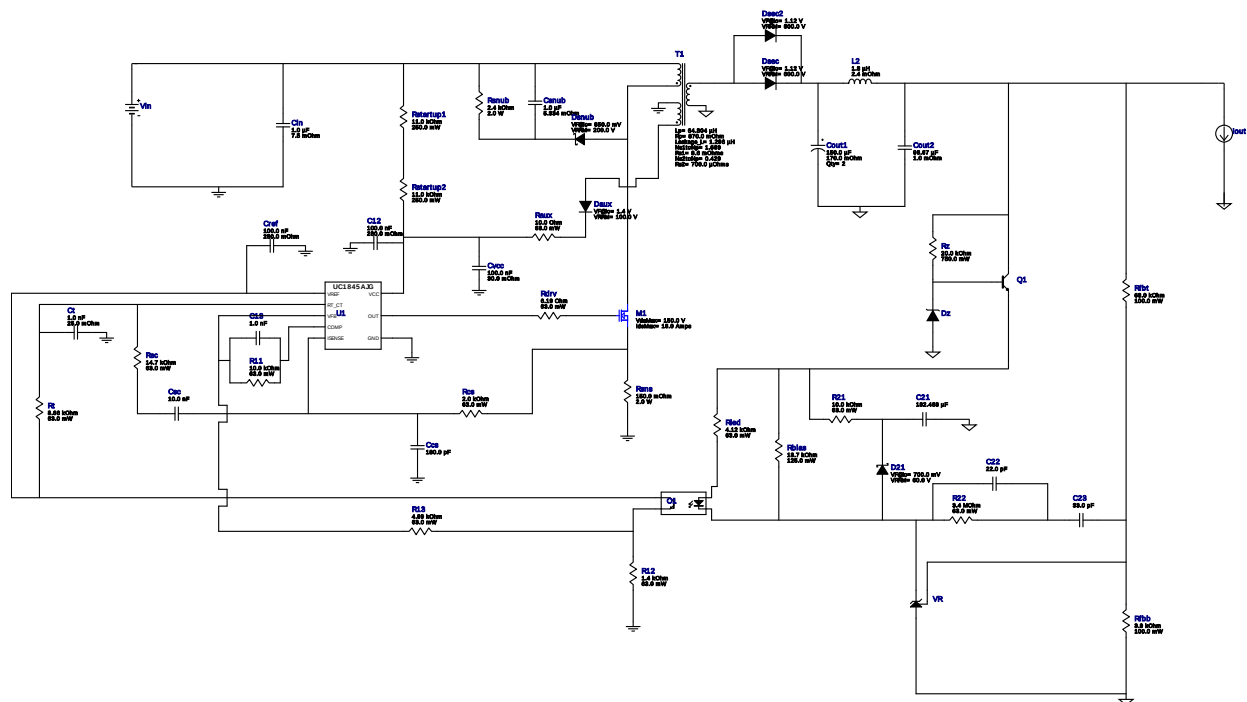


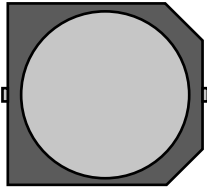
## WEBENCH® Design Report

Design : 4738744/31 UC1845AJ  
UC1845AJ 45.0V-59.0V to 46.00V @ 1.0A

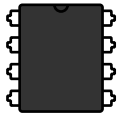


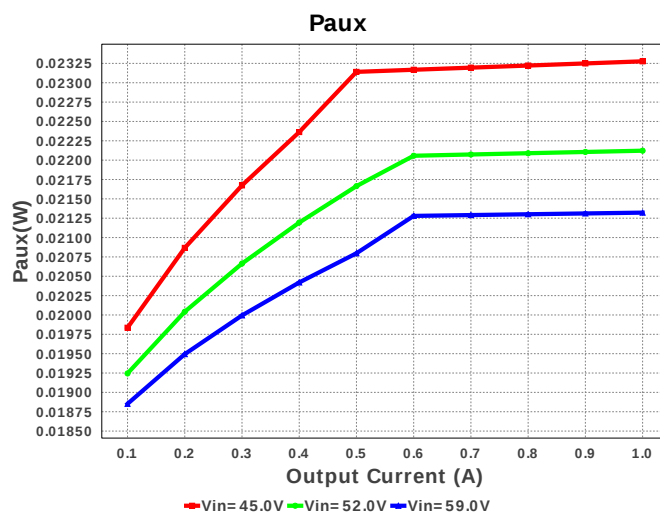
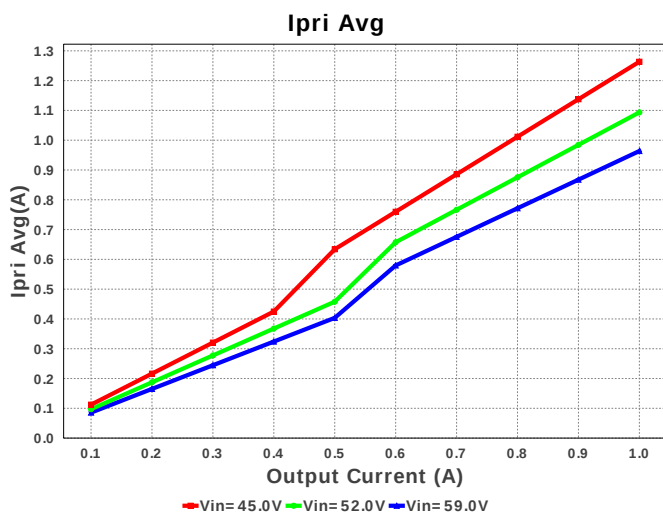
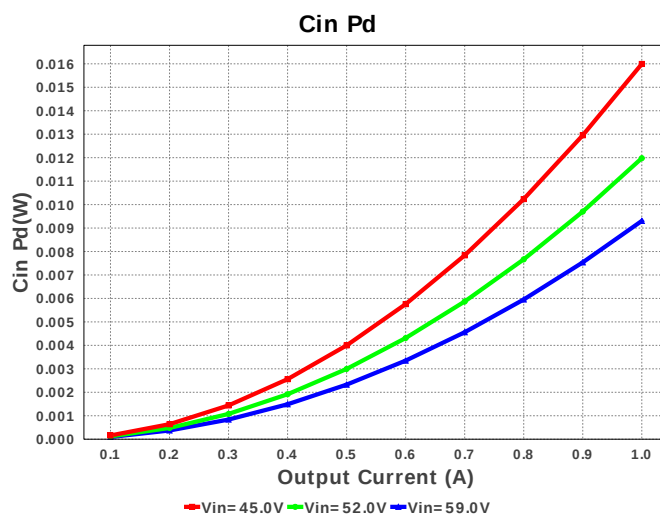
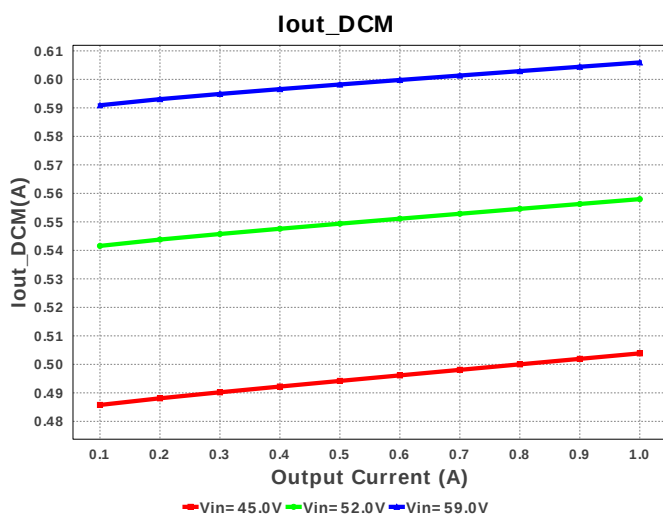
## Electrical BOM

