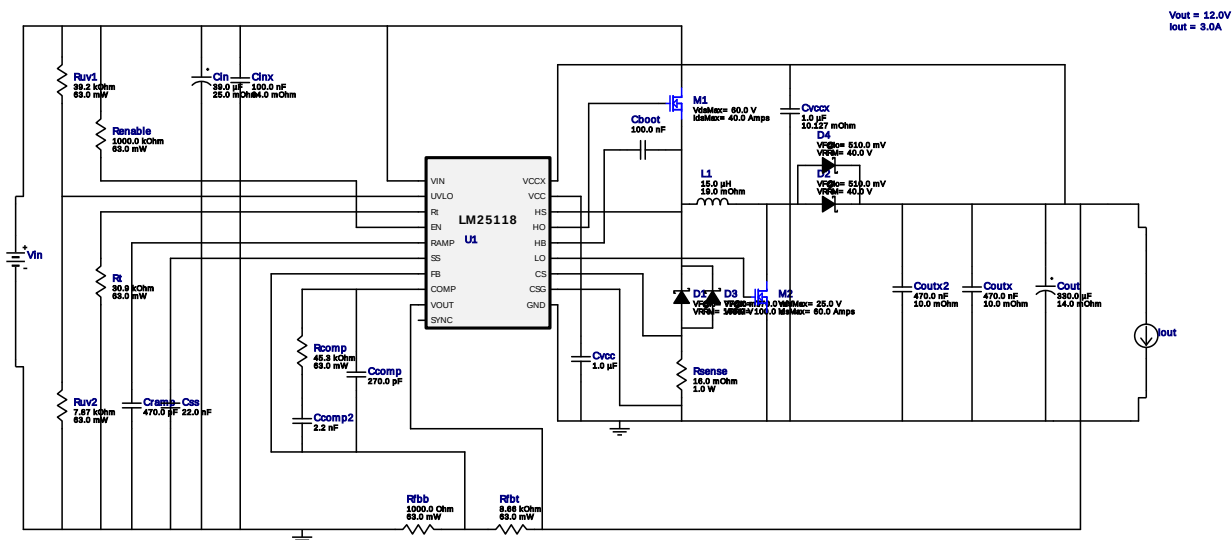
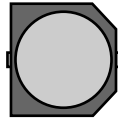


## WEBENCH® Design Report

Design : 4109964/2 LM25118MH/NOPB  
LM25118MH/NOPB 9.0V-36.0V to 12.00V @ 3.0A

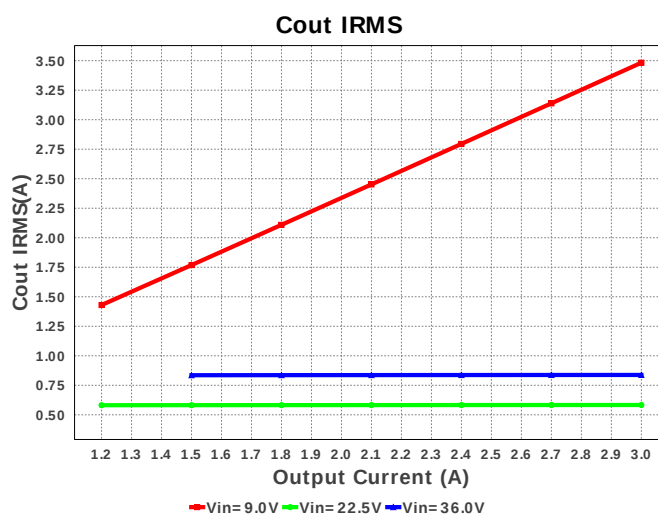
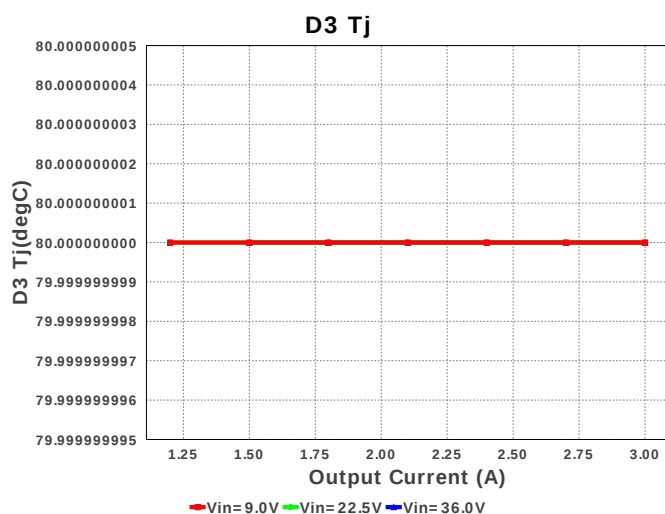
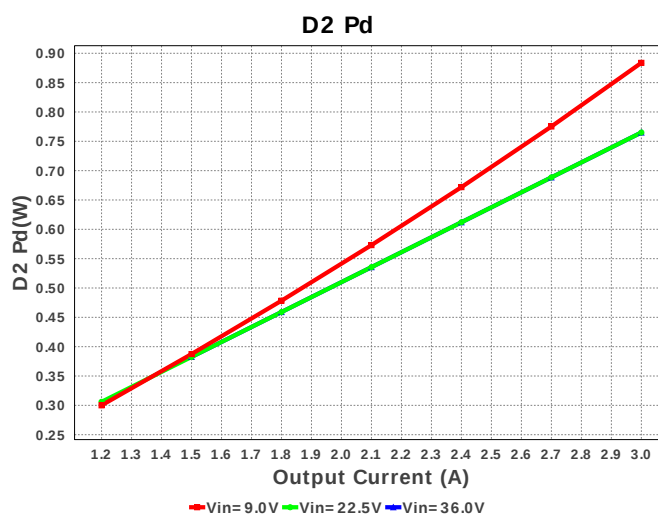
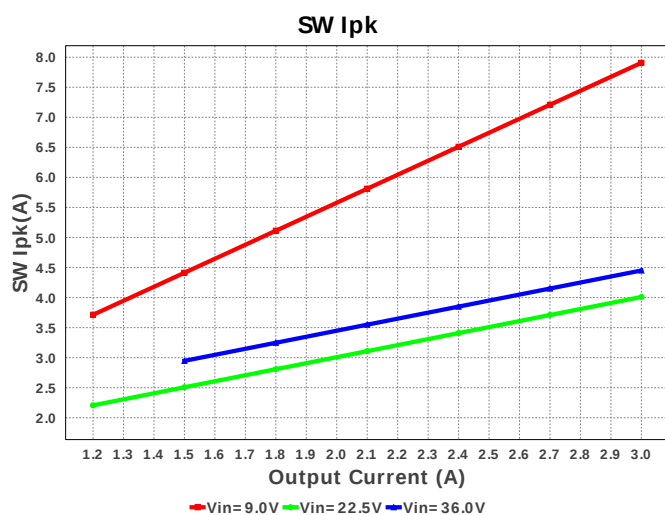


