CRCW..e3 | Res= 10.5 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | 0402 3 mm² |
| 12. | Rfbb | Vishay-Dale | CRCW040210K2FKED<br>Series= CRCW..e3 | Res= 10.2 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | 0402 3 mm² |
| 13. | Rfbt | 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 |

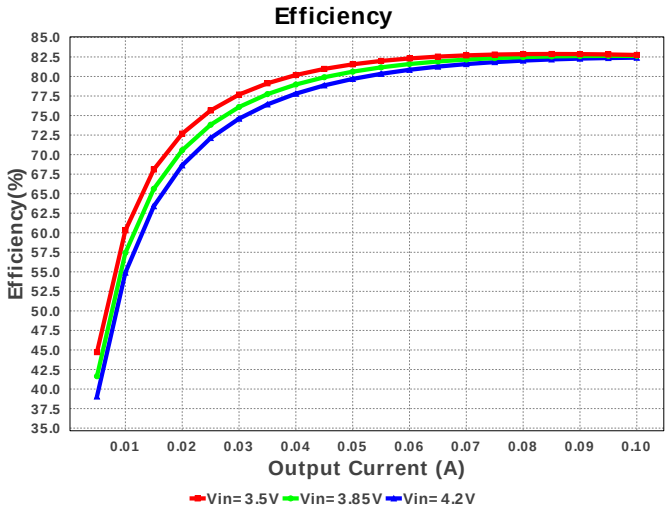
| # | Name | Manufacturer | Part Number | Properties | Qty | Price | Footprint |
|---|---|---|---|---|---|---|---|
| 14. | Rflt | Vishay-Dale | CRCW0402100KFKED<br>Series= CRCW..e3 | Res= 100.0 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | 0402 3 mm$^2$ |
| 15. | Rt | Vishay-Dale | CRCW0402191KFKED<br>Series= CRCW..e3 | Res= 191.0 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | 0402 3 mm$^2$ |
| 16. | Ruvb | Vishay-Dale | CRCW040247K5FKED<br>Series= CRCW..e3 | Res= 47.5 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | 0402 3 mm$^2$ |
| 17. | Ruvt | Vishay-Dale | CRCW040288K7FKED<br>Series= CRCW..e3 | Res= 88.7 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | 0402 3 mm$^2$ |
| 18. | Rz | Vishay-Dale | CRCW0402200RFKED<br>Series= CRCW..e3 | Res= 200.0 Ohm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | 0402 3 mm$^2$ |
| 19. | T1 | CUSTOM | CUSTOM | Lp= 1.242 µH<br>Rp= 27.876 mOhm<br>Leakage_L= 24.838 nH<br>Ns1toNp= 5.357<br>Rs1= 1.8 Ohms | 1 | NA | CUSTOM 0 mm$^2$ |
| 20. | U1 | Texas Instruments | TPS55010RTER | Switcher | 1 | $0.99 | RTE0016C 16 mm$^2$ |