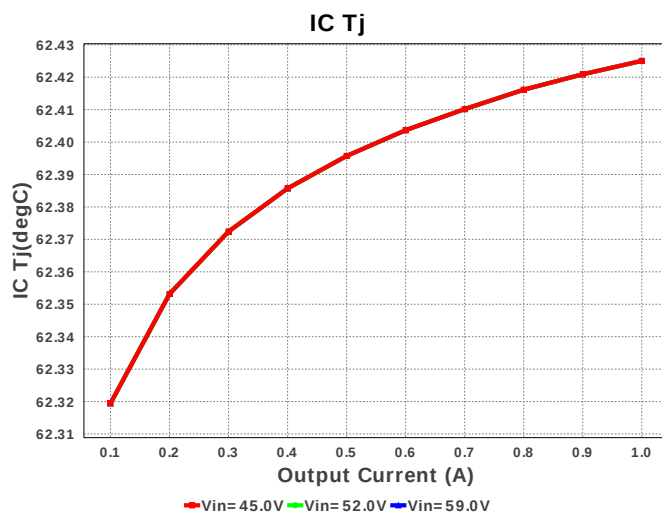
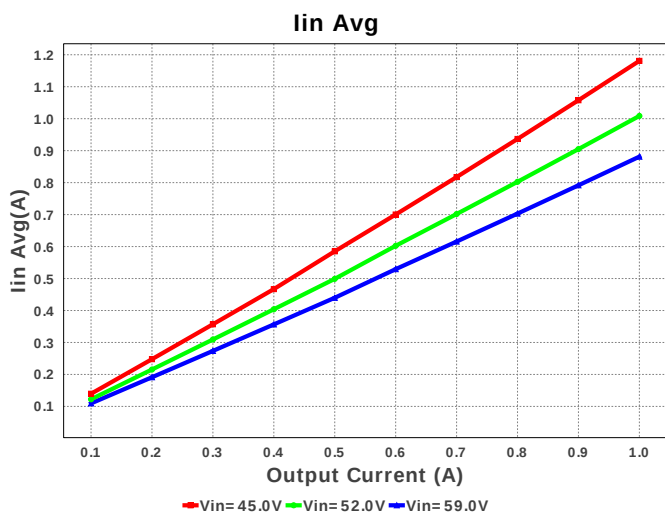
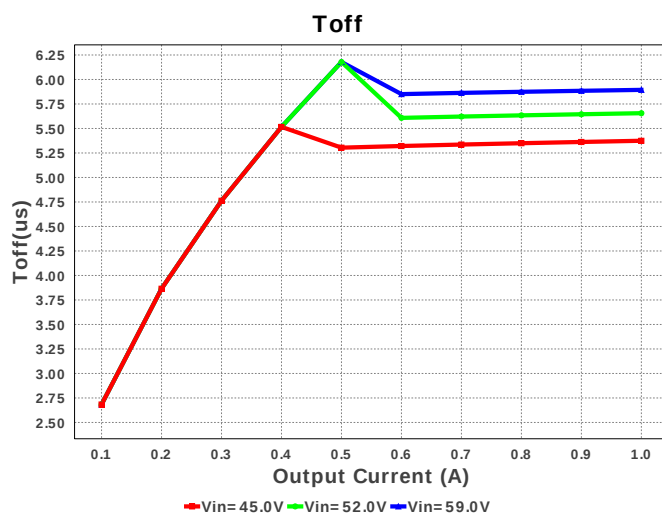
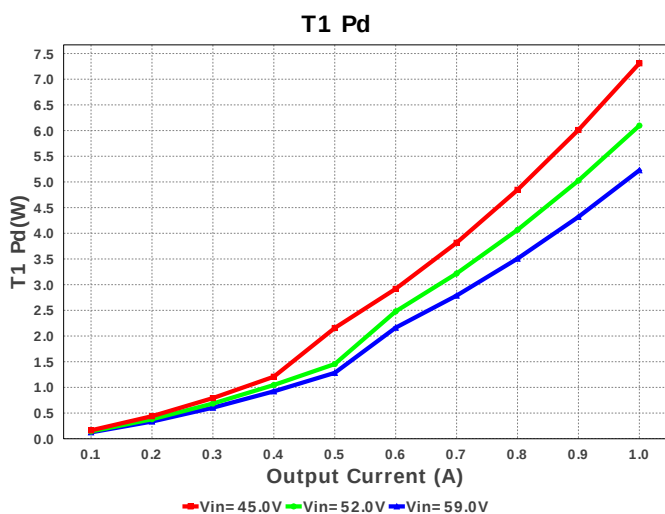
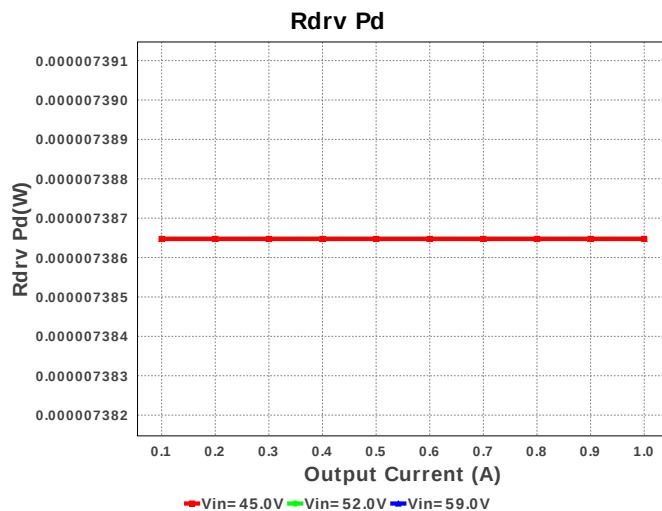
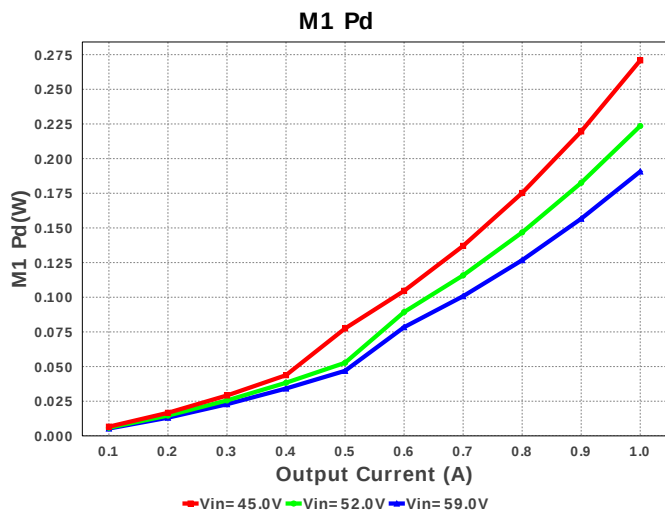
| #  | Name | Manufacturer              | Part Number                         | Properties                                                     | Qty | Price  | Footprint                |
|----|------|---------------------------|-------------------------------------|----------------------------------------------------------------|-----|--------|--------------------------|
| 1. | C12  | AVX                       | 08053C104KAT2A<br>Series= X7R       | Cap= 100.0 nF<br>ESR= 280.0 mOhm<br>VDC= 25.0 V<br>IRMS= 0.0 A | 1   | \$0.01 | 0805 7 mm <sup>2</sup>   |
| 2. | C13  | Samsung Electro-Mechanics | CL21C102JBCNFNC<br>Series= C0G/NP0  | Cap= 1.0 nF<br>VDC= 50.0 V<br>IRMS= 0.0 A                      | 1   | \$0.01 | 0805 7 mm <sup>2</sup>   |
| 3. | C21  | CUSTOM                    | CUSTOM<br>Series= ?                 | Cap= 182.468 uF<br>VDC= 40.0 V<br>IRMS= 0.0 A                  | 1   | NA     | CUSTOM 0 mm <sup>2</sup> |
| 4. | C22  | Kemet                     | C0805C220K3GACTU<br>Series= C0G/NP0 | Cap= 22.0 pF<br>VDC= 25.0 V<br>IRMS= 0.0 A                     | 1   | \$0.01 | 0805 7 mm <sup>2</sup>   |
| 5. | C23  | Kemet                     | C0805C330K5GACTU<br>Series= C0G/NP0 | Cap= 33.0 pF<br>VDC= 50.0 V<br>IRMS= 0.0 A                     | 1   | \$0.01 | 0805 7 mm <sup>2</sup>   |
| 6. | Ccs  | Kemet                     | C0805C181K5GACTU<br>Series= C0G/NP0 | Cap= 180.0 pF<br>VDC= 50.0 V<br>IRMS= 0.0 A                    | 1   | \$0.01 | 0805 7 mm <sup>2</sup>   |
| 7. | Cin  | TDK                       | C3216X7R2A105M160AA<br>Series= X7R  | Cap= 1.0 uF<br>ESR= 7.5 mOhm<br>VDC= 100.0 V<br>IRMS= 5.9235 A | 1   | \$0.11 | 1206 11 mm <sup>2</sup>  |