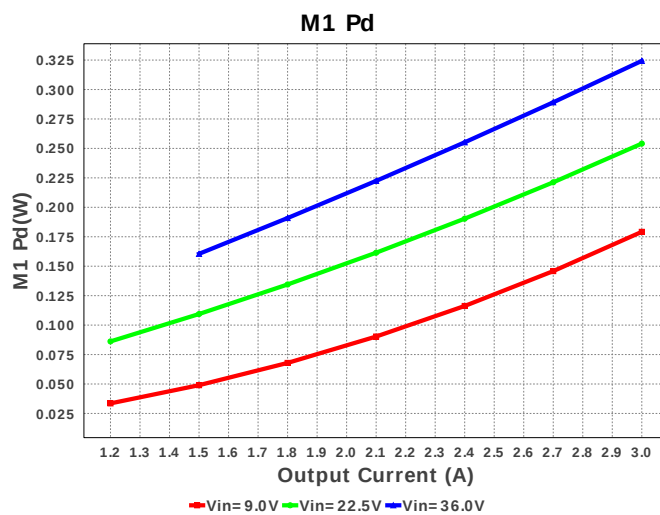
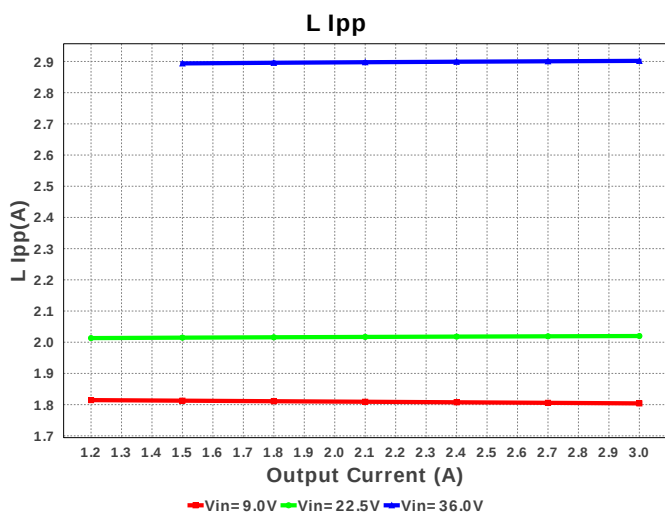
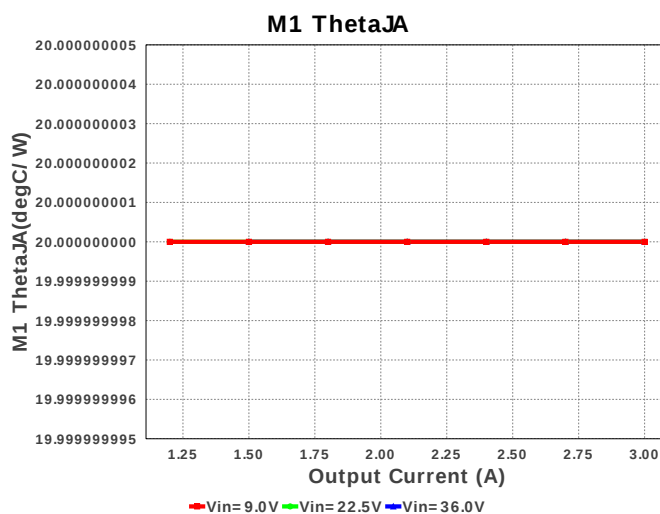
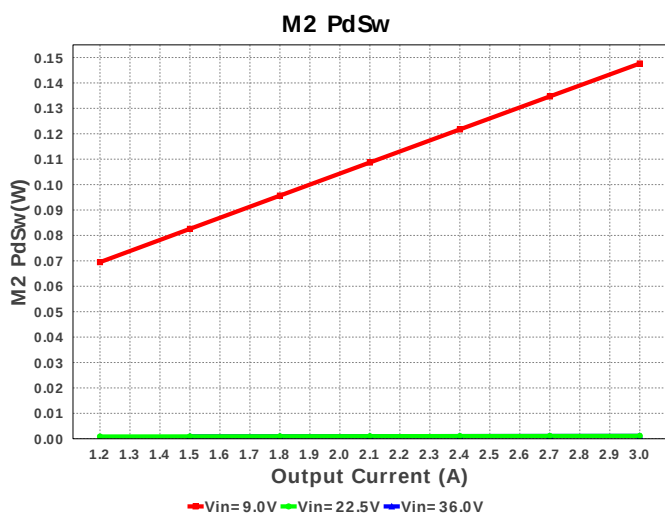
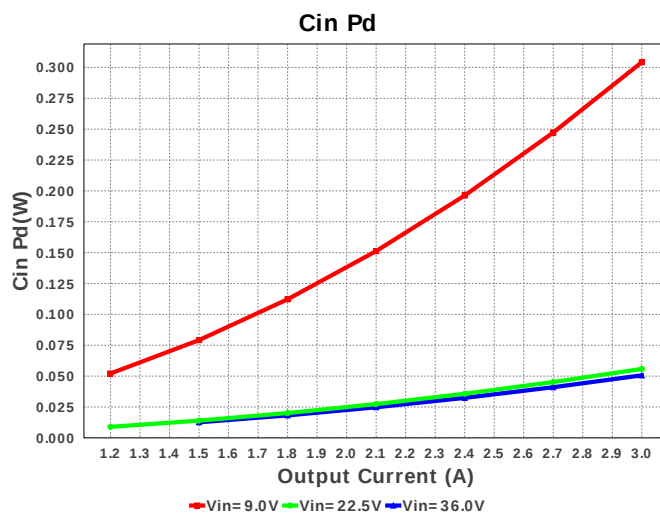
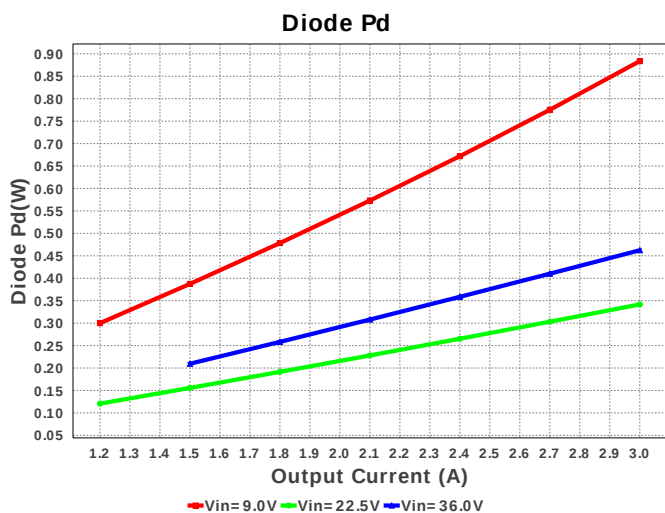
## Electrical BOM

