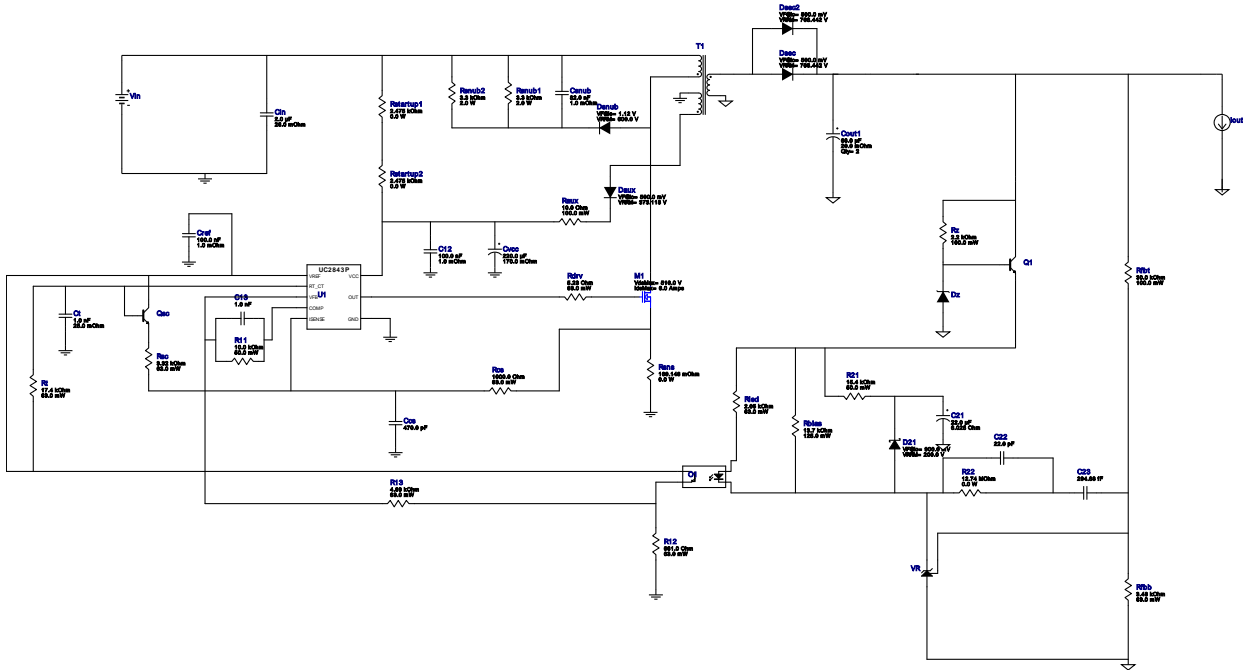


# WEBENCH® Design Report



UC2843N 20V-400V to 24.00V @ 1A



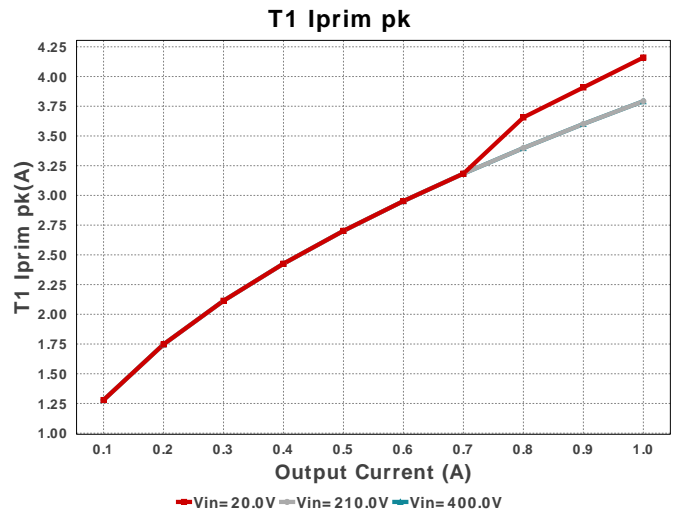
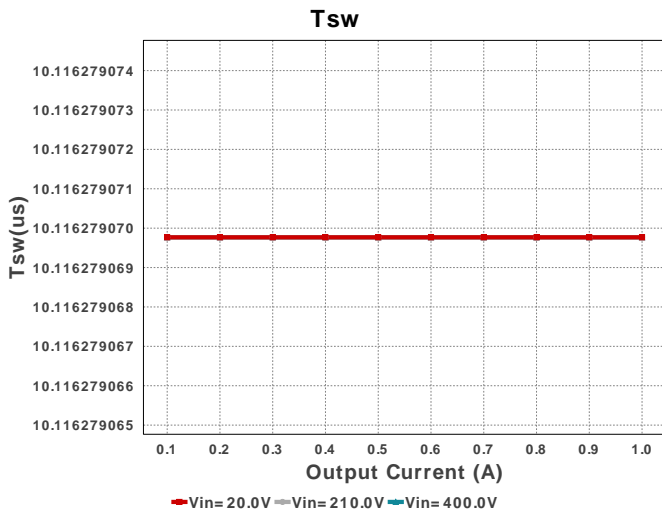
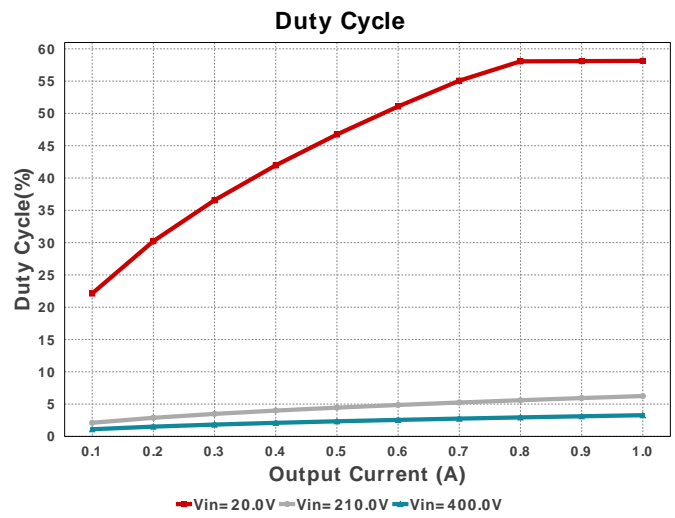
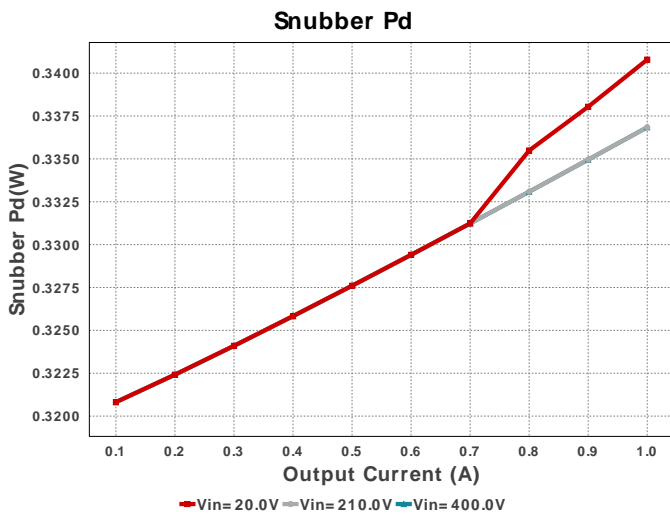
## Electrical BOM