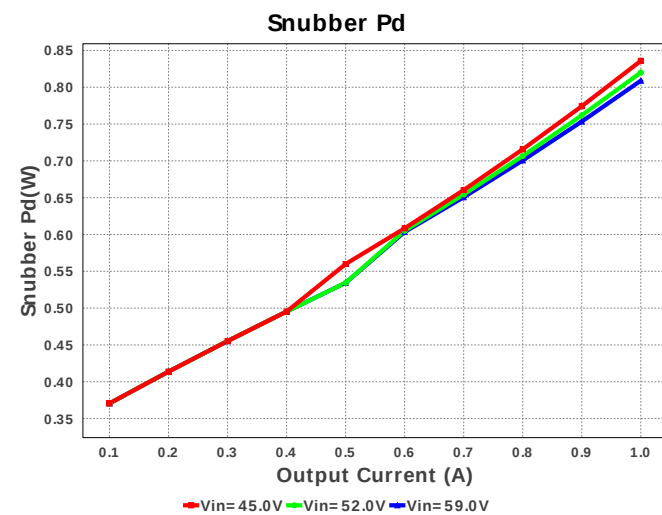
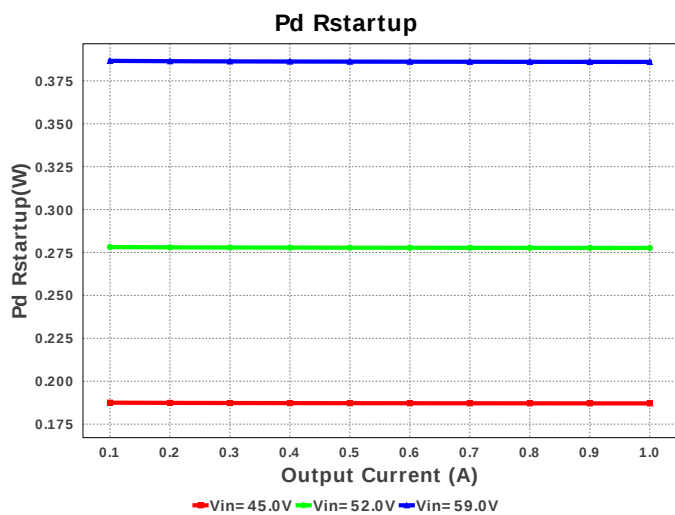
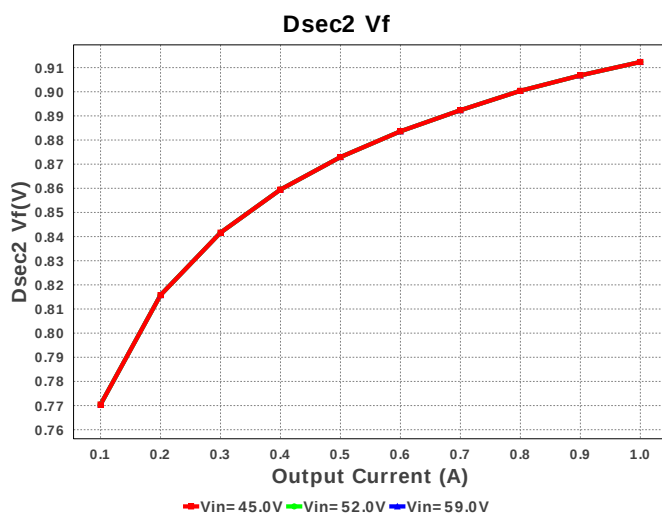
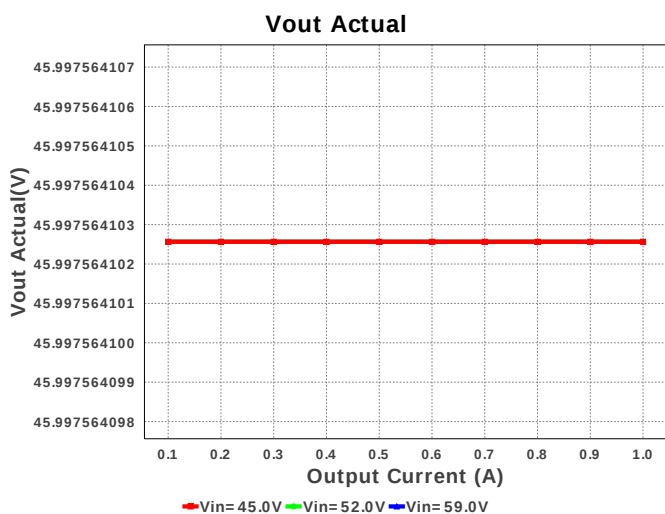
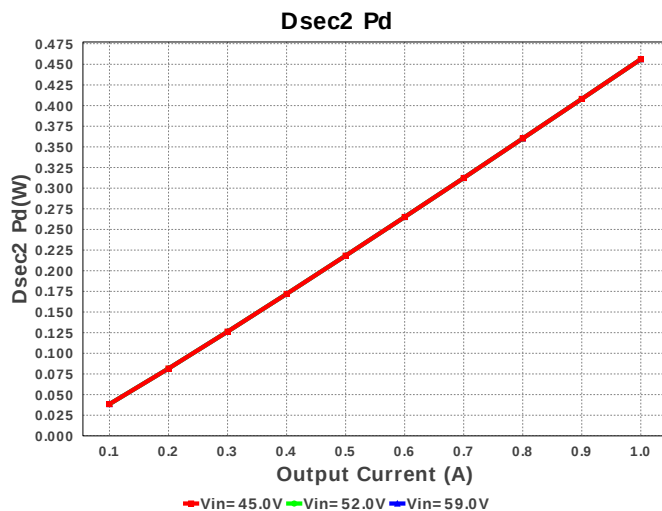
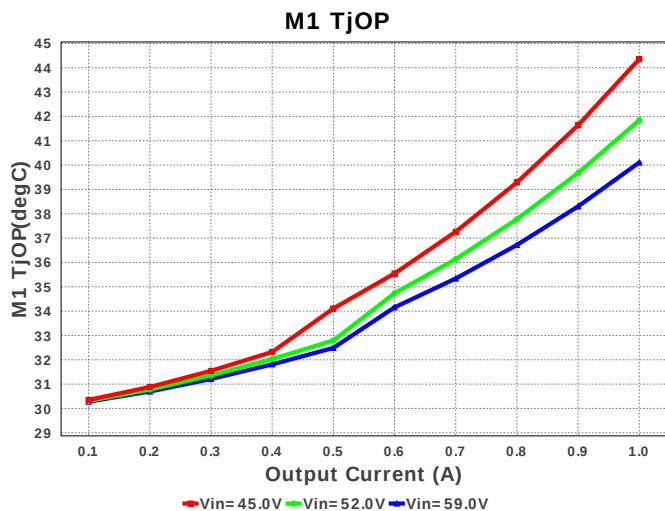
| #   | Name  | Manufacturer            | Part Number                         | Properties                                                         | Qty | Price  | Footprint                                                                                                                 |
|-----|-------|-------------------------|-------------------------------------|--------------------------------------------------------------------|-----|--------|---------------------------------------------------------------------------------------------------------------------------|
| 8.  | Cout1 | Panasonic               | EEV-FK2A151M<br>Series= FK          | Cap= 150.0 uF<br>ESR= 170.0 mOhm<br>VDC= 100.0 V<br>IRMS= 793.0 mA | 2   | \$0.78 | <br>SM_RADIAL_J16 399 mm²              |
| 9.  | Cout2 | CUSTOM                  | CUSTOM<br>Series= ?                 | Cap= 96.67 uF<br>ESR= 1.0 mOhm<br>VDC= 115.0 V<br>IRMS= 1.31022 A  | 1   | NA     | CUSTOM 0 mm²                                                                                                              |
| 10. | Cref  | AVX                     | 08053C104KAT2A<br>Series= X7R       | Cap= 100.0 nF<br>ESR= 280.0 mOhm<br>VDC= 25.0 V<br>IRMS= 0.0 A     | 1   | \$0.01 | <br>0805 7 mm²                         |
| 11. | Csc   | MuRata                  | GRM216R71H103KA01D<br>Series= X7R   | Cap= 10.0 nF<br>VDC= 50.0 V<br>IRMS= 0.0 A                         | 1   | \$0.01 | <br>0805 7 mm²                         |
| 12. | Csnub | MuRata                  | GRM31CR72A105KA01L<br>Series= X7R   | Cap= 1.0 uF<br>ESR= 5.334 mOhm<br>VDC= 100.0 V<br>IRMS= 1.55432 A  | 1   | \$0.11 | <br>1206_190 11 mm²                    |
| 13. | Ct    | Kemet                   | C0805C102J5GACTU<br>Series= C0G/NP0 | Cap= 1.0 nF<br>ESR= 25.0 mOhm<br>VDC= 50.0 V<br>IRMS= 1.71 A       | 1   | \$0.01 | <br>0805 7 mm²                         |
| 14. | Cvcc  | MuRata                  | GRM188R71E104KA01D<br>Series= X7R   | Cap= 100.0 nF<br>ESR= 30.0 mOhm<br>VDC= 25.0 V<br>IRMS= 1.51 A     | 1   | \$0.01 | <br>0603 5 mm²                         |
| 15. | D21   | Diodes Inc.             | B160-13-F                           | VF@Io= 700.0 mV<br>VRRM= 60.0 V                                    | 1   | \$0.06 | <br>SMA 37 mm²                       |
| 16. | Daux  | NXP Semiconductor       | BAS316,115                          | VF@Io= 1.4 V<br>VRRM= 100.0 V                                      | 1   | \$0.02 | <br>SOD-323 9 mm²                    |
| 17. | Dsec  | Bourns                  | CD214C-F3600                        | VF@Io= 1.12 V<br>VRRM= 600.0 V                                     | 1   | \$0.18 | <br>SMC 83 mm²                       |
| 18. | Dsec2 | Bourns                  | CD214C-F3600                        | VF@Io= 1.12 V<br>VRRM= 600.0 V                                     | 1   | \$0.18 | <br>SMC 83 mm²                       |
| 19. | Dsnub | Diodes Inc.             | DFLS1200-7                          | VF@Io= 850.0 mV<br>VRRM= 200.0 V                                   | 1   | \$0.21 | <br>PowerDI123 13 mm²                |
| 20. | Dz    | Diodes Inc.             | MMSZ5250B-7-F                       | Zener                                                              | 1   | \$0.03 | <br>SOD-123 13 mm²                   |
| 21. | L2    | Coilcraft               | SER1360-182KLB                      | L= 1.8 uH<br>DCR= 2.4 mOhm                                         | 1   | \$0.72 | <br>SER1360 225 mm²                  |
| 22. | M1    | Fairchild Semiconductor | FDMC86240                           | VdsMax= 150.0 V<br>IdsMax= 16.0 Amps                               | 1   | \$0.93 | <br>TRANS_Fairchild_MLP08S<br>18 mm² |
| 23. | O1    | Vishay-Semiconductor    | TCMT1107                            | Optocoupler                                                        | 1   | \$0.21 | <br>SOP-4 44 mm²                     |