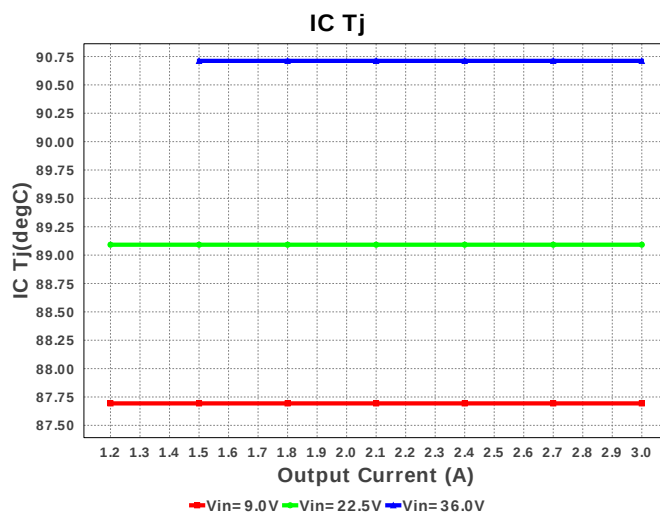
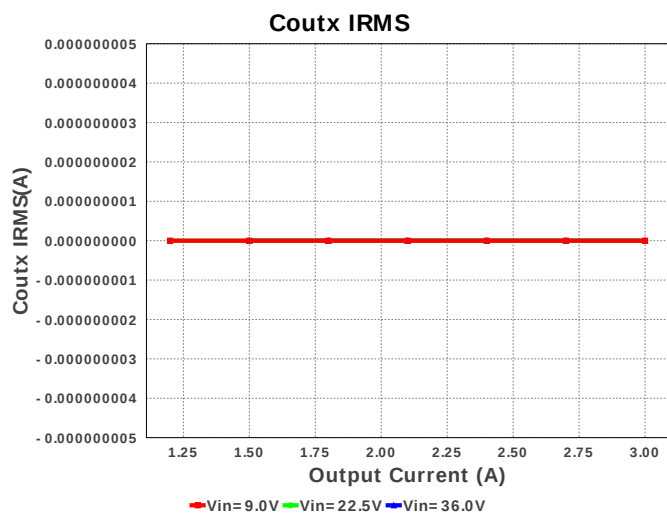
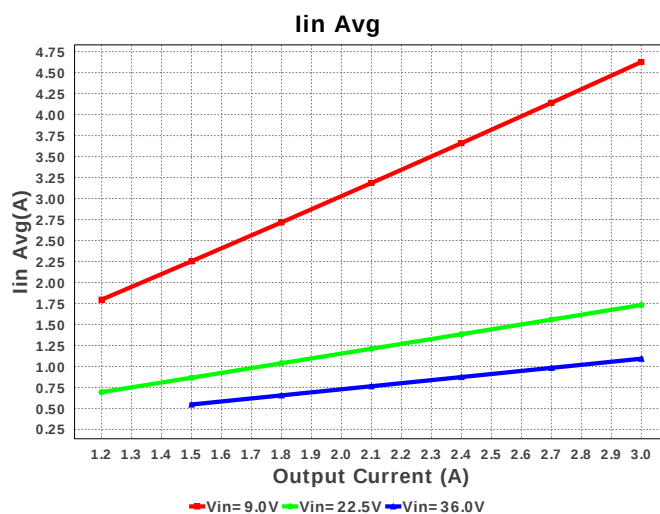
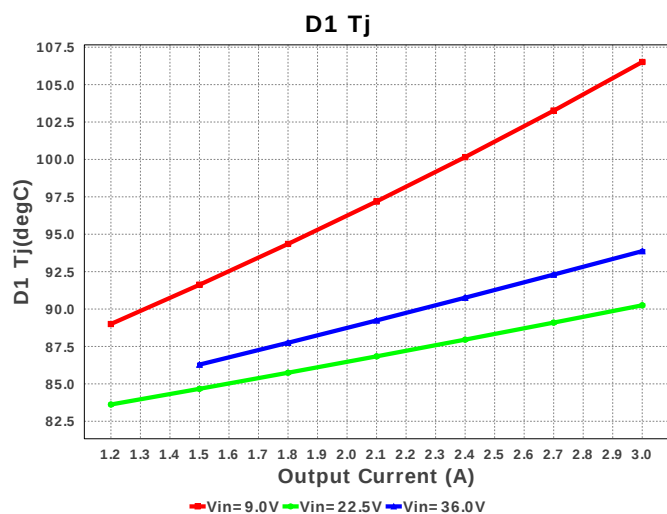
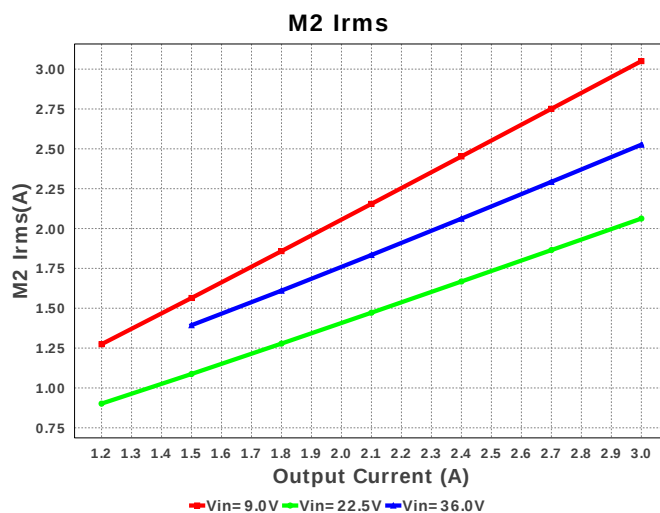
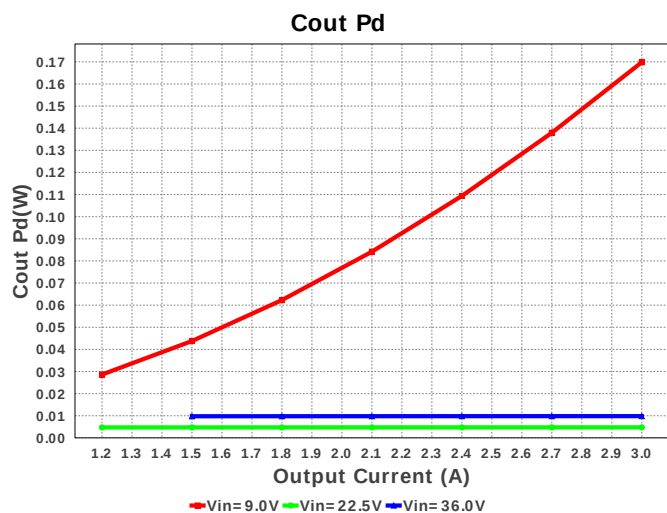
| #  | Name   | Manufacturer  | Part Number                       | Properties                                                     | Qty | Price  | Footprint                                                                                                                  |
|----|--------|---------------|-----------------------------------|----------------------------------------------------------------|-----|--------|----------------------------------------------------------------------------------------------------------------------------|
| 1. | Cboot  | MuRata        | GRM21BR71E104KA01L<br>Series= X7R | Cap= 100.0 nF<br>VDC= 25.0 V<br>IRMS= 0.0 A                    | 1   | \$0.01 | 0805 7 mm <sup>2</sup>                                                                                                     |
| 2. | Ccomp  | Yageo America | CC0805KRX7R9BB271<br>Series= X7R  | Cap= 270.0 pF<br>VDC= 50.0 V<br>IRMS= 0.0 A                    | 1   | \$0.01 | 0805 7 mm <sup>2</sup>                                                                                                     |
| 3. | Ccomp2 | 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 mm <sup>2</sup>                                                                                                     |
| 4. | Cin    | Panasonic     | 50SVPF39M<br>Series= ?            | Cap= 39.0 uF<br>ESR= 25.0 mOhm<br>VDC= 50.0 V<br>IRMS= 3.8 A   | 1   | \$0.72 | <br>CAPSMT_62_E12 106 mm <sup>2</sup> |
| 5. | Cinx   | Kemet         | C0805C104K5RACTU<br>Series= X7R   | Cap= 100.0 nF<br>ESR= 64.0 mOhm<br>VDC= 50.0 V<br>IRMS= 1.64 A | 1   | \$0.01 | 0805 7 mm <sup>2</sup>                                                                                                     |
| 6. | Cout   | Chemi-Con     | APXA160ARA331MJC0G<br>Series= PXA | Cap= 330.0 uF<br>ESR= 14.0 mOhm<br>VDC= 16.0 V<br>IRMS= 5.05 A | 1   | \$1.12 | <br>CAPSMT_62_JC0 156 mm <sup>2</sup> |
| 7. | Coutx  | MuRata        | GRM188R71C474KA88D<br>Series= X7R | Cap= 470.0 nF<br>ESR= 10.0 mOhm<br>VDC= 16.0 V<br>IRMS= 0.0 A  | 1   | \$0.02 | 0603 5 mm <sup>2</sup>                                                                                                     |
| 8. | Coutx2 | MuRata        | GRM188R71C474KA88D<br>Series= X7R | Cap= 470.0 nF<br>ESR= 10.0 mOhm<br>VDC= 16.0 V<br>IRMS= 0.0 A  | 1   | \$0.02 | 0603 5 mm <sup>2</sup>                                                                                                     |