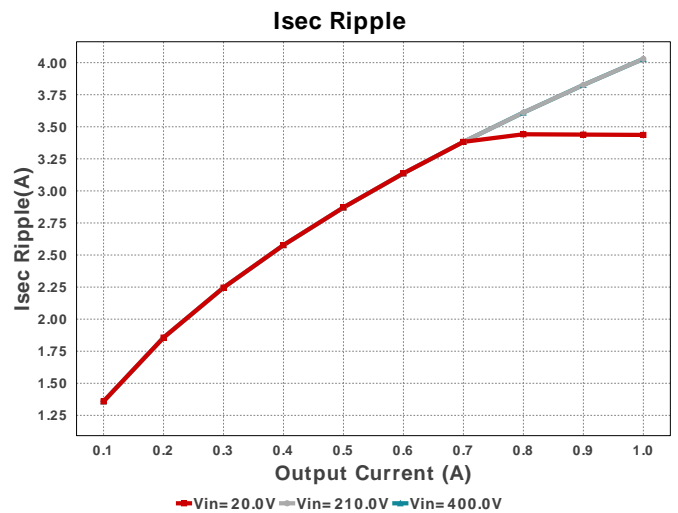
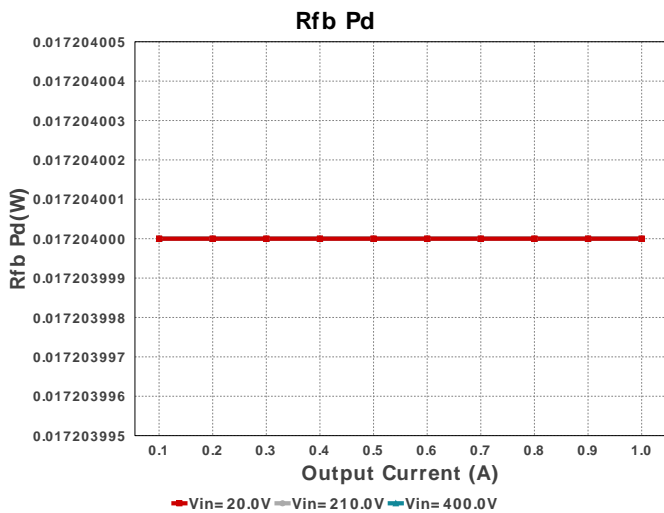
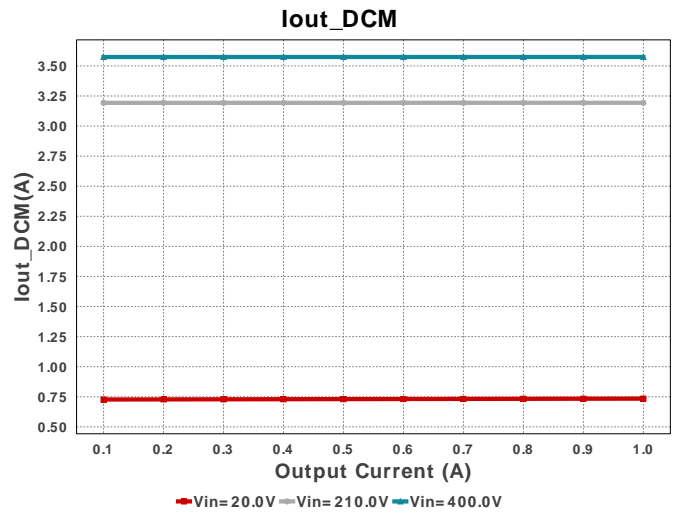
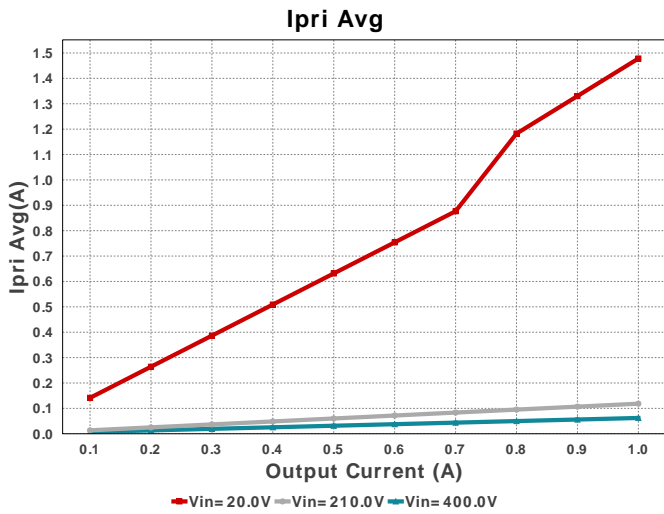
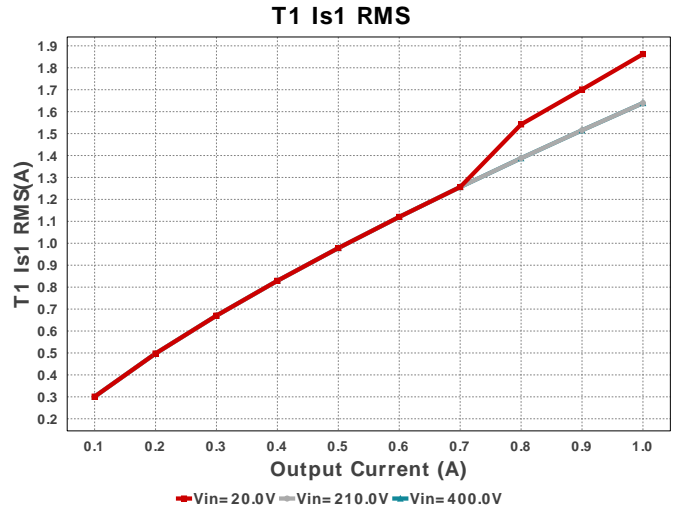
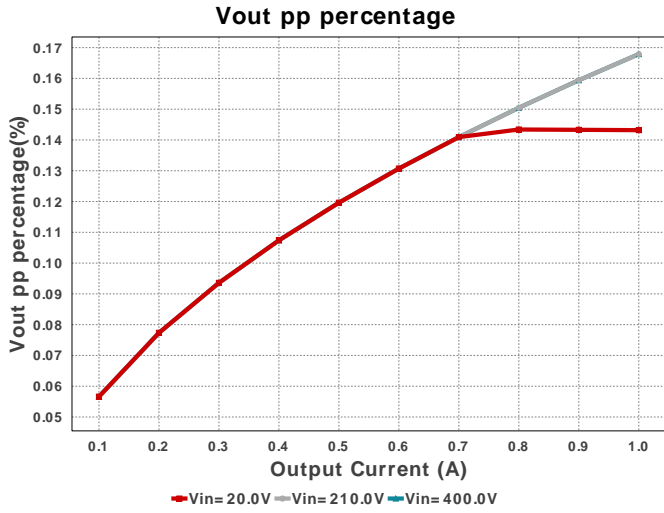
| #  | Name | Manufacturer              | Part Number                           | Properties  | Qty | Price  | Footprint  |
|----|------|---------------------------|---------------------------------------|---|-----|--------|--|
| 1. | C12  | MuRata                    | GRM155R71C104KA88D<br>Series= X7R     | Cap= 100.0 nF<br>ESR= 1.0 mOhm<br>VDC= 16.0 V<br>IRMS= 0.0 A    | 1   | \$0.01 | 0402 3 mm <sup>2</sup>   |
| 2. | C13  | MuRata                    | GRM1555C1H102JA01J<br>Series= C0G/NP0 | Cap= 1.0 nF<br>VDC= 50.0 V<br>IRMS= 0.0 A                       | 1   | \$0.01 | 0402 3 mm <sup>2</sup>   |
| 3. | C21  | Panasonic                 | EEUFC1H220<br>Series= FC              | Cap= 22.0 uF<br>ESR= 6.028 Ohm<br>VDC= 50.0 V<br>IRMS= 155.0 mA | 1   | \$0.06 | <br>Panasonic_500x1100 49 mm <sup>2</sup>     |
| 4. | C22  | Samsung Electro-Mechanics | CL21C220JBANNNC<br>Series= C0G/NP0    | Cap= 22.0 pF<br>VDC= 50.0 V<br>IRMS= 0.0 A                      | 1   | \$0.01 | 0805 7 mm <sup>2</sup>   |
| 5. | C23  | CUSTOM                    | CUSTOM<br>Series= ?                   | Cap= 294.68 fF<br>VDC= 0.0 V<br>IRMS= 0.0 A                     | 1   | NA     | CUSTOM 0 mm <sup>2</sup>   |
| 6. | Ccs  | AVX                       | 04025A471JAT2A<br>Series= C0G/NP0     | Cap= 470.0 pF<br>VDC= 50.0 V<br>IRMS= 0.0 A                     | 1   | \$0.01 | 0402 3 mm <sup>2</sup>   |
| 7. | Cin  | TDK                       | B32774D205K<br>Series= B32774         | Cap= 2.0 uF<br>ESR= 26.0 mOhm<br>VDC= 1.1 kV<br>IRMS= 4.5 A     | 1   | \$1.99 | <br>B32774_3150x2150x1250 486 mm <sup>2</sup> |