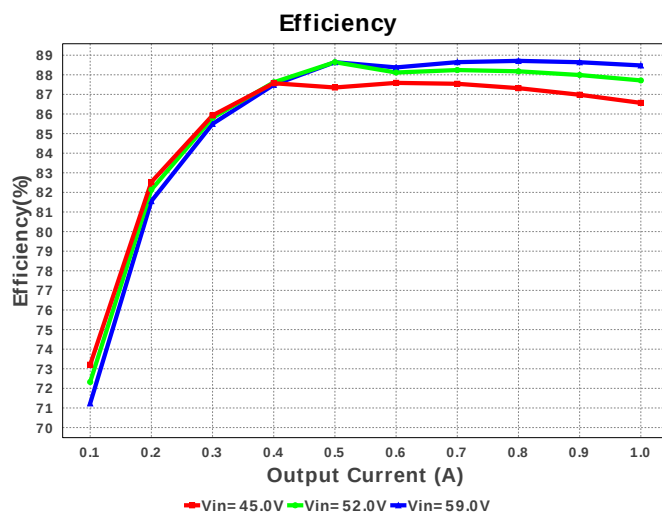
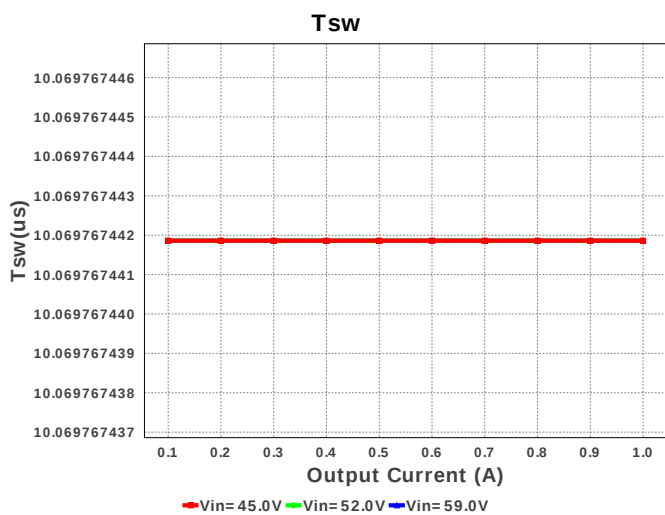
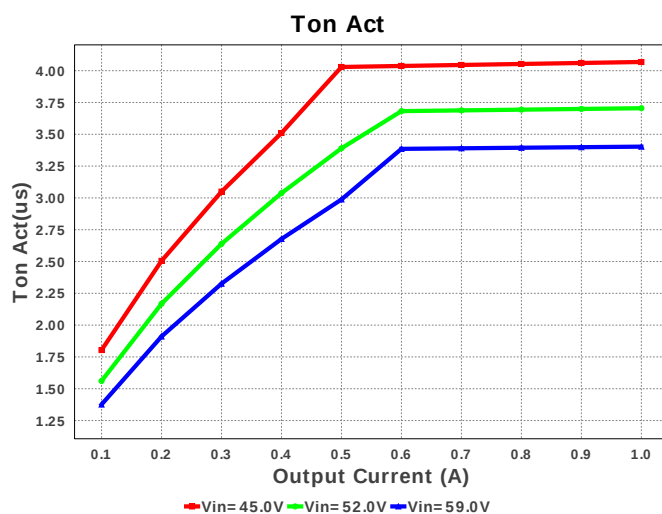
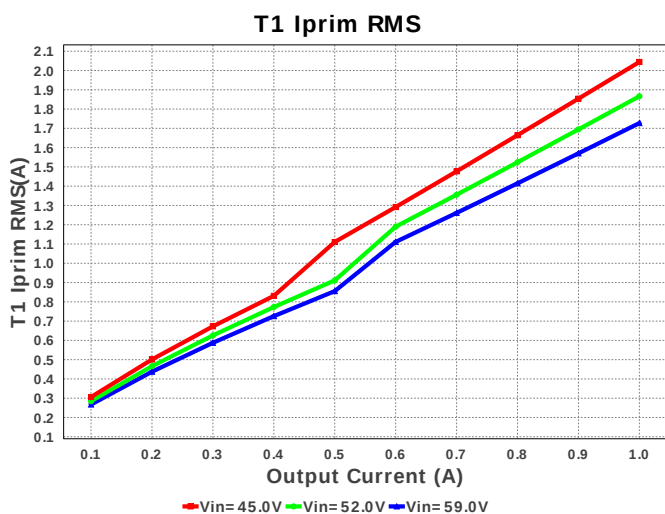
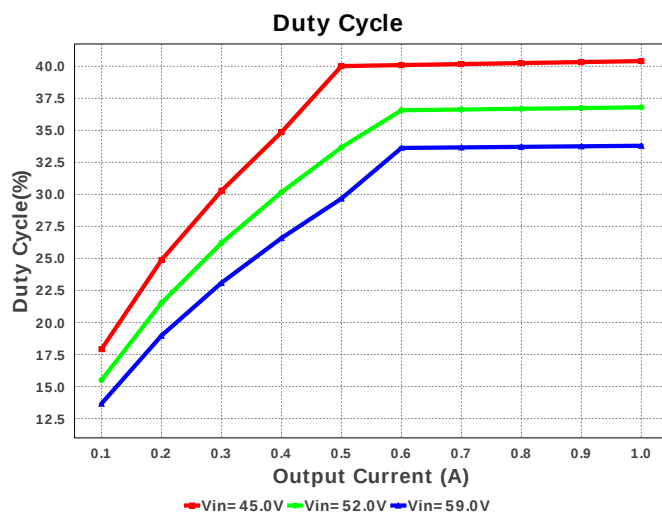
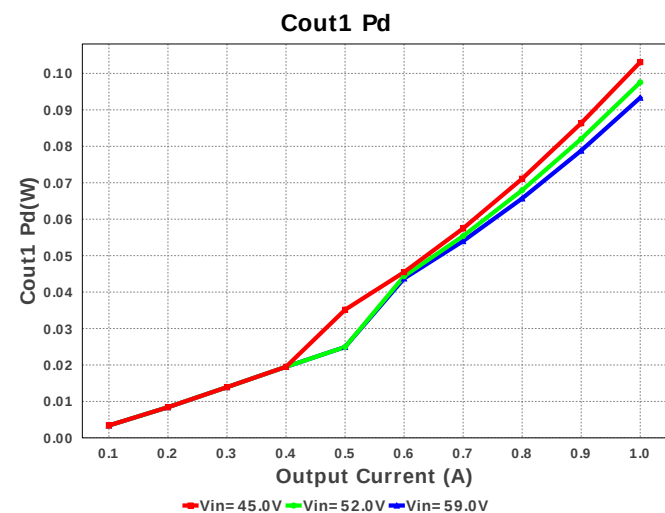
| #   | Name      | Manufacturer              | Part Number                          | Properties                                           | Qty | Price  | Footprint                                                                                                        |
|-----|-----------|---------------------------|--------------------------------------|------------------------------------------------------|-----|--------|------------------------------------------------------------------------------------------------------------------|
| 24. | Q1        | ON Semiconductor          | BC846BLT1G                           | Bipolar Transistor                                   | 1   | \$0.02 | <br>SOT-23 14 mm <sup>2</sup> |
| 25. | R11       | Vishay-Dale               | CRCW040210K0FKED<br>Series= CRCW..e3 | Res= 10.0 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0%  | 1   | \$0.01 | <br>0402 3 mm <sup>2</sup>    |
| 26. | R12       | Vishay-Dale               | CRCW04021K40FKED<br>Series= CRCW..e3 | Res= 1.4 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0%   | 1   | \$0.01 | <br>0402 3 mm <sup>2</sup>    |
| 27. | R13       | Vishay-Dale               | CRCW04024K99FKED<br>Series= CRCW..e3 | Res= 4.99 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0%  | 1   | \$0.01 | <br>0402 3 mm <sup>2</sup>    |
| 28. | R21       | Vishay-Dale               | CRCW040210K0FKED<br>Series= CRCW..e3 | Res= 10.0 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0%  | 1   | \$0.01 | <br>0402 3 mm <sup>2</sup>    |
| 29. | R22       | Vishay-Dale               | CRCW04023M40FKED<br>Series= CRCW..e3 | Res= 3.4 MOhm<br>Power= 63.0 mW<br>Tolerance= 1.0%   | 1   | \$0.01 | <br>0402 3 mm <sup>2</sup>    |
| 30. | Raux      | Vishay-Dale               | CRCW040210R0FKED<br>Series= CRCW..e3 | Res= 10.0 Ohm<br>Power= 63.0 mW<br>Tolerance= 1.0%   | 1   | \$0.01 | <br>0402 3 mm <sup>2</sup>    |
| 31. | Rbias     | Panasonic                 | ERJ-6ENF1372V<br>Series= ERJ-6E      | Res= 13.7 kOhm<br>Power= 125.0 mW<br>Tolerance= 1.0% | 1   | \$0.01 | <br>0805 7 mm <sup>2</sup>    |
| 32. | Rcs       | Vishay-Dale               | CRCW04022K00FKED<br>Series= CRCW..e3 | Res= 2.0 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0%   | 1   | \$0.01 | <br>0402 3 mm <sup>2</sup>    |
| 33. | Rdrv      | Vishay-Dale               | CRCW04026R19FKED<br>Series= CRCW..e3 | Res= 6.19 Ohm<br>Power= 63.0 mW<br>Tolerance= 1.0%   | 1   | \$0.01 | <br>0402 3 mm <sup>2</sup>   |
| 34. | Rfbb      | Yageo America             | RC0603FR-073K9L<br>Series= ?         | Res= 3.9 kOhm<br>Power= 100.0 mW<br>Tolerance= 1.0%  | 1   | \$0.01 | <br>0603 5 mm <sup>2</sup>  |
| 35. | Rfbt      | Yageo America             | RC0603FR-0768KL<br>Series= ?         | Res= 68.0 kOhm<br>Power= 100.0 mW<br>Tolerance= 1.0% | 1   | \$0.01 | <br>0603 5 mm <sup>2</sup>  |
| 36. | Rled      | Vishay-Dale               | CRCW04024K12FKED<br>Series= CRCW..e3 | Res= 4.12 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0%  | 1   | \$0.01 | <br>0402 3 mm <sup>2</sup>  |
| 37. | Rsc       | Vishay-Dale               | CRCW040214K7FKED<br>Series= CRCW..e3 | Res= 14.7 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0%  | 1   | \$0.01 | <br>0402 3 mm <sup>2</sup>  |
| 38. | Rsns      | Stackpole Electronics Inc | CSRN2512FKR150<br>Series= ?          | Res= 150.0 mOhm<br>Power= 2.0 W<br>Tolerance= 1.0%   | 1   | \$0.13 | <br>2512 43 mm <sup>2</sup> |
| 39. | Rsns      | Vishay-Bcomponents        | PR02000202401JR500<br>Series= ?      | Res= 2.4 kOhm<br>Power= 2.0 W<br>Tolerance= 5.0%     | 1   | \$0.05 | PR02 113 mm <sup>2</sup>                                                                                         |
| 40. | Rstartup1 | Panasonic                 | ERJ-8ENF1102V<br>Series= ERJ-8E      | Res= 11.0 kOhm<br>Power= 250.0 mW<br>Tolerance= 1.0% | 1   | \$0.01 | <br>1206 11 mm <sup>2</sup> |
| 41. | Rstartup2 | Panasonic                 | ERJ-8ENF1102V<br>Series= ERJ-8E      | Res= 11.0 kOhm<br>Power= 250.0 mW<br>Tolerance= 1.0% | 1   | \$0.01 | <br>1206 11 mm <sup>2</sup> |
| 42. | Rt        | Vishay-Dale               | CRCW04028K66FKED<br>Series= CRCW..e3 | Res= 8.66 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0%  | 1   | \$0.01 | <br>0402 3 mm <sup>2</sup>  |
| 43. | Rz        | Vishay-Dale               | CRCW201020K0FKEF<br>Series= CRCW..e3 | Res= 20.0 kOhm<br>Power= 750.0 mW<br>Tolerance= 1.0% | 1   | \$0.03 | <br>2010 32 mm <sup>2</sup> |