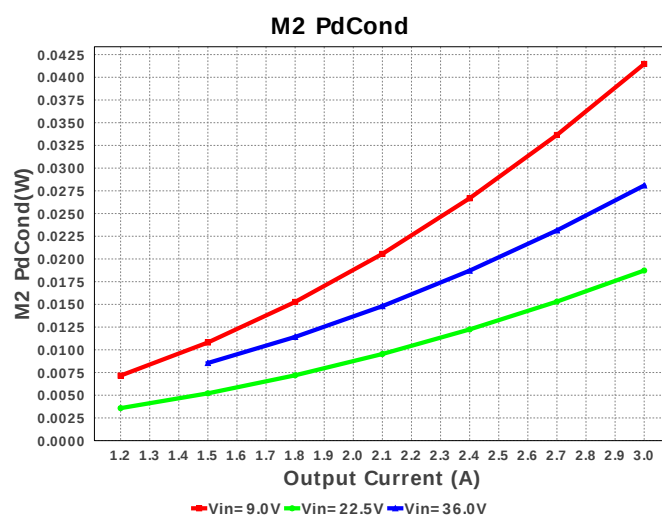
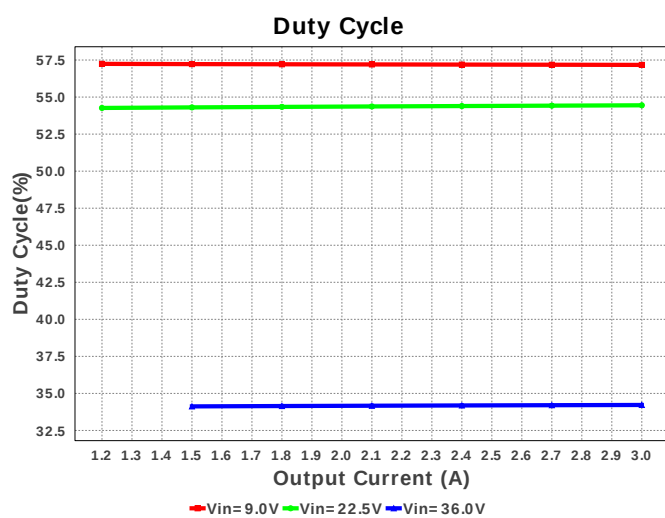
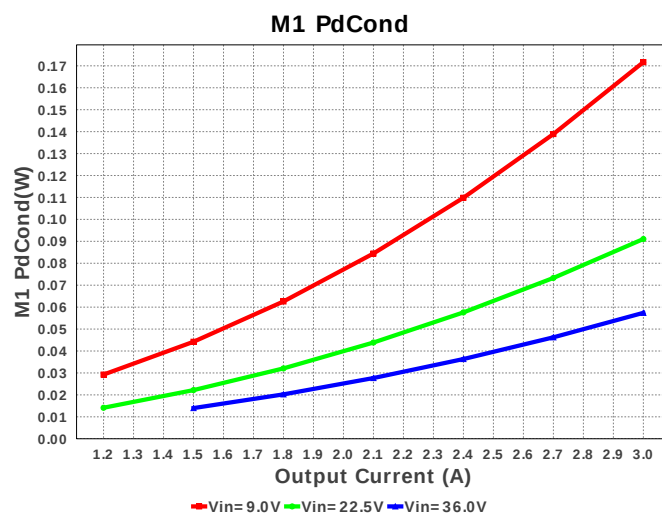
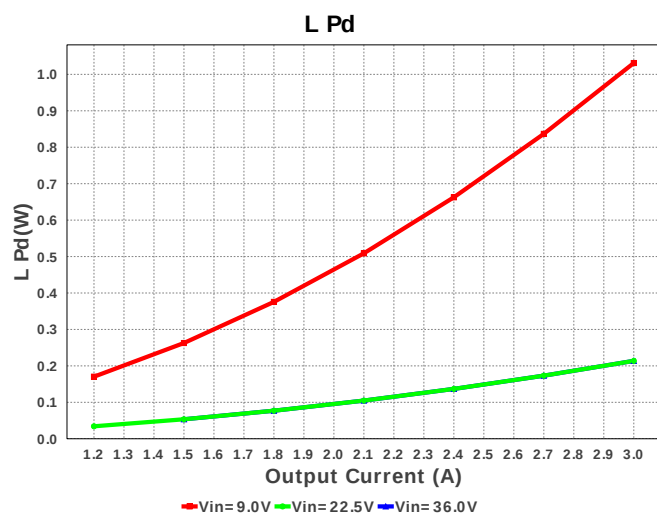
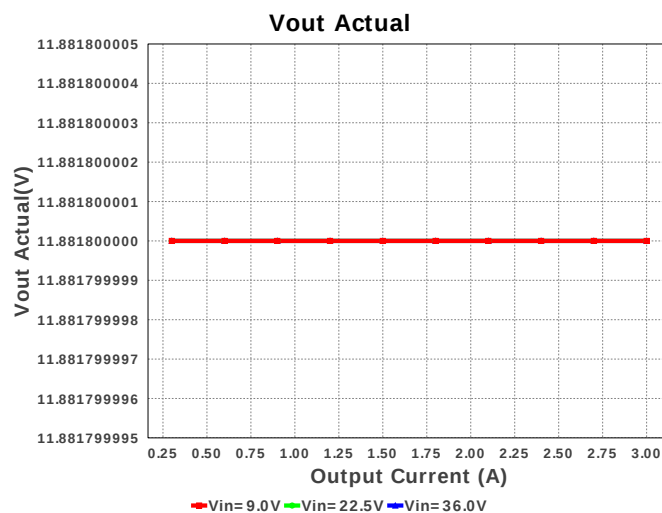
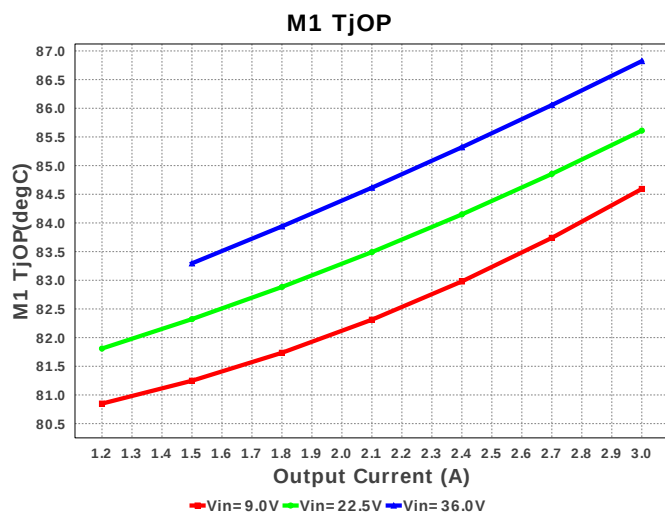
| #   | Name    | Manufacturer          | Part Number                          | Properties                                                        | Qty | Price  | Footprint                                                                                                                |
|-----|---------|-----------------------|--------------------------------------|-------------------------------------------------------------------|-----|--------|--------------------------------------------------------------------------------------------------------------------------|
| 9.  | Cramp   | Yageo America         | CC0805KRX7R9BB471<br>Series= X7R     | Cap= 470.0 pF<br>VDC= 50.0 V<br>IRMS= 0.0 A                       | 1   | \$0.01 |  0805 7 mm <sup>2</sup>               |
| 10. | Css     | Yageo America         | CC0805KRX7R9BB223<br>Series= X7R     | Cap= 22.0 nF<br>VDC= 50.0 V<br>IRMS= 0.0 A                        | 1   | \$0.01 |  0805 7 mm <sup>2</sup>               |
| 11. | Cvcc    | Taiyo Yuden           | EMK212B7105KG-T<br>Series= X7R       | Cap= 1.0 uF<br>VDC= 16.0 V<br>IRMS= 0.0 A                         | 1   | \$0.02 |  0805 7 mm <sup>2</sup>               |
| 12. | Cvccx   | MuRata                | GRM188R61C105KA93D<br>Series= X5R    | Cap= 1.0 uF<br>ESR= 10.127 mOhm<br>VDC= 16.0 V<br>IRMS= 994.63 mA | 1   | \$0.01 |  0603 5 mm <sup>2</sup>               |
| 13. | D1      | Vishay-Semiconductor  | 50WQ10FNPBF                          | VF@Io= 770.0 mV<br>VRRM= 100.0 V                                  | 1   | \$0.74 |  DPAK 102 mm <sup>2</sup>             |
| 14. | D2      | Vishay-Semiconductor  | 50WQ04FNPBF                          | VF@Io= 510.0 mV<br>VRRM= 40.0 V                                   | 1   | \$0.40 |  DPAK 102 mm <sup>2</sup>             |
| 15. | D3      | Vishay-Semiconductor  | 50WQ10FNPBF                          | VF@Io= 770.0 mV<br>VRRM= 100.0 V                                  | 1   | \$0.74 |  DPAK 102 mm <sup>2</sup>             |
| 16. | D4      | Vishay-Semiconductor  | 50WQ04FNPBF                          | VF@Io= 510.0 mV<br>VRRM= 40.0 V                                   | 1   | \$0.40 |  DPAK 102 mm <sup>2</sup>            |
| 17. | L1      | Coilcraft             | MSS1210-153MEB                       | L= 15.0 uH<br>DCR= 19.0 mOhm                                      | 1   | \$0.81 |  MSS1210 204 mm <sup>2</sup>        |
| 18. | M1      | Infineon Technologies | BSZ100N06LS3 G                       | VdsMax= 60.0 V<br>IdsMax= 40.0 Amps                               | 1   | \$0.39 |  PG-TSDSON-8 19 mm <sup>2</sup>     |
| 19. | M2      | Texas Instruments     | CSD16323Q3                           | VdsMax= 25.0 V<br>IdsMax= 60.0 Amps                               | 1   | \$0.44 |  TRANS_NexFET_Q3 18 mm <sup>2</sup> |
| 20. | Rcomp   | Vishay-Dale           | CRCW040245K3FKED<br>Series= CRCW..e3 | Res= 45.3 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0%               | 1   | \$0.01 |  0402 3 mm <sup>2</sup>             |
| 21. | Renable | Vishay-Dale           | CRCW04021M00FKED<br>Series= CRCW..e3 | Res= 1000.0 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0%             | 1   | \$0.01 |  0402 3 mm <sup>2</sup>             |
| 22. | Rfbb    | Vishay-Dale           | CRCW04021K00FKED<br>Series= CRCW..e3 | Res= 1000.0 Ohm<br>Power= 63.0 mW<br>Tolerance= 1.0%              | 1   | \$0.01 |  0402 3 mm <sup>2</sup>             |
| 23. | Rfbt    | Vishay-Dale           | CRCW04028K66FKED<br>Series= CRCW..e3 | Res= 8.66 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0%               | 1   | \$0.01 |  0402 3 mm <sup>2</sup>             |
| 24. | Rsense  | Susumu Co Ltd         | PRL1632-R016-F-T1<br>Series= PRL1632 | Res= 16.0 mOhm<br>Power= 1.0 W<br>Tolerance= 1.0%                 | 1   | \$0.19 |  0612 11 mm <sup>2</sup>            |
| 25. | Rt      | Vishay-Dale           | CRCW040230K9FKED<br>Series= CRCW..e3 | Res= 30.9 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0%               | 1   | \$0.01 |  0402 3 mm <sup>2</sup>             |