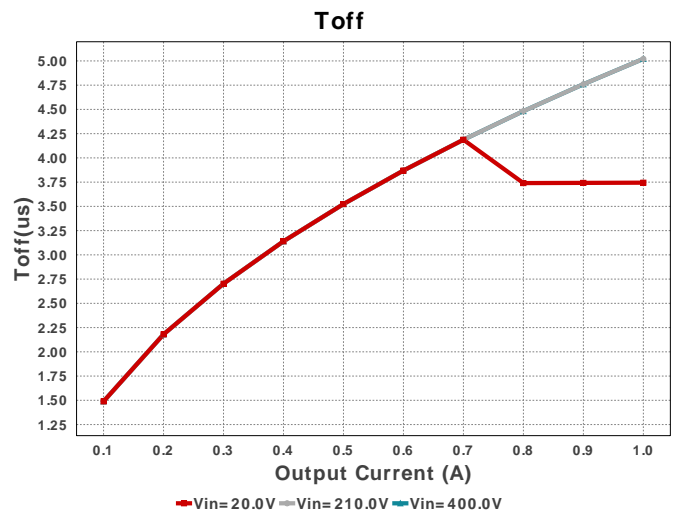
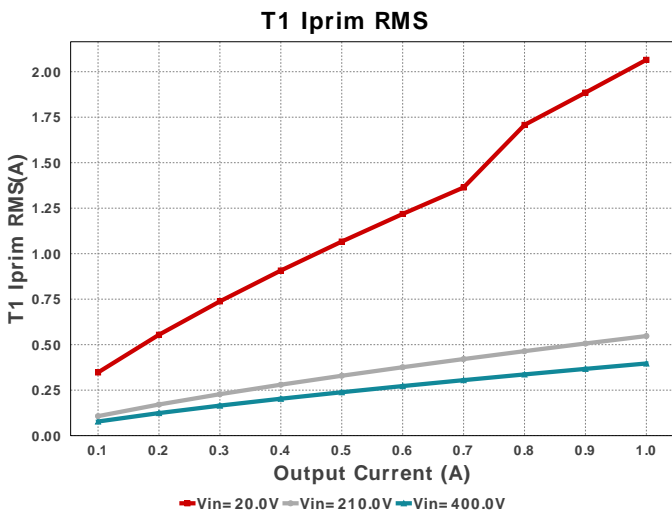
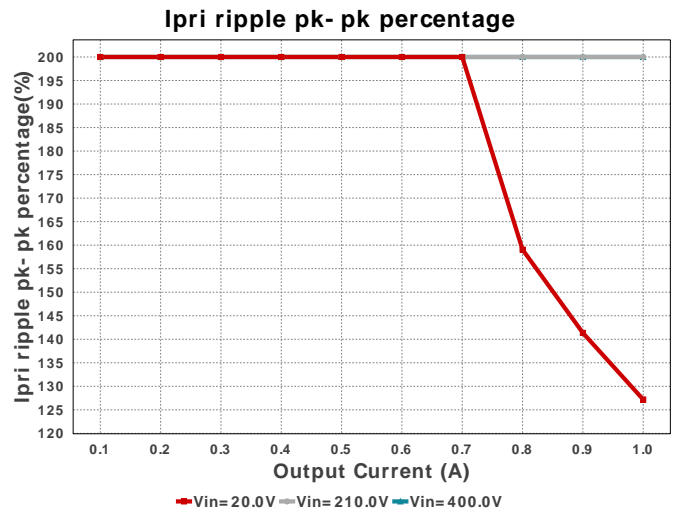
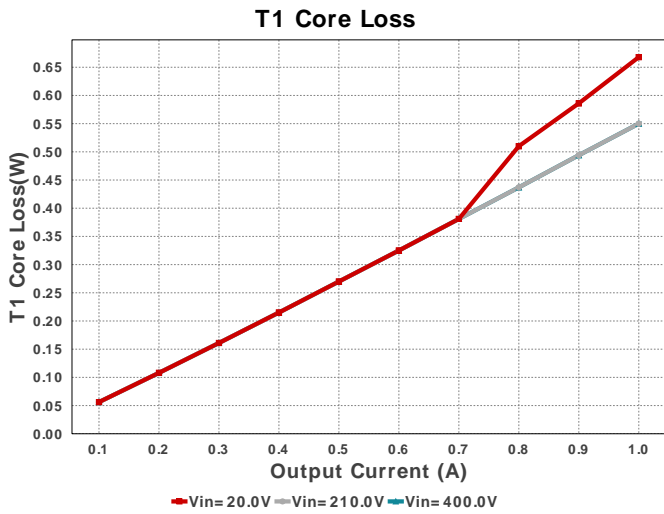
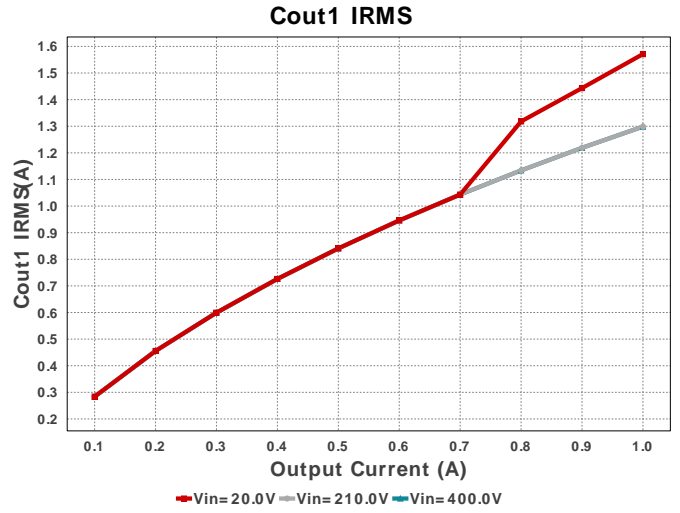
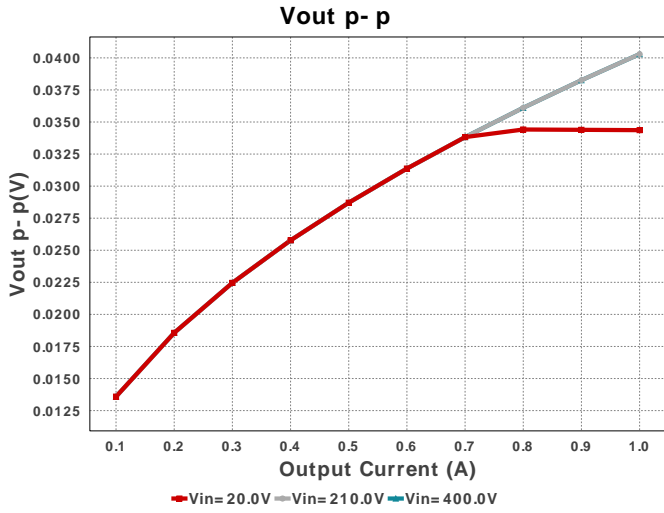
| #   | Name  | Manufacturer            | Part Number                          | Properties  | Qty | Price  | Footprint  |
|-----|-------|-------------------------|--------------------------------------|---|-----|--------|--|
| 8.  | Cout1 | Panasonic               | 50SVPF68M<br>Series= SVPF            | Cap= 68.0 uF<br>ESR= 20.0 mOhm<br>VDC= 50.0 V<br>IRMS= 4.3 A      | 2   | \$0.95 | <br>CAPSMT_62_F12 151 mm² |
| 9.  | Cref  | MuRata                  | GRM155R71C104KA88D<br>Series= X7R    | Cap= 100.0 nF<br>ESR= 1.0 mOhm<br>VDC= 16.0 V<br>IRMS= 0.0 A      | 1   | \$0.01 | <br>0402 3 mm²            |
| 10. | Csub  | Kemet                   | C0805C822KBRACU<br>Series= X7R       | Cap= 82.0 nF<br>ESR= 1.0 mOhm<br>VDC= 630.0 V<br>IRMS= 0.0 A      | 1   | \$0.06 | <br>0805 7 mm²            |
| 11. | Ct    | Kemet                   | C0805C102J1GACTU<br>Series= C0G/NP0  | Cap= 1.0 nF<br>ESR= 25.0 mOhm<br>VDC= 100.0 V<br>IRMS= 1.71 A     | 1   | \$0.09 | <br>0805 7 mm²            |
| 12. | Cvcc  | Nichicon                | UUD1E221MNL1GS<br>Series= uD         | Cap= 220.0 uF<br>ESR= 170.0 mOhm<br>VDC= 25.0 V<br>IRMS= 450.0 mA | 1   | \$0.17 | <br>SM_RADIAL_8MM 113 mm² |
| 13. | D21   | SMC Diode Solutions     | SK220ATR                             | VF@Io= 900.0 mV<br>VRRM= 200.0 V                                  | 1   | \$0.04 | <br>SMA 37 mm²            |
| 14. | Daux  | CUSTOM                  | CUSTOM                               | VF@Io= 500.0 mV<br>VRRM= 373.118 V                                | 1   | NA     | CUSTOM 0 mm²   |
| 15. | Dsec  | CUSTOM                  | CUSTOM                               | VF@Io= 500.0 mV<br>VRRM= 768.442 V                                | 1   | NA     | CUSTOM 0 mm²   |
| 16. | Dsec2 | CUSTOM                  | CUSTOM                               | VF@Io= 500.0 mV<br>VRRM= 768.442 V                                | 1   | NA     | CUSTOM 0 mm²   |
| 17. | Dsub  | Bourns                  | CD214C-F3600                         | VF@Io= 1.12 V<br>VRRM= 600.0 V                                    | 1   | \$0.23 | <br>SMC 83 mm²          |
| 18. | Dz    | Diodes Inc.             | MMSZ5250B-7-F                        | Zener   | 1   | \$0.03 | <br>SOD-123 13 mm²      |
| 19. | M1    | NA                      | IdealFET                             | VdsMax= 516.0 V<br>IdsMax= 6.0 Amps                               | 1   | NA     | NA 0 mm²   |
| 20. | O1    | Fairchild Semiconductor | FOD817A                              | Optocoupler   | 1   | \$0.11 | <br>DIP-4 71 mm²        |
| 21. | Q1    | Diodes Inc.             | MMBT4401-7-F                         | Bipolar Transistor  | 1   | \$0.02 | <br>SOT-23 14 mm²       |
| 22. | Qsc   | STMicroelectronics      | 2N2222A                              | Bipolar Transistor  | 1   | \$1.11 | <br>TO-18 57 mm²        |
| 23. | R11   | Yageo                   | RC0201FR-0710KL<br>Series= ?         | Res= 10000.0Ohm<br>Power= 50.0 mW<br>Tolerance= 1.0%              | 1   | \$0.01 | <br>0201 2 mm²          |
| 24. | R12   | Vishay-Dale             | CRCW0402681RFKED<br>Series= CRCW..e3 | Res= 681.0Ohm<br>Power= 63.0 mW<br>Tolerance= 1.0%                | 1   | \$0.01 | <br>0402 3 mm²          |
| 25. | R13   | Vishay-Dale             | CRCW04024K99FKED<br>Series= CRCW..e3 | Res= 4990.0Ohm<br>Power= 63.0 mW<br>Tolerance= 1.0%               | 1   | \$0.01 | <br>0402 3 mm²          |
| 26. | R21   | Yageo                   | RC0201FR-0715K4L<br>Series= ?        | Res= 15400.0Ohm<br>Power= 50.0 mW<br>Tolerance= 1.0%              | 1   | \$0.01 | <br>0201 2 mm²          |