| #   | Name | Manufacturer      | Part Number | Properties                                                                                                                                      | Qty | Price   | Footprint                                                                                                           |
|-----|------|-------------------|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------|-----|---------|---------------------------------------------------------------------------------------------------------------------|
| 44. | T1   | CUSTOM            | CUSTOM      | Lp= 64.804 $\mu$ H<br>Rp= 870.0 mOhm<br>Leakage_L= 1.296 $\mu$ H<br>Ns1toNp= 1.669<br>Rs1= 8.6 mOhms<br>Ns2toNp= 0.429<br>Rs2= 700.0 $\mu$ Ohms | 1   | NA      | CUSTOM 0 mm <sup>2</sup>                                                                                            |
| 45. | U1   | Texas Instruments | UC1845AJ    | Switcher                                                                                                                                        | 1   | \$14.16 | <br>JG0008A 111 mm <sup>2</sup>  |
| 46. | VR   | Texas Instruments | TL431AIDBVR | Voltage References                                                                                                                              | 1   | \$0.07  | <br>R-PDSO-G3 16 mm <sup>2</sup> |

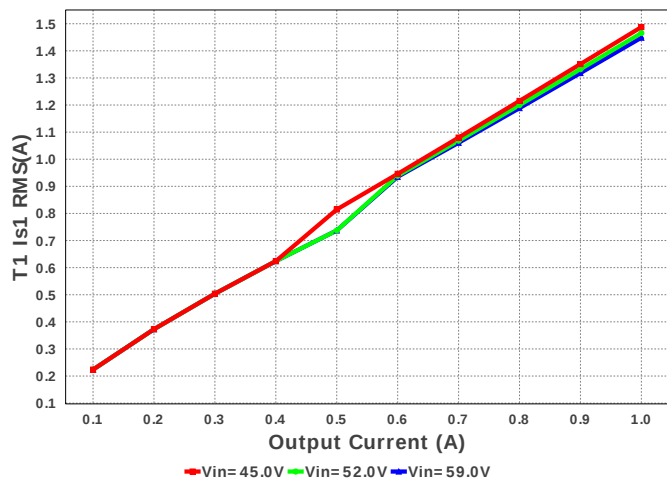




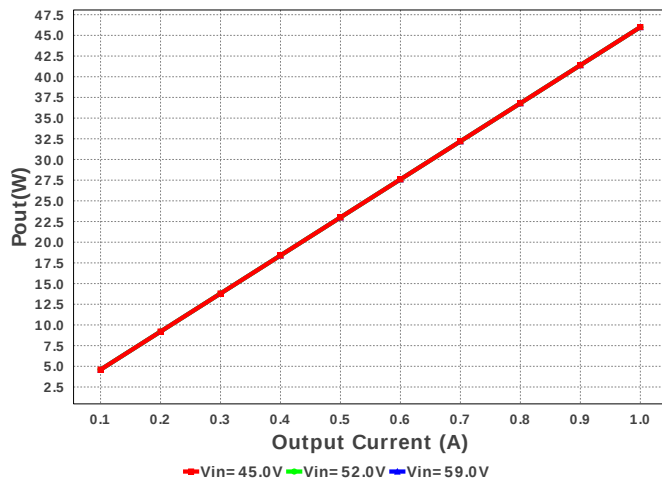




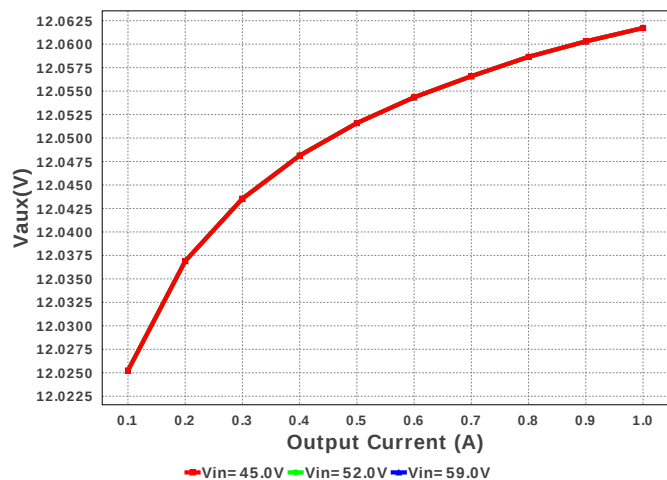
T1 Is1 RMS



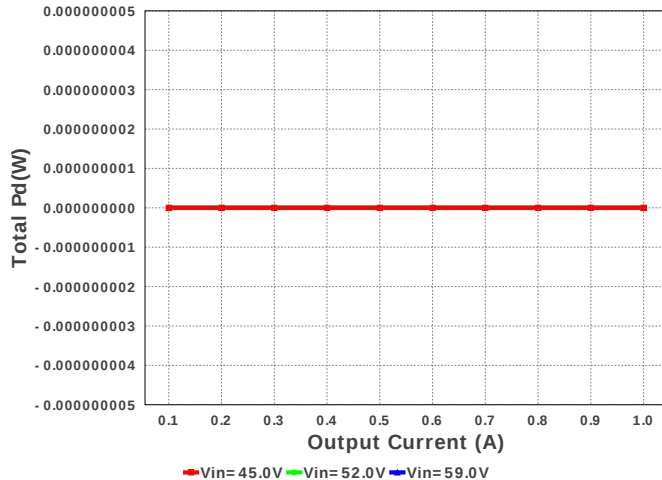
Pout



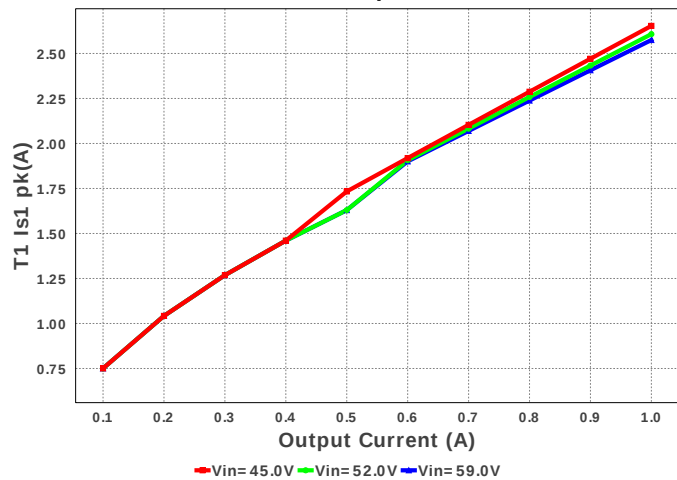
Vaux



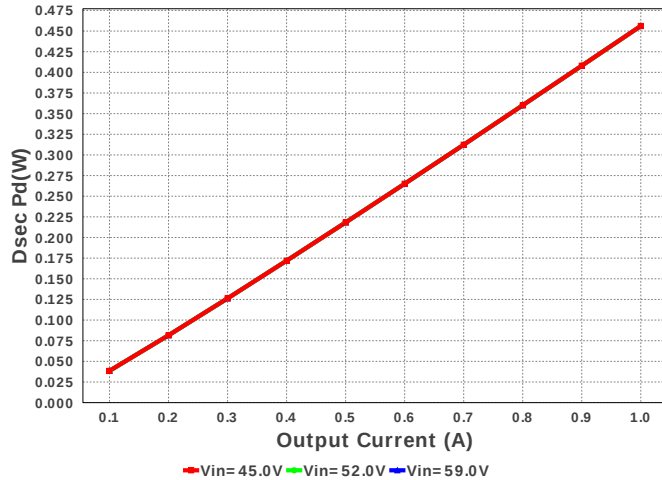
Total Pd

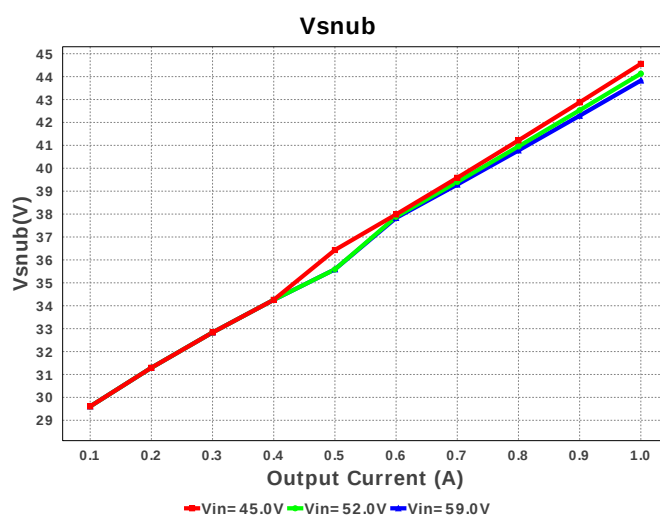
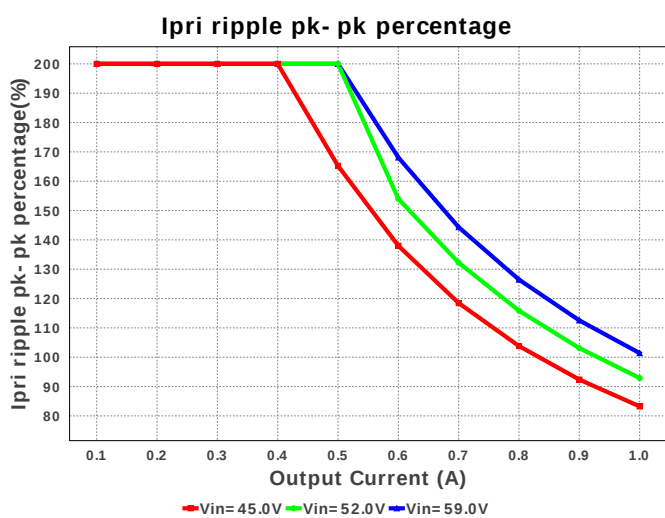
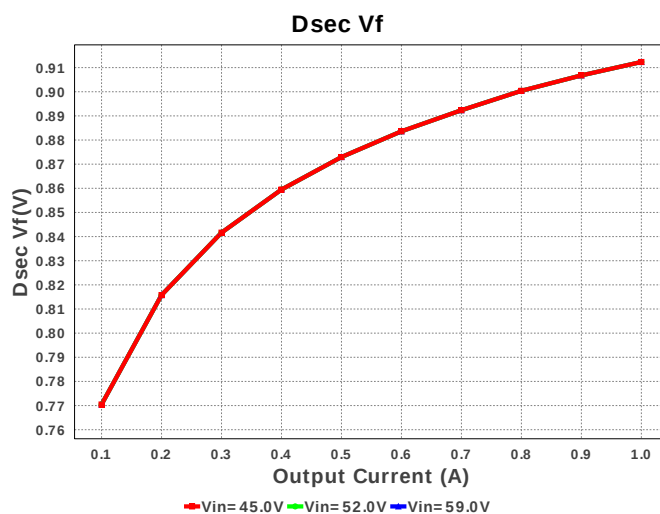
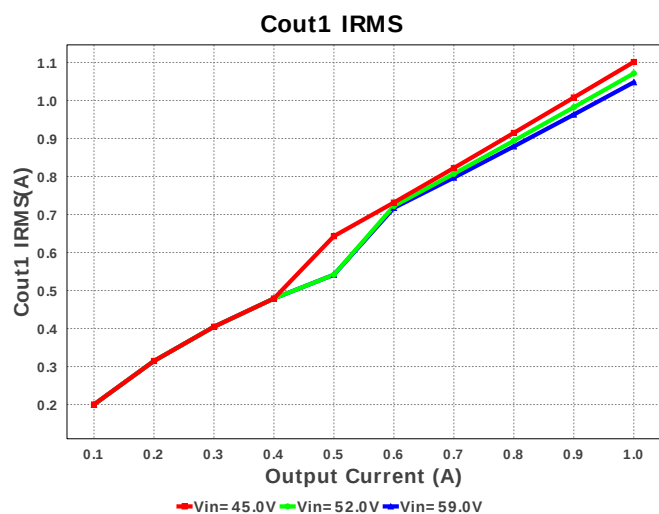
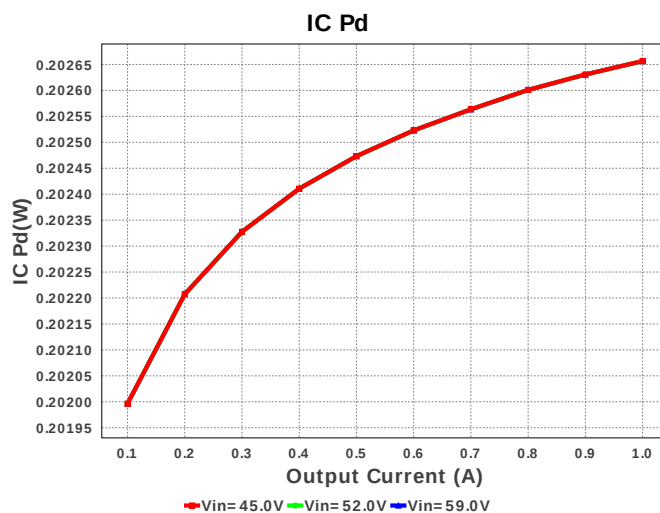
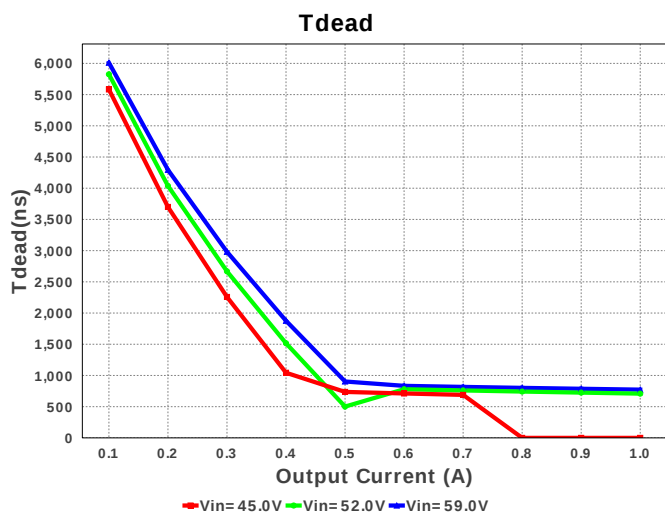