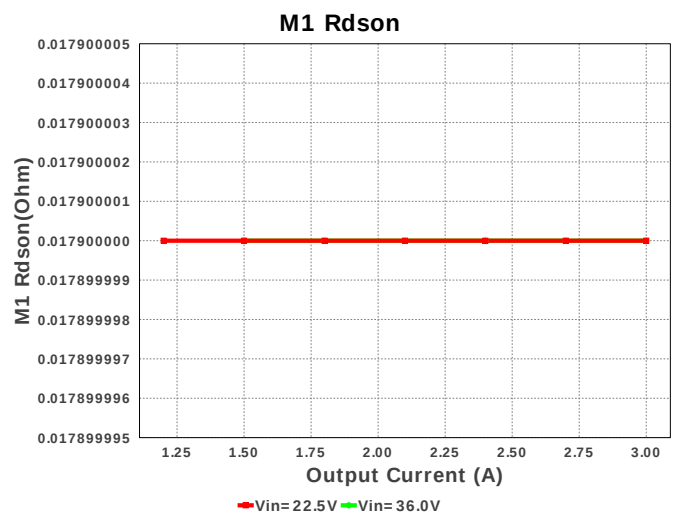
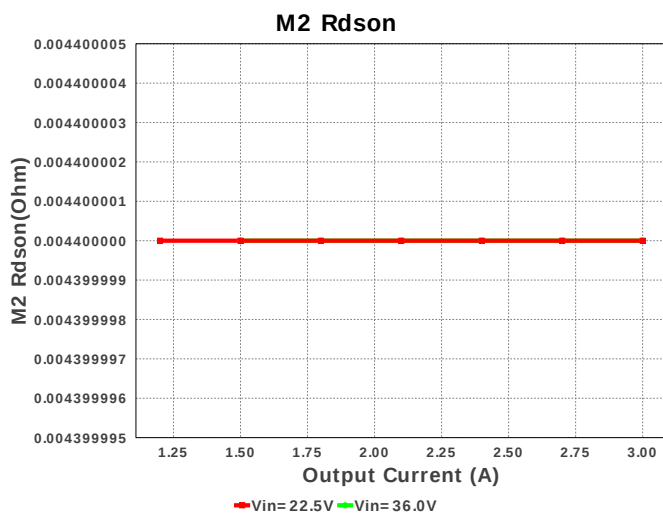
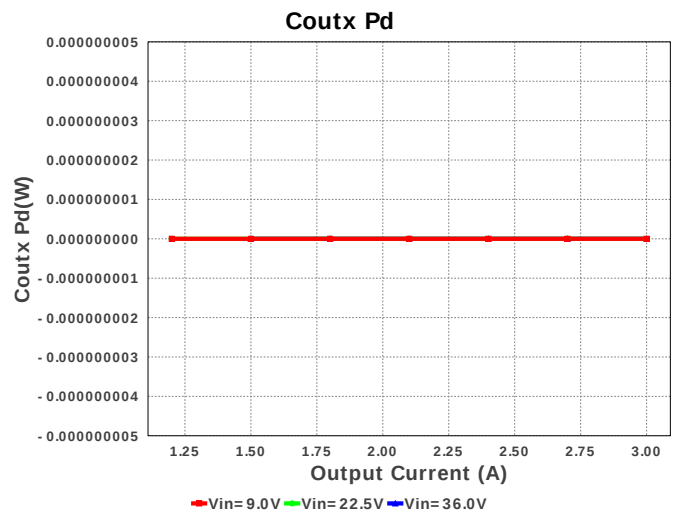
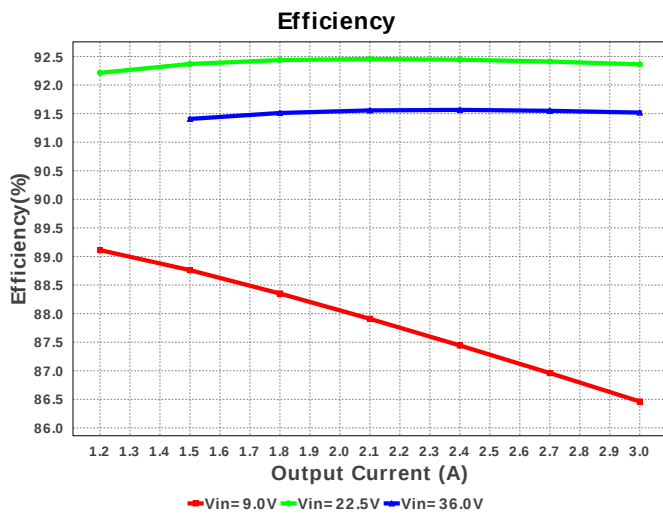
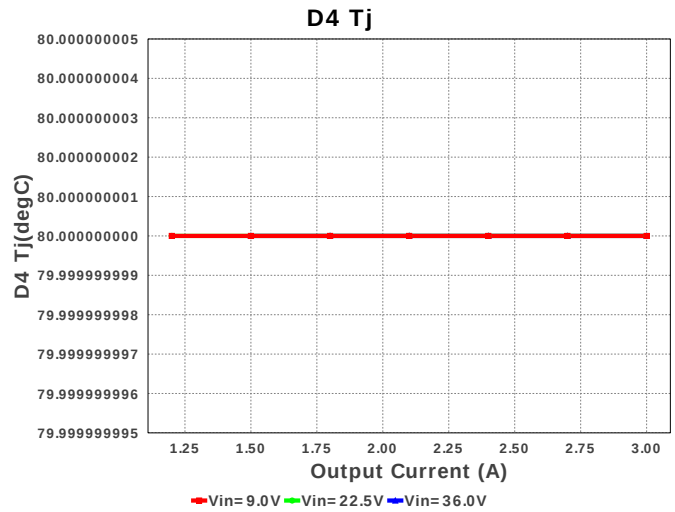
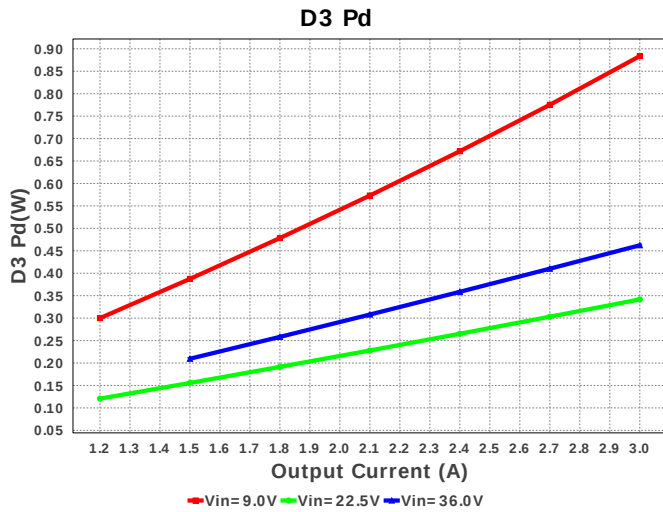
| #   | Name | Manufacturer      | Part Number                          | Properties                                          | Qty | Price  | Footprint                                                                                         |
|-----|------|-------------------|--------------------------------------|-----------------------------------------------------|-----|--------|---------------------------------------------------------------------------------------------------|
| 26. | Ruv1 | Vishay-Dale       | CRCW040239K2FKED<br>Series= CRCW..e3 | Res= 39.2 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1   | \$0.01 |  0402 3 mm²    |
| 27. | Ruv2 | Vishay-Dale       | CRCW04027K87FKED<br>Series= CRCW..e3 | Res= 7.87 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1   | \$0.01 |  0402 3 mm²    |
| 28. | U1   | Texas Instruments | LM25118MH/NOPB                       | Switcher                                            | 1   | \$2.40 |  MXA20A 71 mm² |