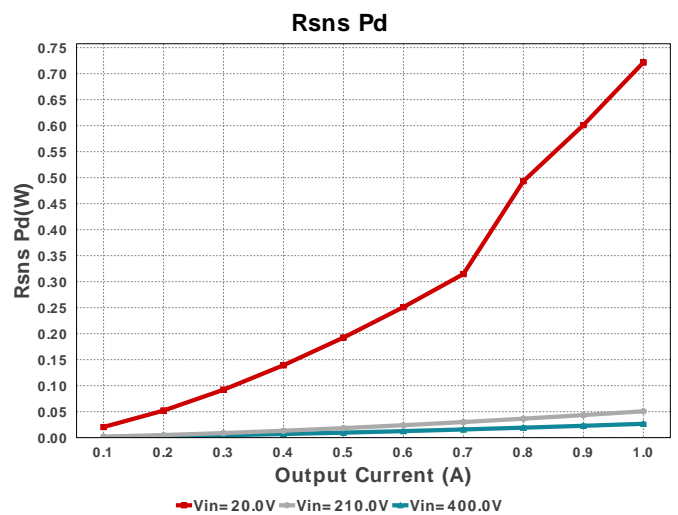
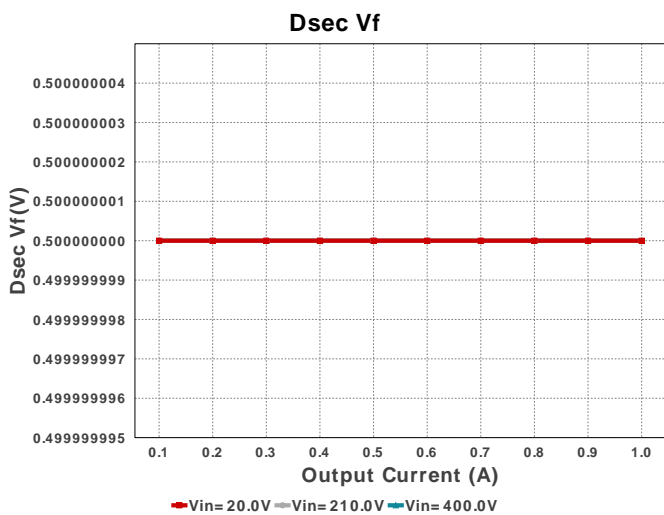
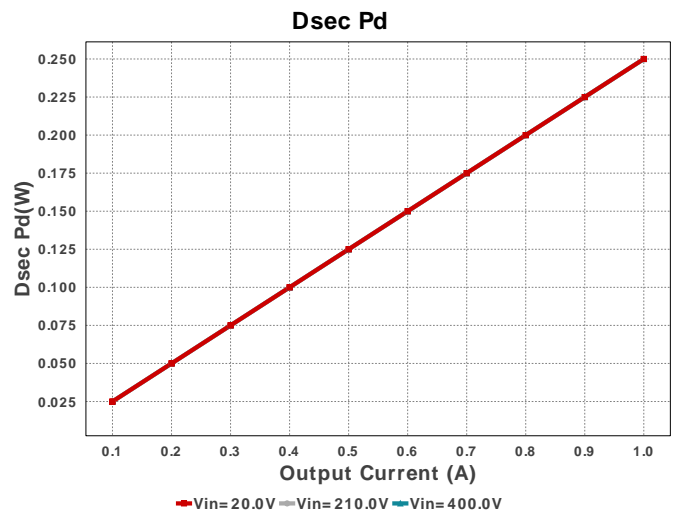
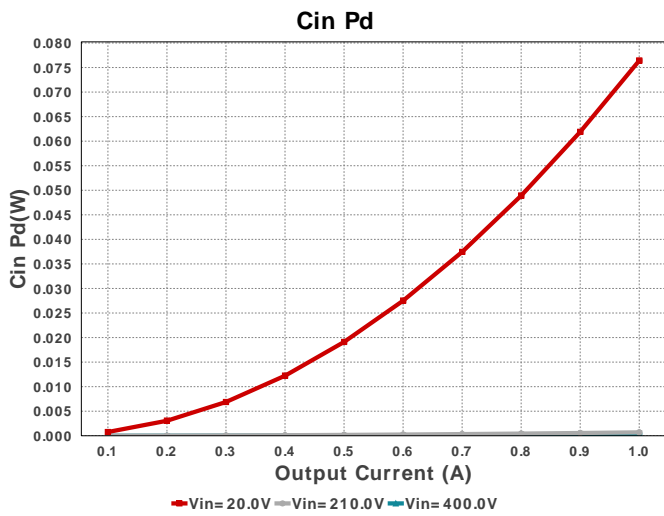
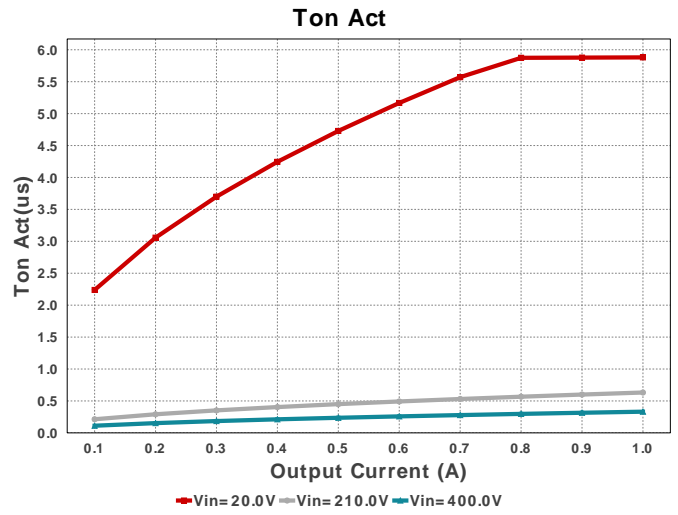
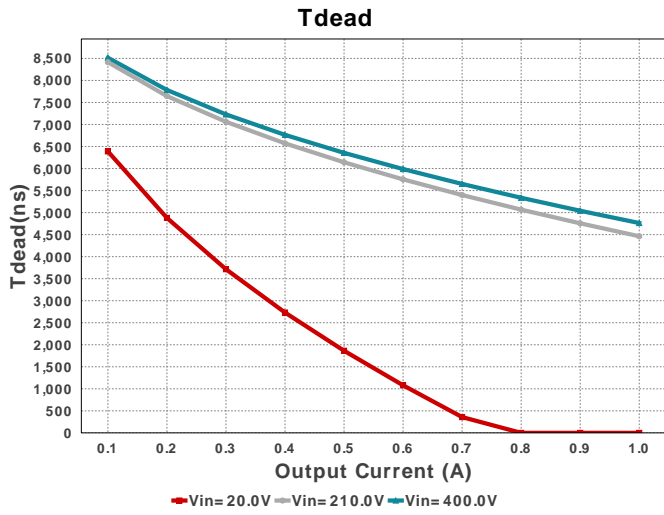
| #   | Name      | Manufacturer                 | Part Number  | Properties  | Qty | Price  | Footprint  |
|-----|-----------|------------------------------|--|---|-----|--------|--|
| 27. | R22       | CUSTOM                       | CUSTOM<br>Series= ?                                  | Res= 1.2740244856225204E7Ohm<br>Power= 0.0 W<br>Tolerance= 0.0%   | 1   | NA     | CUSTOM 0 mm <sup>2</sup>   |
| 28. | Raux      | Vishay-Dale                  | CRCW060310R0FKEA<br>Series= CRCW..e3                 | Res= 10.0Ohm<br>Power= 100.0 mW<br>Tolerance= 1.0%  | 1   | \$0.01 |  0603 5 mm <sup>2</sup>           |
| 29. | Rbias     | Vishay-Dale                  | CRCW080513K7FKEA<br>Series= CRCW..e3                 | Res= 13700.0Ohm<br>Power= 125.0 mW<br>Tolerance= 1.0%   | 1   | \$0.01 |  0805 7 mm <sup>2</sup>           |
| 30. | Rcs       | Vishay-Dale                  | CRCW04021K00FKED<br>Series= CRCW..e3                 | Res= 1000.0Ohm<br>Power= 63.0 mW<br>Tolerance= 1.0%   | 1   | \$0.01 |  0402 3 mm <sup>2</sup>           |
| 31. | Rdrv      | Vishay-Dale                  | CRCW04025R23FKED<br>Series= CRCW..e3                 | Res= 5.23Ohm<br>Power= 63.0 mW<br>Tolerance= 1.0%   | 1   | \$0.01 |  0402 3 mm <sup>2</sup>           |
| 32. | Rfbb      | Vishay-Dale                  | CRCW04023K48FKED<br>Series= CRCW..e3                 | Res= 3480.0Ohm<br>Power= 63.0 mW<br>Tolerance= 1.0%   | 1   | \$0.01 |  0402 3 mm <sup>2</sup>           |
| 33. | Rfbt      | Yageo                        | RC0603FR-0730KL<br>Series= ?                         | Res= 30000.0Ohm<br>Power= 100.0 mW<br>Tolerance= 1.0%   | 1   | \$0.01 |  0603 5 mm <sup>2</sup>           |
| 34. | Rled      | Vishay-Dale                  | CRCW04022K05FKED<br>Series= CRCW..e3                 | Res= 2050.0Ohm<br>Power= 63.0 mW<br>Tolerance= 1.0%   | 1   | \$0.01 |  0402 3 mm <sup>2</sup>           |