T1 Is1 pk

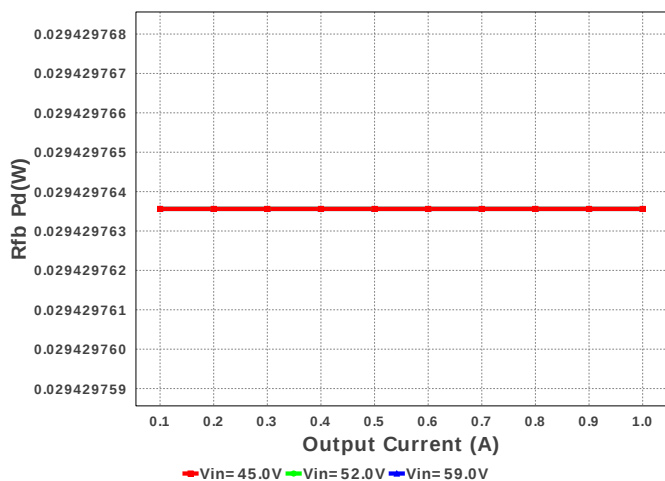


Dsec Pd

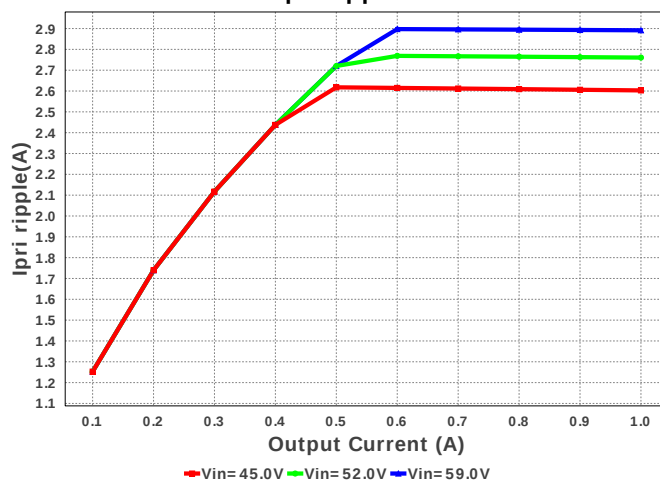




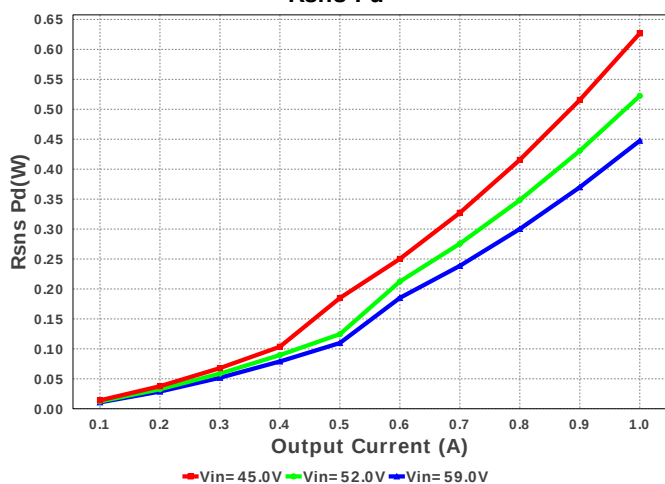
Rfb Pd



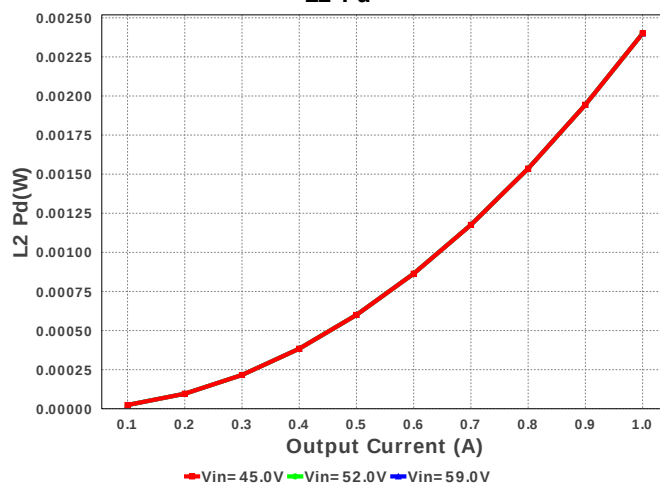
Ipri ripple



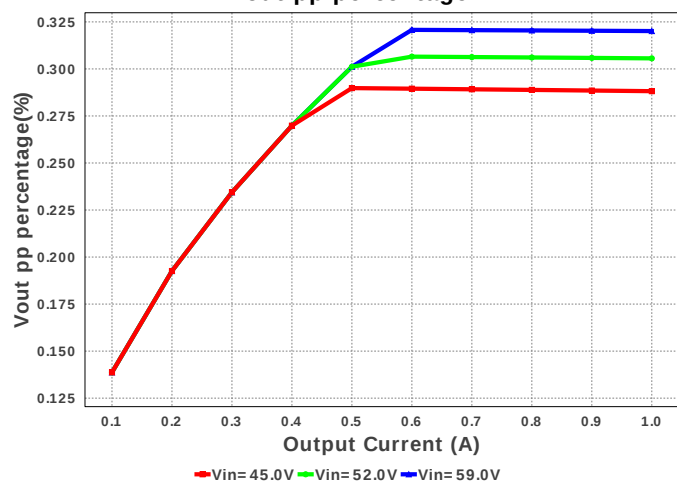
Rsns Pd



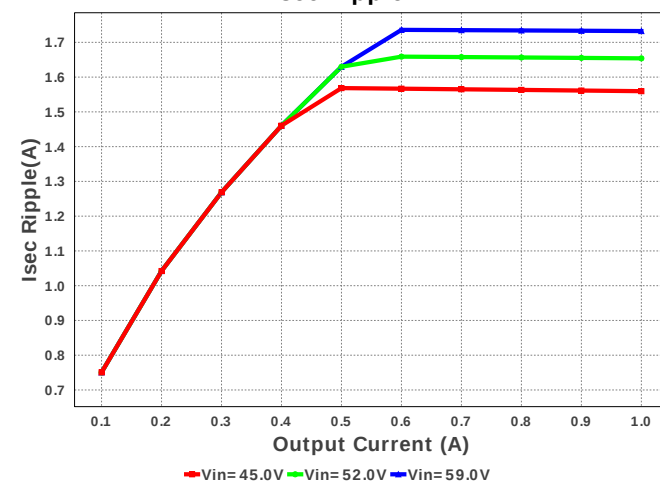
L2 Pd

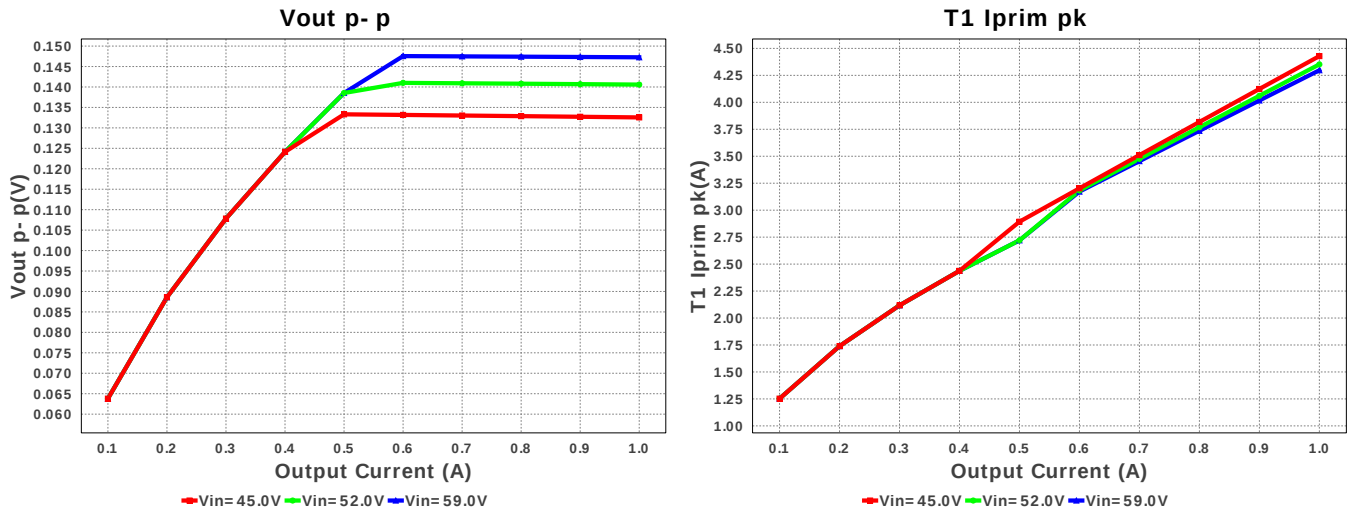


Vout pp percentage



Isec Ripple





## Operating Values

| #   | Name                         | Value                   | Category | Description                                                           |
|-----|------------------------------|-------------------------|----------|-----------------------------------------------------------------------|
| 1.  | Cout1 IRMS                   | 1.101 A                 | Current  | Output capacitor1 RMS ripple current                                  |
| 2.  | Iin Avg                      | 1.181 A                 | Current  | Average input current                                                 |
| 3.  | Iout_DCM                     | 503.857 mA              | Current  | Approximate Current below which DCM mode of operation will begin      |
| 4.  | Ipri Avg                     | 1.263 A                 | Current  | Average Current in Primary Winding over the complete Switching Period |
| 5.  | Ipri ripple                  | 2.603 A                 | Current  | Ripple Current in the Primary Winding                                 |
| 6.  | Ipri ripple pk-pk percentage | 83.238 %                | Current  | Primary Current pk-pk ripple percentage(of Ipri avg during ton only)  |
| 7.  | Isec Ripple                  | 1.56 A                  | Current  | Ripple Current in the Secondary Winding                               |
| 8.  | T1 Iprim RMS                 | 2.044 A                 | Current  | Transformer Primary RMS Current                                       |
| 9.  | T1 Iprim pk                  | 4.429 A                 | Current  | Transformer Primary Peak Current                                      |
| 10. | T1 Is1 RMS                   | 1.488 A                 | Current  | Transformer Secondary1 RMS Current                                    |
| 11. | T1 Is1 pk                    | 2.653 A                 | Current  | Transformer Secondary1 Peak Current                                   |
| 12. | BOM Count                    | 47                      | General  | Total Design BOM count                                                |
| 13. | Daux trr                     | 4.0 ns                  | General  | Auxiliary Diode Reverse Recovery Time                                 |
| 14. | Dsec Vf                      | 912.33 mV               | General  | Effective Forward Voltage Drop at the Operating Current               |
| 15. | Dsec trr                     | 30.0 ns                 | General  | Output Diode Reverse Recovery Time                                    |
| 16. | Dsec2 Vf                     | 912.33 mV               | General  | Effective Forward Voltage Drop at the Operating Current               |
| 17. | Dsnub trr                    | 0.0 ns                  | General  | Snubber Diode Reverse Recovery Time                                   |
| 18. | FootPrint                    | 1.855 k mm <sup>2</sup> | General  | Total Foot Print Area of BOM components                               |
| 19. | Frequency                    | 99.307 kHz              | General  | Switching frequency                                                   |
| 20. | Pout                         | 46.0 W                  | General  | Total output power                                                    |
| 21. | Tdead                        | 0.0 ns                  | General  | Approximate Dead Time of the Regulator                                |
| 22. | Toff                         | 5.375 us                | General  | Approximate Converter Off Time                                        |
| 23. | Ton Act                      | 4.068 us                | General  | Approximate Converter On Time                                         |
| 24. | Total BOM                    | \$0.0                   | General  | Total BOM Cost                                                        |
| 25. | Tsw                          | 10.07 us                | General  | Switching Time Period                                                 |
| 26. | Vaux                         | 12.062 V                | General  | Auxiliary Voltage                                                     |
| 27. | Vsnub                        | 44.556 V                | General  | Voltage Across the Snubber                                            |
| 28. | Vout Actual                  | 45.998 V                | Op_Point | Vout Actual calculated based on selected voltage divider resistors    |
| 29. | Vout OP                      | 46.0 V                  | Op_Point | Operational Output Voltage                                            |