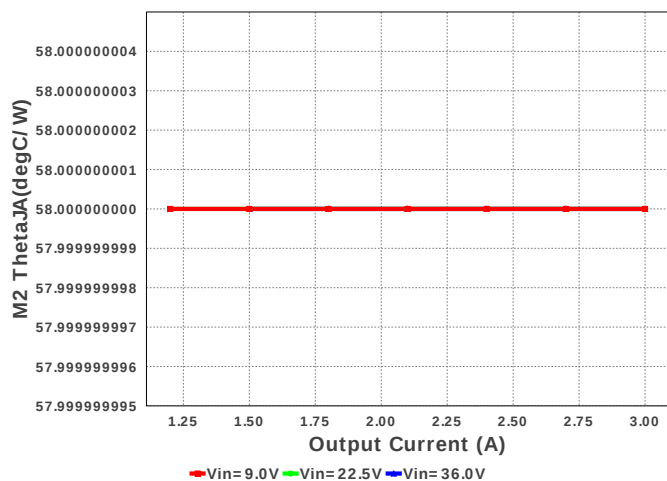




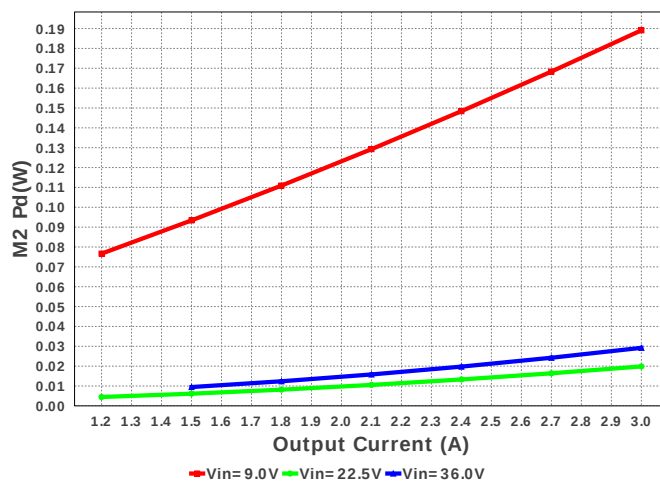




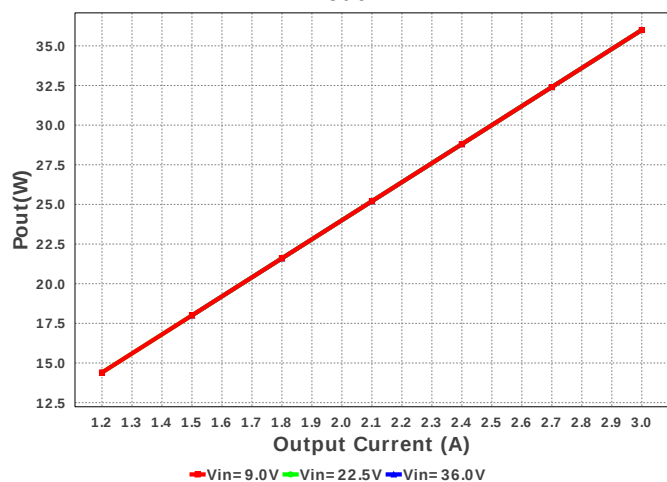
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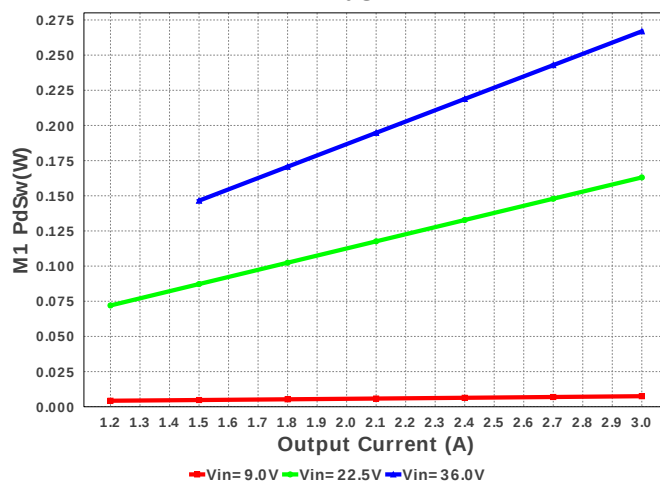
M2 Pd