| 35. | Rsc       | Vishay-Dale                  | CRCW04023K32FKED<br>Series= CRCW..e3                 | Res= 3320.0Ohm<br>Power= 63.0 mW<br>Tolerance= 1.0%   | 1   | \$0.01 |  0402 3 mm <sup>2</sup>           |
| 36. | Rsns      | CUSTOM                       | CUSTOM<br>Series= ?                                  | Res= 0.16914572864321606Ohm<br>Power= 0.0 W<br>Tolerance= 0.0%  | 1   | NA     | CUSTOM 0 mm <sup>2</sup>   |
| 37. | Rsub1     | Vishay-Bcomponents           | PR02000203301JR500<br>Series= ?                      | Res= 3300.0Ohm<br>Power= 2.0 W<br>Tolerance= 5.0%   | 1   | \$0.05 |  PR02 117 mm <sup>2</sup>       |
| 38. | Rsub2     | Vishay-Bcomponents           | PR02000203301JR500<br>Series= ?                      | Res= 3300.0Ohm<br>Power= 2.0 W<br>Tolerance= 5.0%   | 1   | \$0.05 |  PR02 117 mm <sup>2</sup>       |
| 39. | Rstartup1 | CUSTOM                       | CUSTOM<br>Series= ?                                  | Res= 2475.0Ohm<br>Power= 0.0 W<br>Tolerance= 0.0%   | 1   | NA     | CUSTOM 0 mm <sup>2</sup>   |
| 40. | Rstartup2 | CUSTOM                       | CUSTOM<br>Series= ?                                  | Res= 2475.0Ohm<br>Power= 0.0 W<br>Tolerance= 0.0%   | 1   | NA     | CUSTOM 0 mm <sup>2</sup>   |
| 41. | Rt        | Vishay-Dale                  | CRCW040217K4FKED<br>Series= CRCW..e3                 | Res= 17400.0Ohm<br>Power= 63.0 mW<br>Tolerance= 1.0%  | 1   | \$0.01 |  0402 3 mm <sup>2</sup>         |
| 42. | Rz        | Yageo                        | RC0603FR-072K2L<br>Series= ?                         | Res= 2200.0Ohm<br>Power= 100.0 mW<br>Tolerance= 1.0%  | 1   | \$0.01 |  0603 5 mm <sup>2</sup>         |
| 43. | T1        | Core=TDK ,<br>CoilFormer=TDK | Core=B65807J0000R041 ,<br>CoilFormer=B65821C1008T001 | Lp= 35.0 µH<br>Turns Ratio(Nas)= 8:16<br>Turns Ratio(Nps)= 17:16<br>Npri= 17.0<br>Naux= 8.0<br>Naux= 16.0 | 1   | \$1.52 |  TDK_B65803 365 mm <sup>2</sup> |
| 44. | U1        | Texas Instruments            | UC2843N  | Switcher  | 1   | \$0.54 |  P0008A 116 mm <sup>2</sup>     |