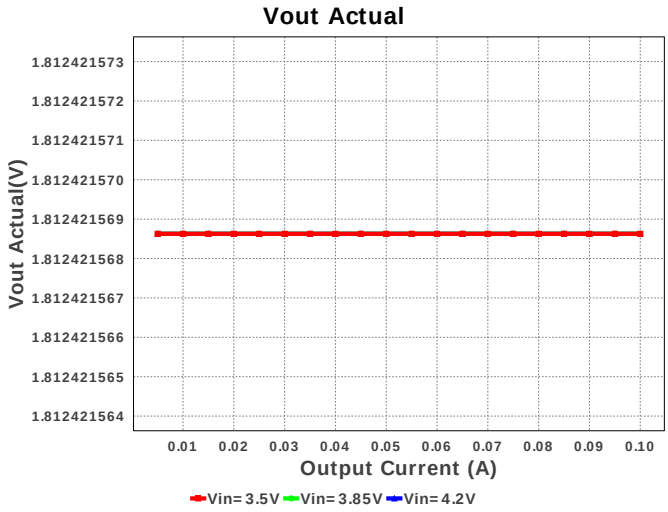


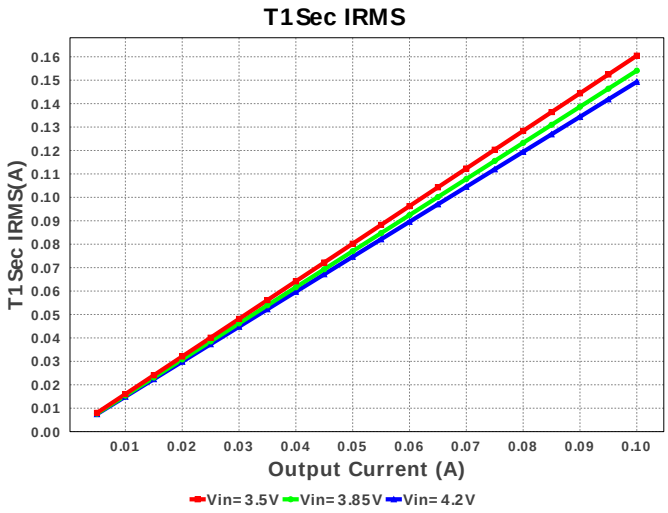



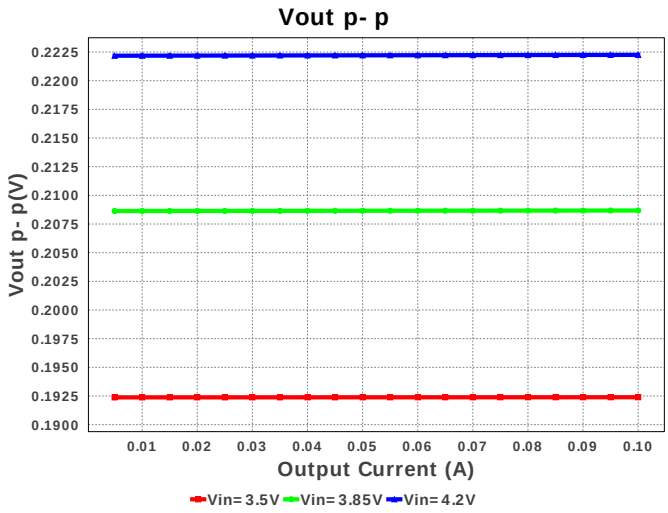


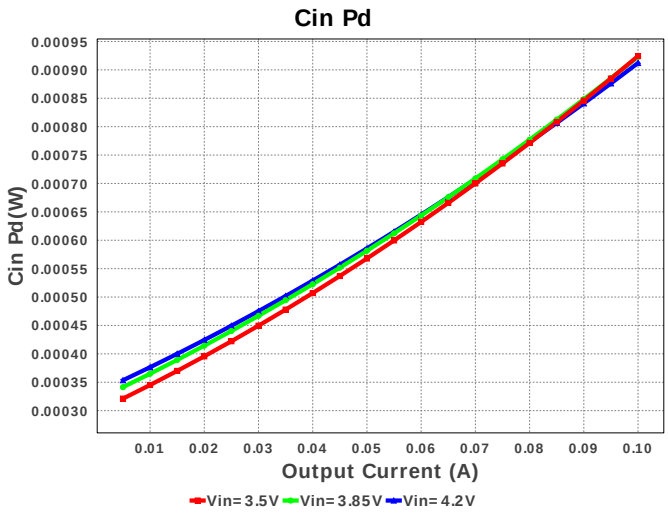



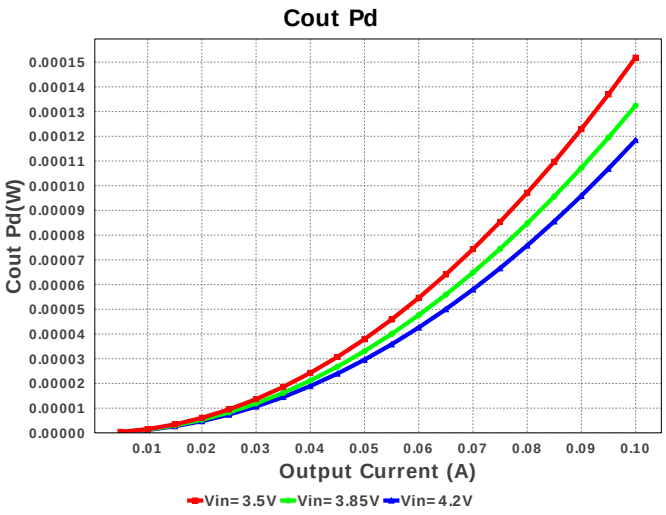



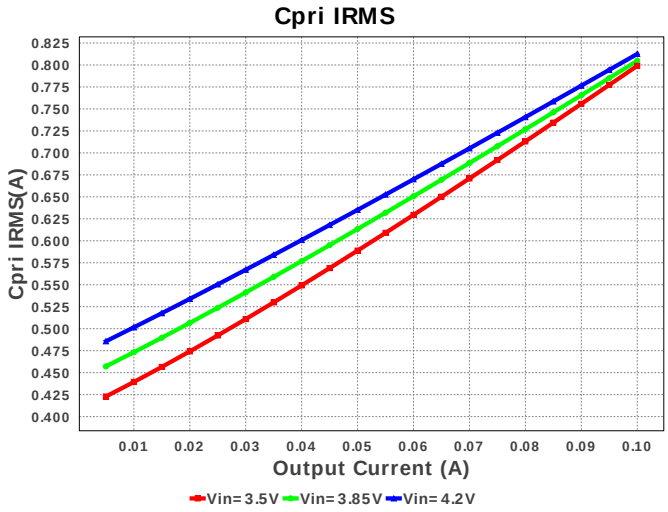



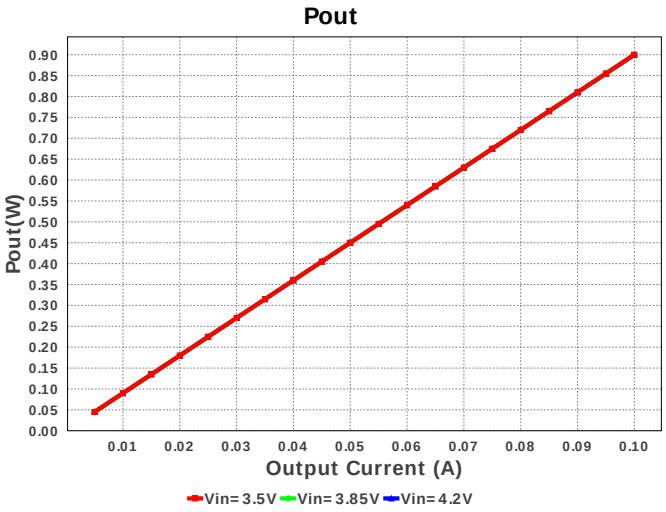



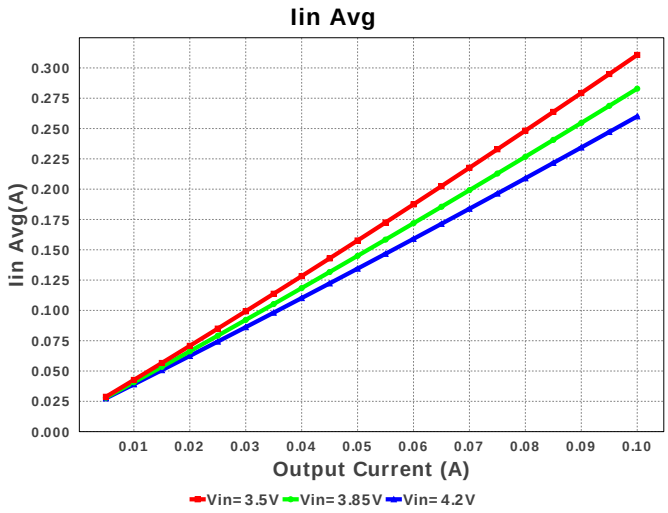



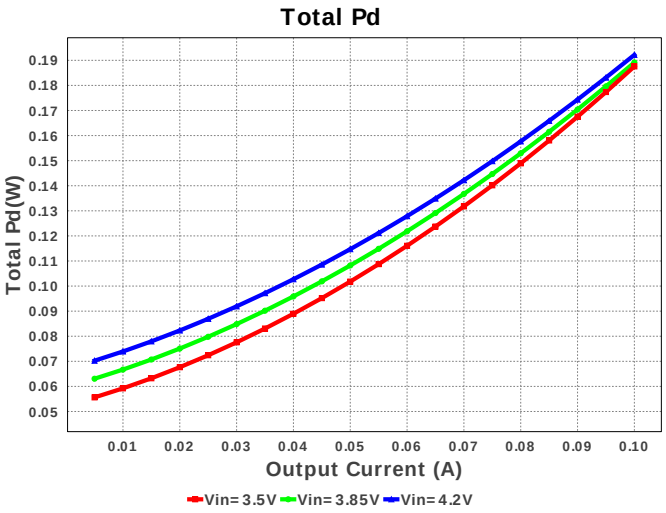


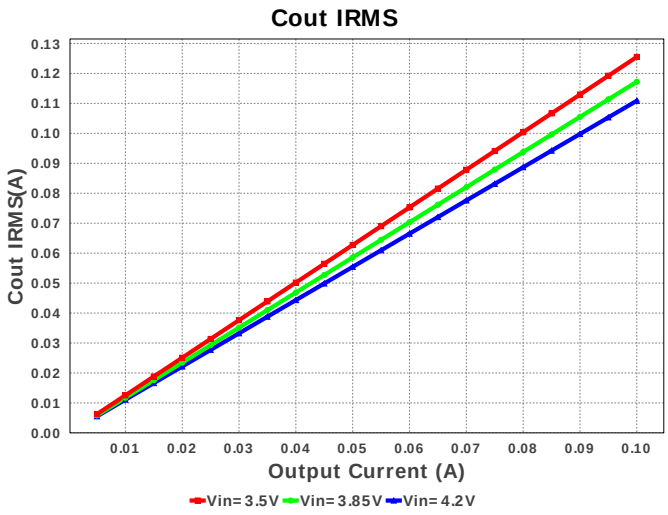



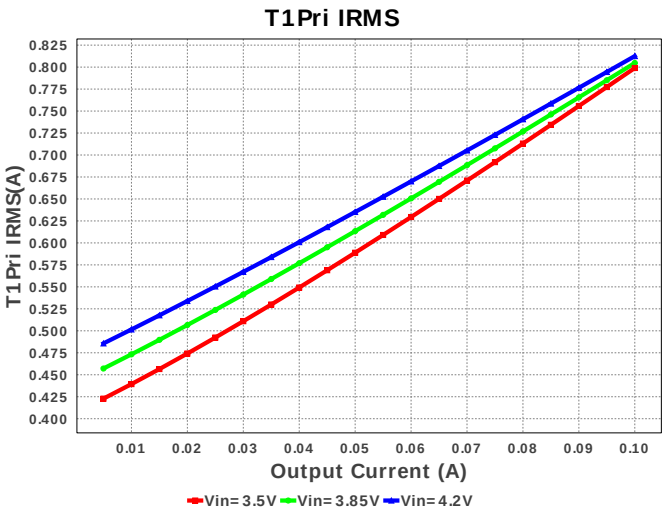



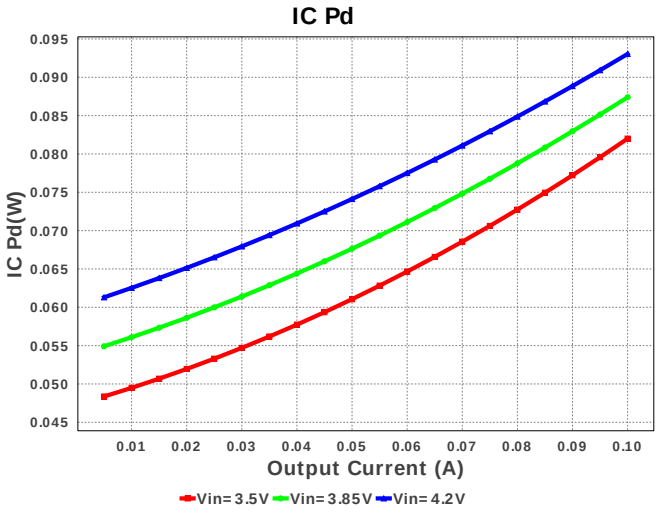



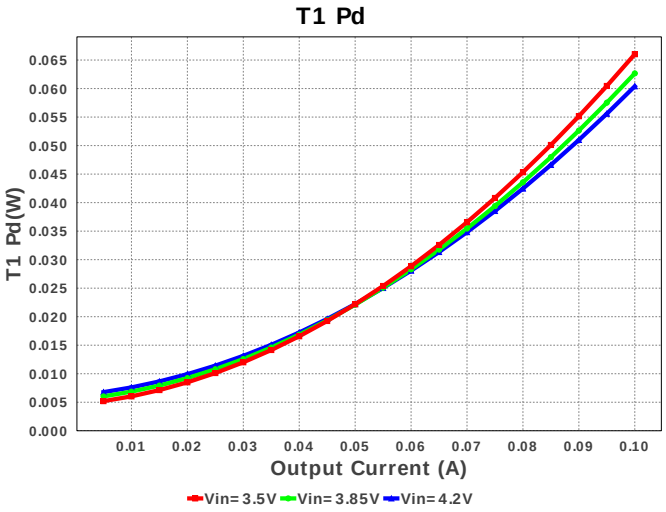



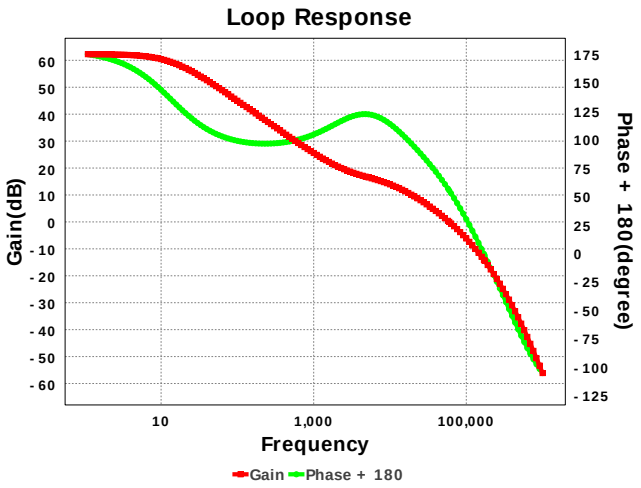






## Operating Values

| # | Name | Value | Category | Description |
|---|---|---|---|---|
| 1. | Cin IRMS | 494.154 mA | Current | Input capacitor RMS ripple current |
| 2. | Cout IRMS | 110.865 mA | Current | Output capacitor RMS ripple current |