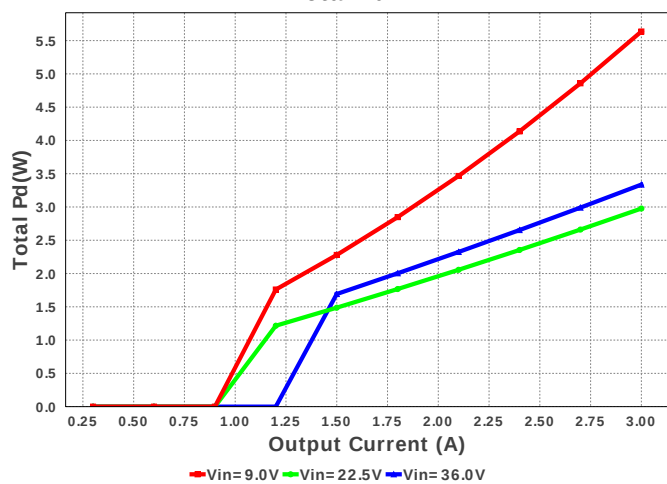
Pout



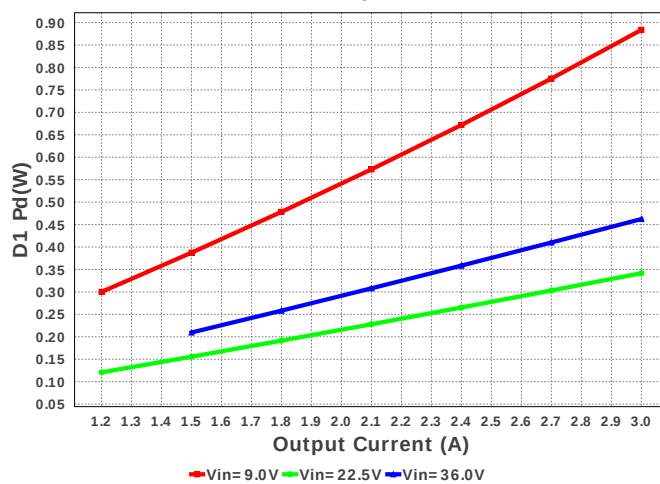
M1 PdSw

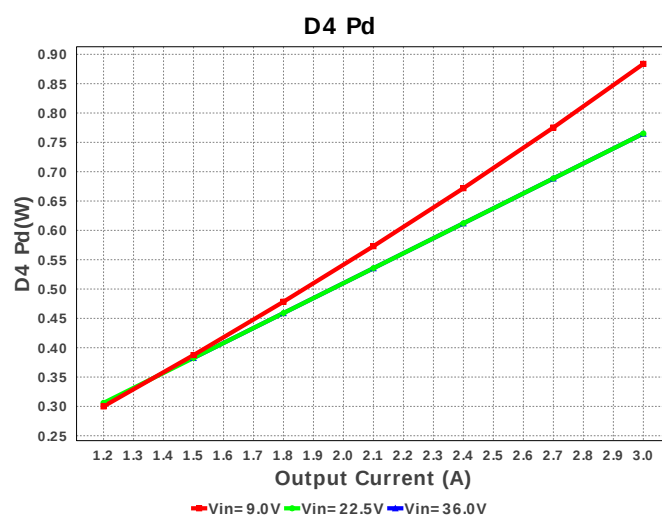
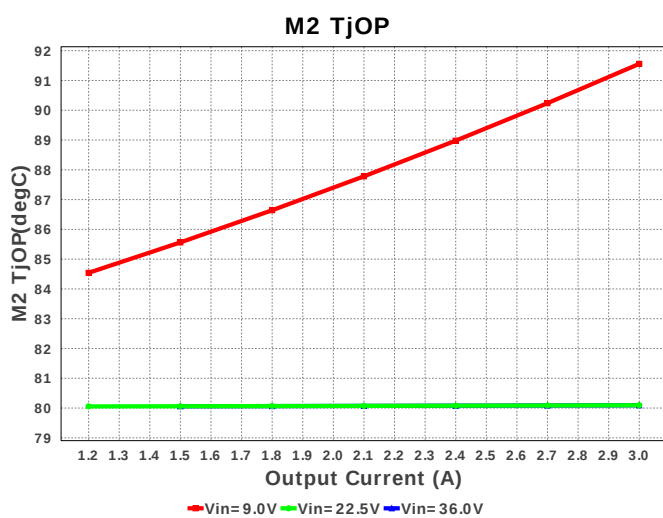
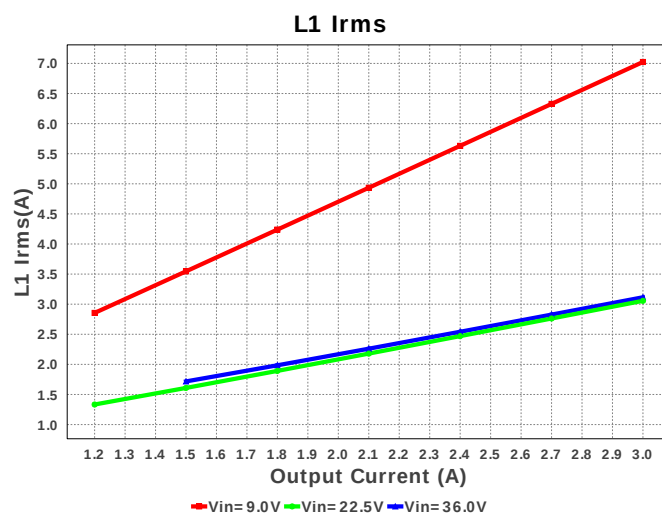
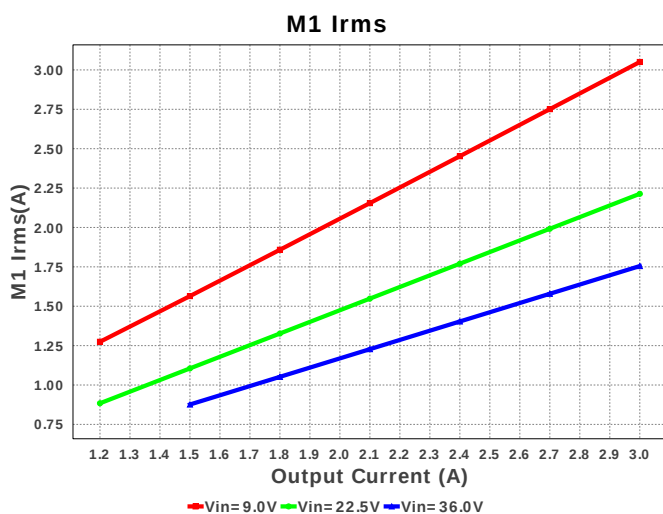
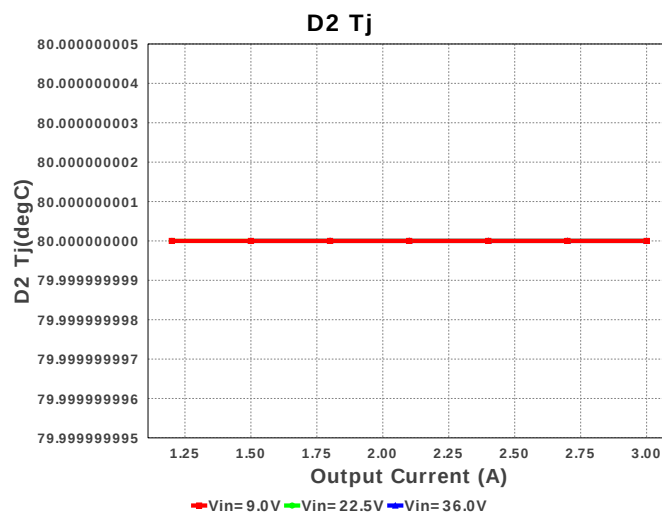
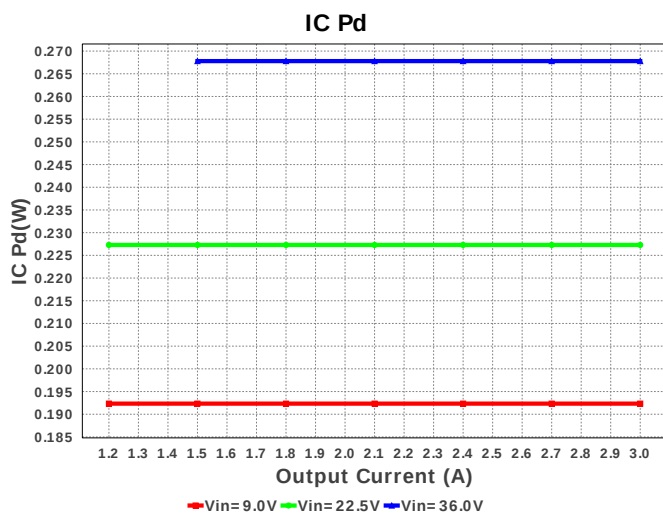


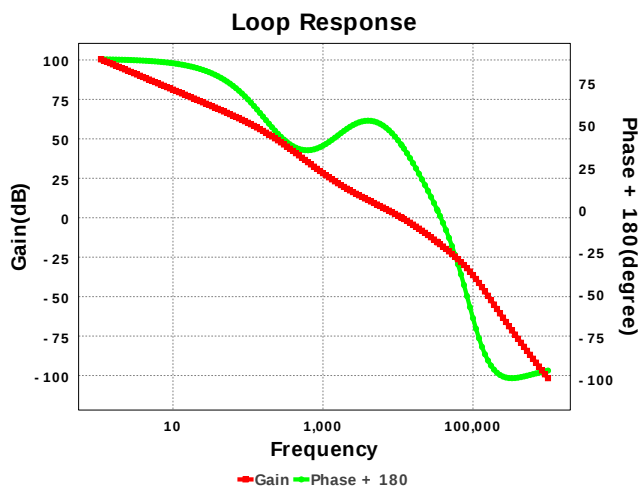
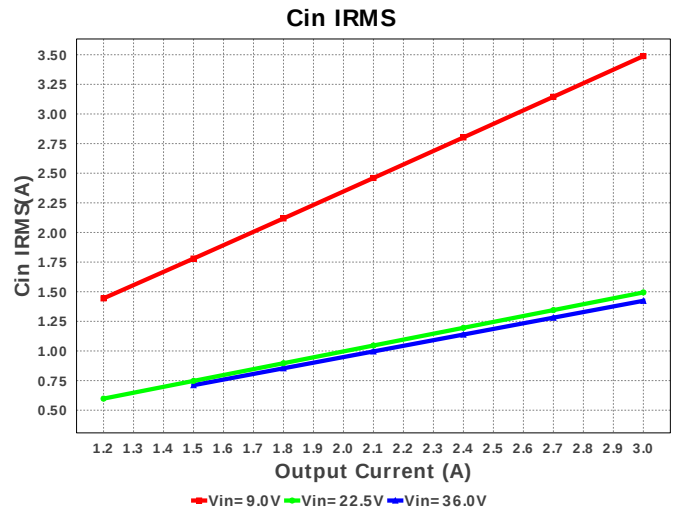
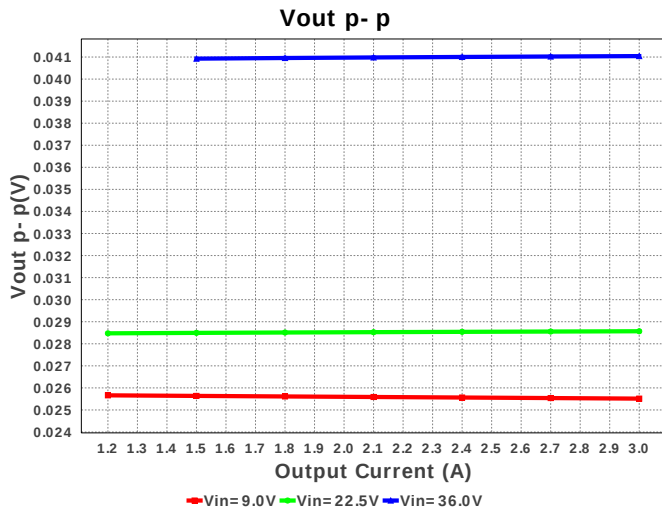
Total Pd