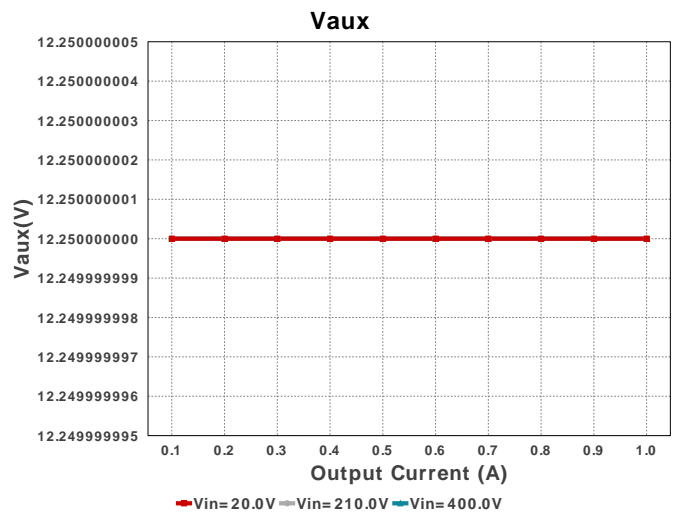
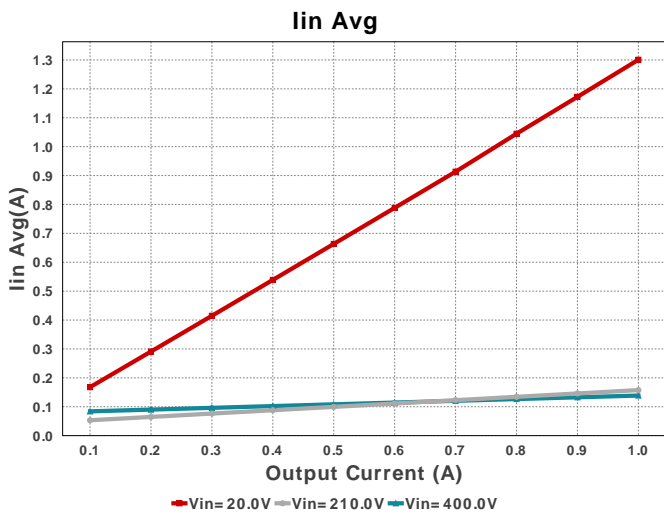
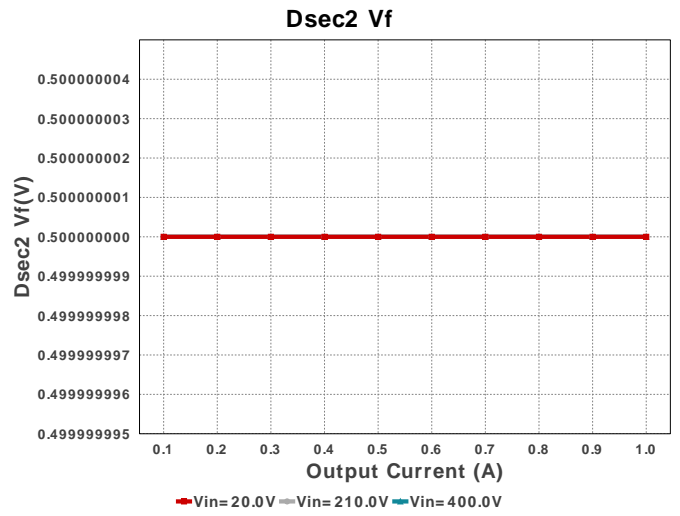
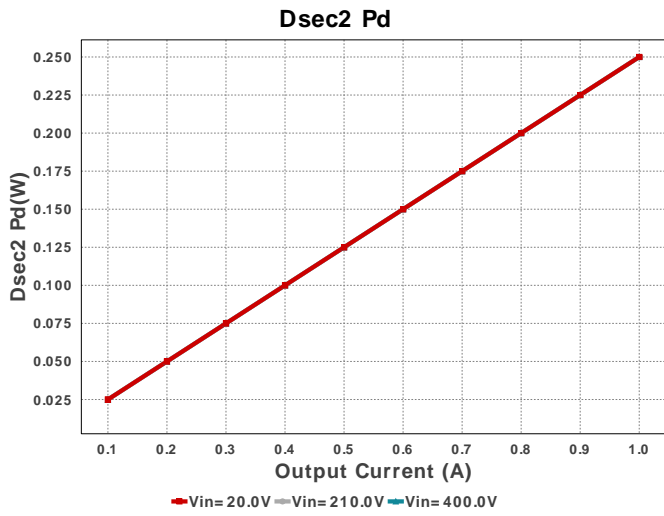
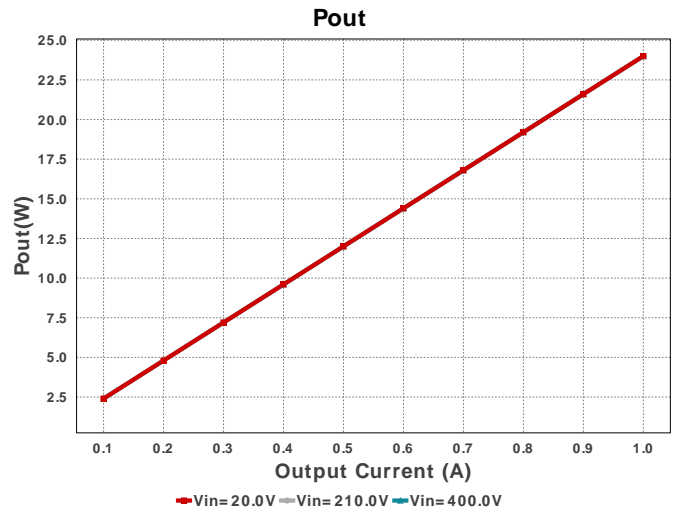
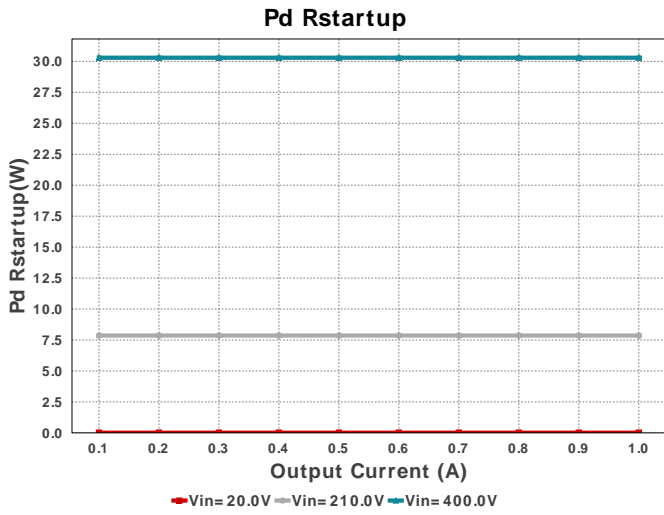
| #   | Name | Manufacturer      | Part Number | Properties         | Qty | Price  | Footprint   |
|-----|------|-------------------|-------------|--------------------|-----|--------|---|
| 45. | VR   | Texas Instruments | TL431IDBVR  | Voltage References | 1   | \$0.06 | <br>R-PDSO-G3 16 mm <sup>2</sup> |