| 3. | Cpri IRMS | 812.526 mA | Current | Primary Capacitor RMS Current |
| 4. | Iin Avg | 264.96 mA | Current | Average input current |
| 5. | T1Pri IRMS | 812.526 mA | Current | Transformer Primary RMS Current |
| 6. | T1Sec IRMS | 149.302 mA | Current | Transformer Secondary RMS Current |
| 7. | BOM Count | 20 | General | Total Design BOM count |
| 8. | FootPrint | 122.0 $mm^2$ | General | Total Foot Print Area of BOM components |
| 9. | Frequency | 499.033 kHz | General | Switching frequency |
| 10. | Mode | DCM | General | Conduction Mode |
| 11. | Pout | 900.0 mW | General | Total output power |

| # | Name | Value | Category | Description |
|---|---|---|---|---|
| 12. | Total BOM | $0.0 | General | Total BOM Cost |
| 13. | Low Freq Gain | 62.269 dB | Op_Point | Gain at 10Hz |
| 14. | Vout Actual | 1.812 V | Op_Point | Vout Actual calculated based on selected voltage divider resistors |
| 15. | Vout OP | 9.0 V | Op_Point | Operational Output Voltage |
| 16. | Cross Freq | 59.79 kHz | Op_point | Bode plot crossover frequency |
| 17. | Duty Cycle | 40.185 % | Op_point | Duty cycle |
| 18. | Efficiency | 80.875 % | Op_point | Steady state efficiency |
| 19. | IC Tj | 35.582 degC | Op_point | IC junction temperature |
| 20. | ICThetaJA | 60.0 degC/W | Op_point | IC junction-to-ambient thermal resistance |
| 21. | IOUT_OP | 100.0 mA | Op_point | Iout operating point |
| 22. | Phase Marg | 55.649 deg | Op_point | Bode Plot Phase Margin |
| 23. | VIN_OP | 4.2 V | Op_point | Vin operating point |
| 24. | Vout p-p | 186.127 mV | Op_point | Peak-to-peak output ripple voltage |
| 25. | Cin Pd | 912.045 µW | Power | Input capacitor power dissipation |
| 26. | Cout Pd | 118.448 µW | Power | Output capacitor power dissipation |
| 27. | D1 Pd | 57.0 mW | Power | Output Diode Power Dissipation |
| 28. | IC Pd | 93.04 mW | Power | IC power dissipation |
| 29. | T1 Pd | 60.442 mW | Power | Transformer Power Dissipation |
| 30. | Total Pd | 212.832 mW | Power | Total Power Dissipation |
| 31. | Vout Tolerance | 2.56 % | | Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable |

## Design Inputs

| # | Name | Value | Description |
|---|---|---|---|
| 1. | Iout | 100.0 m | Maximum Output Current |
| 2. | VinMax | 4.2 | Maximum input voltage |
| 3. | VinMin | 3.5 | Minimum input voltage |
| 4. | Vout | 9.0 | Output Voltage |
| 5. | base_pn | TPS55010 | Texas Instruments Base Part Number |
| 6. | source | DC | Input Source Type |
| 7. | ta | 30.0 | Ambient temperature |

## Design Assistance

1. TPS55010 Product Folder : http://www.ti.com/product/TPS55010 : contains the data sheet and other resources.