D1 Pd







## Operating Values

| #   | Name          | Value                   | Category | Description                                                        |
|-----|---------------|-------------------------|----------|--------------------------------------------------------------------|
| 1.  | Cin IRMS      | 1.426 A                 | Current  | Input capacitor RMS ripple current                                 |
| 2.  | Cout IRMS     | 843.125 mA              | Current  | Output capacitor RMS ripple current                                |
| 3.  | Coutx IRMS    | 0.0 A                   | Current  | Output capacitor_x RMS ripple current                              |
| 4.  | Iin Avg       | 1.089 A                 | Current  | Average input current                                              |
| 5.  | L Ipp         | 2.921 A                 | Current  | Peak-to-peak inductor ripple current                               |
| 6.  | L1 Irms       | 3.116 A                 | Current  | Inductor ripple current                                            |
| 7.  | M1 Irms       | 1.761 A                 | Current  | MOSFET RMS ripple current                                          |
| 8.  | M2 Irms       | 2.523 A                 | Current  | MOSFET RMS ripple current                                          |
| 9.  | SW Ipk        | 4.46 A                  | Current  | Peak switch current                                                |
| 10. | BOM Count     | 28                      | General  | Total Design BOM count                                             |
| 11. | FootPrint     | 1.076 k mm <sup>2</sup> | General  | Total Foot Print Area of BOM components                            |
| 12. | Frequency     | 188.679 kHz             | General  | Switching frequency                                                |
| 13. | IC Tolerance  | 18.0 mV                 | General  | IC Feedback Tolerance                                              |
| 14. | M1 Rdson      | 17.9 mOhm               | General  | Drain-Source On-resistance                                         |
| 15. | M1 ThetaJA    | 20.0 degC/W             | General  | MOSFET junction-to-ambient thermal resistance                      |
| 16. | M2 Rdson      | 4.4 mOhm                | General  | Drain-Source On-resistance                                         |
| 17. | M2 ThetaJA    | 58.0 degC/W             | General  | MOSFET junction-to-ambient thermal resistance                      |
| 18. | Pout          | 36.0 W                  | General  | Total output power                                                 |
| 19. | Total BOM     | \$8.55                  | General  | Total BOM Cost                                                     |
| 20. | D1 Tj         | 97.381 degC             | Op_Point | D1 junction temperature                                            |
| 21. | D1 Tj         | 97.381 degC             | Op_Point | D1 junction temperature                                            |
| 22. | D2 Tj         | 105.837 degC            | Op_Point | D2 junction temperature                                            |
| 23. | D3 Tj         | 97.381 degC             | Op_Point | D3 junction temperature                                            |
| 24. | D4 Tj         | 105.837 degC            | Op_Point | D4 junction temperature                                            |
| 25. | Low Freq Gain | 100.428 dB              | Op_Point | Gain at 10Hz                                                       |
| 26. | Vout Actual   | 11.882 V                | Op_Point | Vout Actual calculated based on selected voltage divider resistors |
| 27. | Vout OP       | 12.0 V                  | Op_Point | Operational Output Voltage                                         |
| 28. | Cross Freq    | 11.247 kHz              | Op_point | Bode plot crossover frequency                                      |
| 29. | Duty Cycle    | 34.442 %                | Op_point | Duty cycle                                                         |
| 30. | Efficiency    | 91.843 %                | Op_point | Steady state efficiency                                            |
| 31. | Gain Marg     | -15.648 dB              | Op_point | Bode Plot Gain Margin                                              |

| #   | Name           | Value       | Category | Description                                                                                |
|-----|----------------|-------------|----------|--------------------------------------------------------------------------------------------|
| 32. | IC Tj          | 90.712 degC | Op_point | IC junction temperature                                                                    |
| 33. | ICThetaJA      | 40.0 degC/W | Op_point | IC junction-to-ambient thermal resistance                                                  |
| 34. | IOUT_OP        | 3.0 A       | Op_point | Iout operating point                                                                       |
| 35. | M1 TjOP        | 86.836 degC | Op_point | MOSFET junction temperature                                                                |
| 36. | M2 TjOP        | 90.964 degC | Op_point | MOSFET junction temperature                                                                |
| 37. | Phase Marg     | 38.788 deg  | Op_point | Bode Plot Phase Margin                                                                     |
| 38. | VIN_OP         | 36.0 V      | Op_point | Vin operating point                                                                        |
| 39. | Vout p-p       | 41.308 mV   | Op_point | Peak-to-peak output ripple voltage                                                         |
| 40. | Cin Pd         | 50.804 mW   | Power    | Input capacitor power dissipation                                                          |
| 41. | Cout Pd        | 9.952 mW    | Power    | Output capacitor power dissipation                                                         |
| 42. | Coutx Pd       | 0.0 W       | Power    | Output capacitor_x power loss                                                              |
| 43. | D1 Pd          | 579.372 mW  | Power    | Diode power dissipation                                                                    |
| 44. | D2 Pd          | 574.147 mW  | Power    | Diode2 power dissipation                                                                   |
| 45. | D3 Pd          | 579.372 mW  | Power    | Diode3 power dissipation                                                                   |
| 46. | D4 Pd          | 574.147 mW  | Power    | Diode4 power dissipation                                                                   |
| 47. | Diode Pd       | 579.372 mW  | Power    | Diode power dissipation                                                                    |
| 48. | IC Pd          | 267.791 mW  | Power    | IC power dissipation                                                                       |
| 49. | L Pd           | 213.75 mW   | Power    | Inductor power dissipation                                                                 |
| 50. | M1 Pd          | 332.62 mW   | Power    | MOSFET power dissipation                                                                   |
| 51. | M1 PdCond      | 65.531 mW   | Power    | M1 MOSFET conduction losses                                                                |
| 52. | M1 PdSw        | 267.089 mW  | Power    | M1 MOSFET switching losses                                                                 |
| 53. | M2 Pd          | 37.42 mW    | Power    | MOSFET power dissipation                                                                   |
| 54. | M2 PdCond      | 29.215 mW   | Power    | M2 MOSFET conduction losses                                                                |
| 55. | M2 PdSw        | 8.206 mW    | Power    | M2 MOSFET switching losses                                                                 |
| 56. | Total Pd       | 3.197 W     | Power    | Total Power Dissipation                                                                    |
| 57. | Vout Tolerance | 3.301 %     |          | Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable |

## Design Inputs

| #  | Name    | Value   | Description            |
|----|---------|---------|------------------------|
| 1. | Iout    | 3.0     | Maximum Output Current |
| 2. | VinMax  | 36.0    | Maximum input voltage  |
| 3. | VinMin  | 9.0     | Minimum input voltage  |
| 4. | Vout    | 12.0    | Output Voltage         |
| 5. | base_pn | LM25118 | Base Product Number    |
| 6. | source  | DC      | Input Source Type      |
| 7. | Ta      | 80.0    | Ambient temperature    |

## Design Assistance

1. The LM25118 is a wide range buck-boost controller which is operable in an ultra wide input range of 3 to 75V. A buck-boost regulator can maintain regulation for input voltages either higher or lower than the output voltage. The challenge is that buck-boost power converters are not as efficient as buck regulators. The LM5118 has been designed as a dual mode controller whereby the power converter acts as a buck regulator while the input voltage is above the output. As the input voltage approaches the output voltage, a gradual transition to the buck-boost mode occurs. This gradual transition between modes eliminates disturbances at the output during transitions.

2. **LM25118 Product Folder** : <http://www.ti.com/product/LM25118> : contains the data sheet and other resources.

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