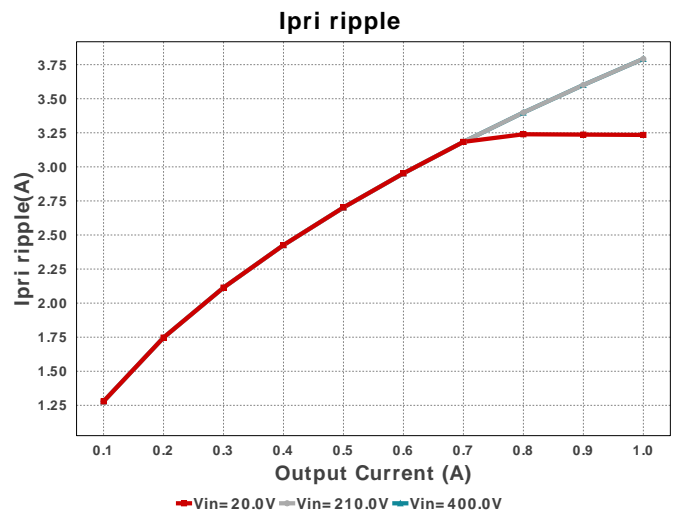
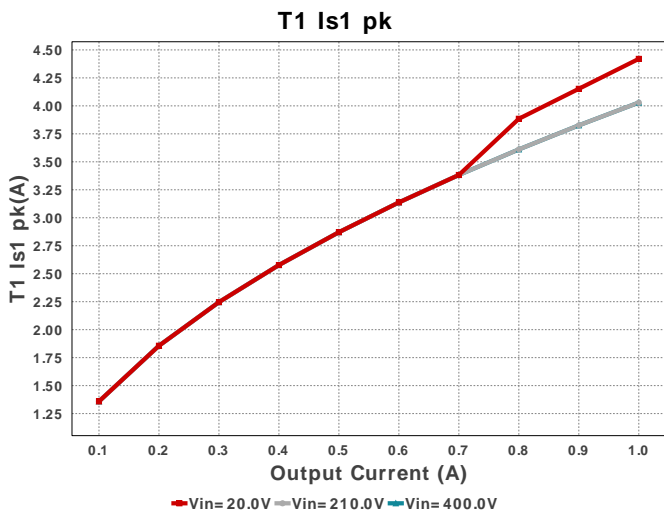
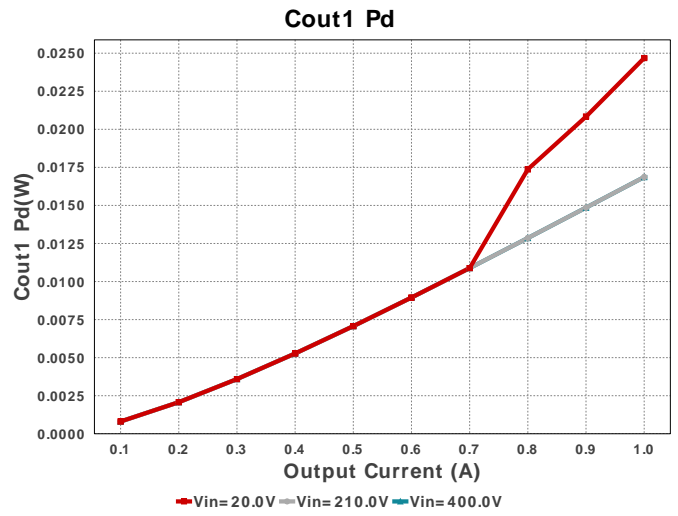
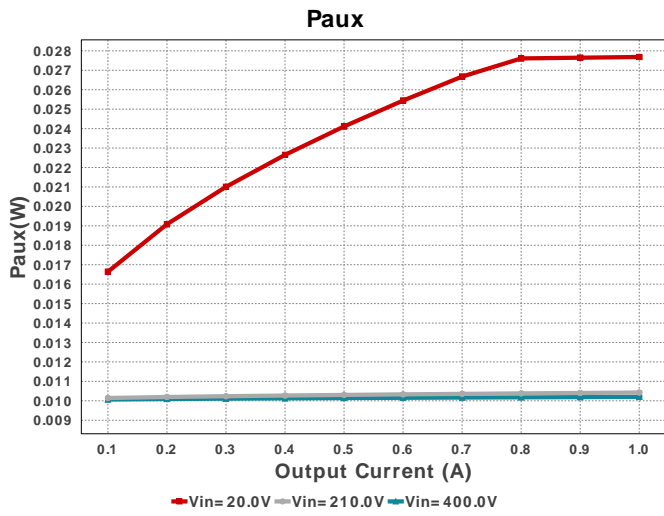
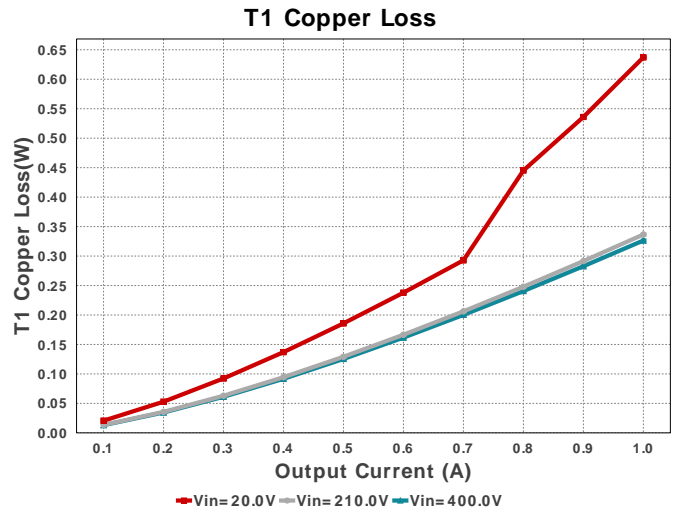
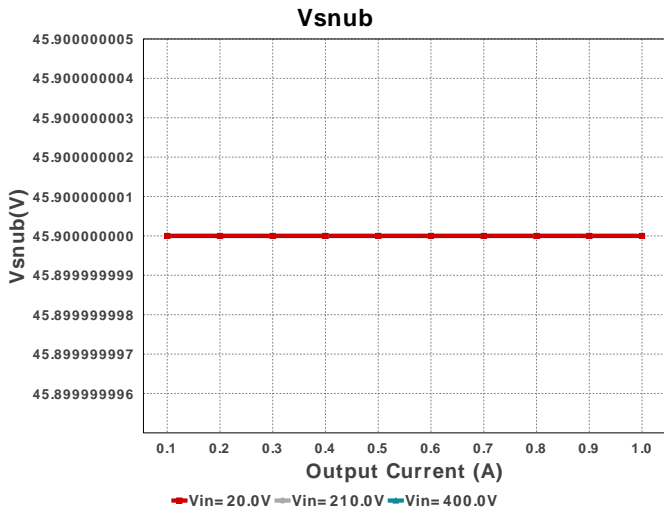