| 30. | Duty Cycle                   | 40.402 %                | Op_point | Duty cycle                                                            |
| 31. | Efficiency                   | 86.567 %                | Op_point | Steady state efficiency                                               |
| 32. | IC Tj                        | 62.425 degC             | Op_point | IC junction temperature                                               |
| 33. | ICThetaJA                    | 160.0 degC/W            | Op_point | IC junction-to-ambient thermal resistance                             |
| 34. | IOUT_OP                      | 1.0 A                   | Op_point | Iout operating point                                                  |
| 35. | M1 TJOP                      | 44.356 degC             | Op_point | M1 MOSFET junction temperature                                        |
| 36. | Vout p-p                     | 132.559 mV              | Op_point | Peak-to-peak output ripple voltage                                    |
| 37. | Cin Pd                       | 15.994 mW               | Power    | Input capacitor power dissipation                                     |
| 38. | Cout1 Pd                     | 103.09 mW               | Power    | Output capacitor1 power dissipation                                   |
| 39. | Dsec Pd                      | 456.165 mW              | Power    | Secondary Diode Power Dissipation                                     |
| 40. | Dsec2 Pd                     | 456.165 mW              | Power    | Secondary Diode Power Dissipation                                     |
| 41. | IC Pd                        | 202.656 mW              | Power    | IC power dissipation                                                  |
| 42. | L2 Pd                        | 2.4 mW                  | Power    | Average Power Dissipation in the Inductor Over the AC Line Period     |
| 43. | M1 Pd                        | 270.863 mW              | Power    | M1 MOSFET total power dissipation                                     |
| 44. | Paux                         | 23.277 mW               | Power    | Power Dissipation in Raux and Daux                                    |
| 45. | Pd Rstartup                  | 187.088 mW              | Power    | Power Dissipation in Rstartup1 and Rstartup2                          |
| 46. | Rdrv Pd                      | 7.386 μW                | Power    | Power Dissipation in Gate Drive Resistor                              |
| 47. | Rfb Pd                       | 29.43 mW                | Power    | Rfb Power Dissipation                                                 |
| 48. | Rsns Pd                      | 626.842 mW              | Power    | Current Limit Sense Resistor Power Dissipation                        |
| 49. | Snubber Pd                   | 835.822 mW              | Power    | Snubber Power Dissipation                                             |
| 50. | T1 Pd                        | 7.309 W                 | Power    | Estimated Losses in Transformer                                       |

| #   | Name               | Value      | Category | Description                                                                                |
|-----|--------------------|------------|----------|--------------------------------------------------------------------------------------------|
| 51. | Total Pd           | 0.0 W      | Power    | Total Power Dissipation                                                                    |
| 52. | Vout Tolerance     | 2.237 %    |          | Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable |
| 53. | Vout pp percentage | 288.171 m% |          | Output Voltage ripple percentage                                                           |

## Design Inputs

| #   | Name    | Value   | Description                        |
|-----|---------|---------|------------------------------------|
| 1.  | Iout    | 1.0     | Maximum Output Current             |
| 2.  | Iout1   | 1.0     | Output Current #1                  |
| 3.  | Iout2   | 1.0     | Output Current #2                  |
| 4.  | Iout3   | 1.0     | Output Current #3                  |
| 5.  | VinMax  | 59.0    | Maximum input voltage              |
| 6.  | VinMin  | 45.0    | Minimum input voltage              |
| 7.  | Vout    | 46.0    | Output Voltage                     |
| 8.  | Vout1   | 46.0    | Output Voltage #1                  |
| 9.  | Vout2   | 78.0    | Output Voltage #2                  |
| 10. | Vout3   | 56.0    | Output Voltage #3                  |
| 11. | base_pn | UC1845A | Texas Instruments Base Part Number |
| 12. | source  | DC      | Input Source Type                  |
| 13. | ta      | 30.0    | Ambient temperature                |

## Design Assistance

1. UC1845A Product Folder : <http://www.ti.com/product/UC1845A> : 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](#).