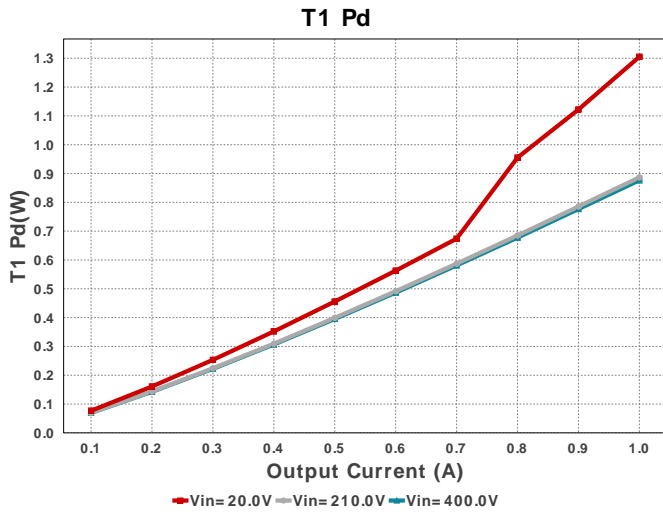












## Operating Values

| #   | Name           | Value                   | Category  | Description  |
|-----|----------------|-------------------------|-----------|--|
| 1.  | Cin Pd         | 76.408 mW               | Capacitor | Input capacitor power dissipation                                |
| 2.  | Cout1 IRMS     | 1.571 A                 | Capacitor | Output capacitor1 RMS ripple current                             |
| 3.  | Cout1 Pd       | 24.683 mW               | Capacitor | Output capacitor1 power dissipation                              |
| 4.  | Daux trr       | 0.0 ns                  | Diode     | Auxiliary Diode Reverse Recovery Time                            |
| 5.  | Dsec Pd        | 250.0 mW                | Diode     | Secondary Diode Power Dissipation                                |
| 6.  | Dsec Vf        | 500.0 mV                | Diode     | Effective Forward Voltage Drop at the Operating Current          |
| 7.  | Dsec trr       | 0.0 ns                  | Diode     | Output Diode Reverse Recovery Time                               |
| 8.  | Dsec2 Pd       | 250.0 mW                | Diode     | Secondary Diode Power Dissipation                                |
| 9.  | Dsec2 Vf       | 500.0 mV                | Diode     | Effective Forward Voltage Drop at the Operating Current          |
| 10. | Dsnub trr      | 30.0 ns                 | Diode     | Snubber Diode Reverse Recovery Time                              |
| 11. | ICThetaJA      | 53.5 degC/W             | IC        | IC junction-to-ambient thermal resistance                        |
| 12. | Iin Avg        | 1.338 A                 | IC        | Average input current  |
| 13. | Cin Pd         | 76.408 mW               | Power     | Input capacitor power dissipation                                |
| 14. | Cout1 Pd       | 24.683 mW               | Power     | Output capacitor1 power dissipation                              |
| 15. | Dsec Pd        | 250.0 mW                | Power     | Secondary Diode Power Dissipation                                |
| 16. | Dsec2 Pd       | 250.0 mW                | Power     | Secondary Diode Power Dissipation                                |
| 17. | Paux           | 27.684 mW               | Power     | Power Dissipation in Raux and Daux                               |
| 18. | Pd Rstartup    | 10.619 mW               | Power     | Power Dissipation in Rstartup1 and Rstartup2                     |
| 19. | Rfb Pd         | 17.204 mW               | Power     | Rfb Power Dissipation  |
| 20. | Rsns Pd        | 721.46 mW               | Power     | Current Limit Sense Resistor Power Dissipation                   |
| 21. | Snubber Pd     | 340.788 mW              | Power     | Snubber Power Dissipation  |
| 22. | T1 Copper Loss | 568.87 mW               | Power     | Transformer Copper Loss Power Dissipation                        |
| 23. | T1 Core Loss   | 568.87 mW               | Power     | Transformer Core Loss Power Dissipation                          |
| 24. | T1 Pd          | 1.138 W                 | Power     | Estimated Losses in Transformer                                  |
| 25. | Pd Rstartup    | 10.619 mW               | Resistor  | Power Dissipation in Rstartup1 and Rstartup2                     |
| 26. | Rfb Pd         | 17.204 mW               | Resistor  | Rfb Power Dissipation  |
| 27. | Rsns Pd        | 721.46 mW               | Resistor  | Current Limit Sense Resistor Power Dissipation                   |
| 28. | BOM Count      | 46                      | System    | Total Design BOM count   |
| 29. | Duty Cycle     | 58.13 %                 | System    | Duty cycle   |
| 30. | FootPrint      | 2.178 k mm <sup>2</sup> | System    | Total Foot Print Area of BOM components                          |
| 31. | Frequency      | 98.851 kHz              | System    | Switching frequency  |
| 32. | Iout           | 1.0 A                   | System    | Iout operating point   |
| 33. | Iout_DCM       | 734.542 mA              | System    | Approximate Current below which DCM mode of operation will begin |
| 34. | Mode           | CCM                     | System    | Conduction Mode  |
| 35. | Pout           | 24.0 W                  | System    | Total output power   |
| 36. | Tdead          | 0.0 ns                  | System    | Approximate Dead Time of the Regulator                           |
| 37. | Toff           | 3.744 us                | System    | Approximate Converter Off Time                                   |
| 38. | Ton Act        | 5.881 us                | System    | Approximate Converter On Time                                    |
| 39. | Total BOM      | NA                      | System    | Total BOM Cost   |

| #   | Name                         | Value      | Category           | Description  |
|-----|------------------------------|------------|--------------------|--|
| 40. | Tsw                          | 10.116 us  | System Information | Switching Time Period  |
| 41. | Vin                          | 20.0 V     | System Information | Vin operating point  |
| 42. | Vout                         | 24.0 V     | System Information | Operational Output Voltage   |
| 43. | Vout Actual                  | 24.004 V   | System Information | Vout Actual calculated based on selected voltage divider resistors                         |
| 44. | Vout Tolerance               | 2.137 %    | System Information | Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable |
| 45. | Vout p-p                     | 34.365 mV  | System Information | Peak-to-peak output ripple voltage   |
| 46. | Vout pp percentage           | 143.186 m% | System Information | Output Voltage ripple percentage   |
| 47. | Vsnub                        | 45.9 V     | System Information | Voltage Across the Snubber   |
| 48. | Ipri Avg                     | 1.478 A    | Transformer        | Average Current in Primary Winding over the complete Switching Period                      |
| 49. | Ipri ripple                  | 3.234 A    | Transformer        | Ripple Current in the Primary Winding  |
| 50. | Ipri ripple pk-pk percentage | 127.195 %  | Transformer        | Primary Current pk-pk ripple percentage(of Ipri avg during ton only)                       |
| 51. | Isec Ripple                  | 3.436 A    | Transformer        | Ripple Current in the Secondary Winding  |
| 52. | Paux                         | 27.684 mW  | Transformer        | Power Dissipation in Raux and Daux   |
| 53. | T1 Copper Loss               | 568.87 mW  | Transformer        | Transformer Copper Loss Power Dissipation  |
| 54. | T1 Core Loss                 | 568.87 mW  | Transformer        | Transformer Core Loss Power Dissipation  |
| 55. | T1 Iprim RMS                 | 2.065 A    | Transformer        | Transformer Primary RMS Current  |
| 56. | T1 Iprim pk                  | 4.16 A     | Transformer        | Transformer Primary Peak Current   |
| 57. | T1 Is1 RMS                   | 1.862 A    | Transformer        | Transformer Secondary1 RMS Current   |
| 58. | T1 Is1 pk                    | 4.42 A     | Transformer        | Transformer Secondary1 Peak Current  |
| 59. | T1 Pd                        | 1.138 W    | Transformer        | Estimated Losses in Transformer  |
| 60. | Vaux                         | 12.25 V    | Transformer        | Auxiliary Voltage  |

## Design Inputs

| #  | Name        | Value  | Description            |
|----|-------------|--------|------------------------|
| 1. | Iout        | 1.0    | Maximum Output Current |
| 2. | VinMax      | 400.0  | Maximum input voltage  |
| 3. | VinMin      | 20.0   | Minimum input voltage  |
| 4. | Vout        | 24.0   | Output Voltage         |
| 5. | acFrequency | 60.0   | AC Frequency           |
| 6. | base_pn     | UC2843 | Base Product Number    |
| 7. | source      | DC     | Input Source Type      |
| 8. | Ta          | 30.0   | Ambient temperature    |

## Design Assistance

1. **UC2843** Product Folder : <http://www.ti.com/product/UC2843> : contains the data sheet and other resources.

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