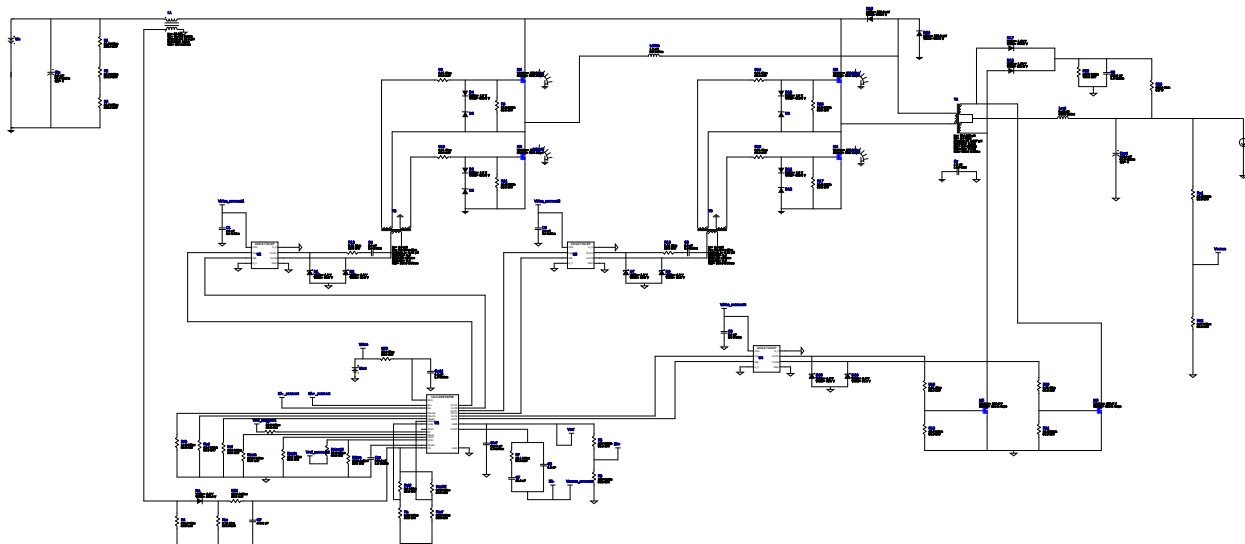


## WEBENCH® Design Report

Design : 10 UCC28950PWR  
UCC28950PWR 200V-400V to 24.00V @ 80A



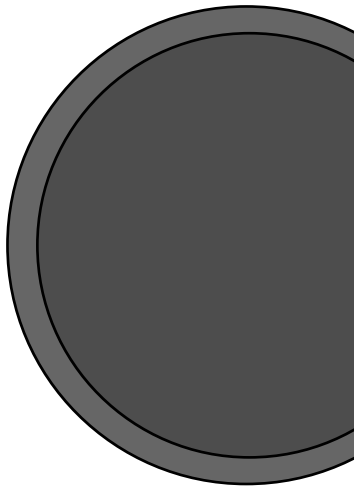
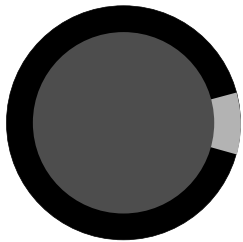
### Design Alerts

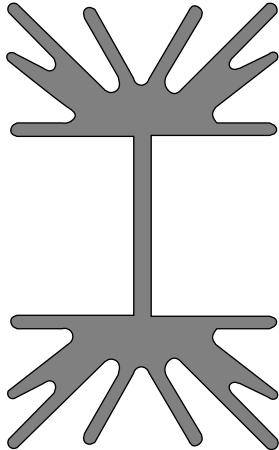
#### UCC28950 Design

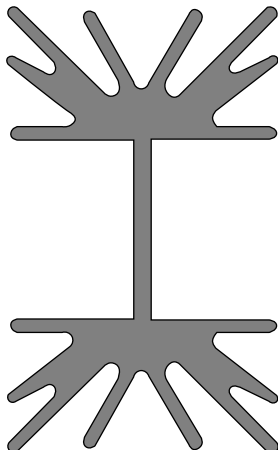
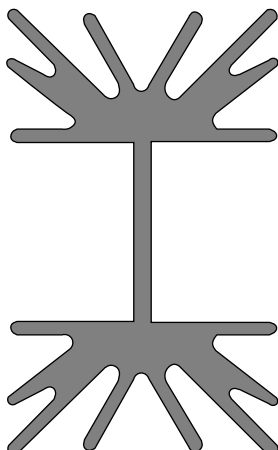
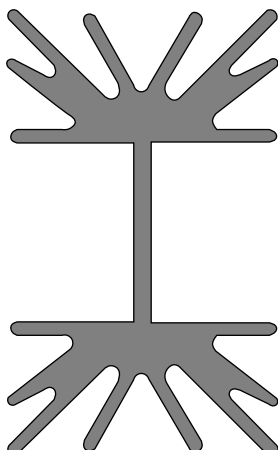
With the current design condition, suitable FETs M5 and M6 could not be found in the current database. Hence, this design is created using ideal FETs. Please note that the resulting FET parameters are ideal, so the efficiency/loss values have been disabled.

### Electrical BOM

| Name | Manufacturer | Part Number                       | Properties                                                    | Qty | Price  | Footprint               |
|------|--------------|-----------------------------------|---------------------------------------------------------------|-----|--------|-------------------------|
| C1   | Taiyo Yuden  | TMK212B7105KG-T<br>Series= X7R    | Cap= 1.0 uF<br>ESR= 1.0 mOhm<br>VDC= 25.0 V<br>IRMS= 0.0 A    | 1   | \$0.02 | 0805 7 mm <sup>2</sup>  |
| C2   | Taiyo Yuden  | TMK212B7105KG-T<br>Series= X7R    | Cap= 1.0 uF<br>ESR= 1.0 mOhm<br>VDC= 25.0 V<br>IRMS= 0.0 A    | 1   | \$0.02 | 0805 7 mm <sup>2</sup>  |
| C3   | Taiyo Yuden  | TMK212B7105KG-T<br>Series= X7R    | Cap= 1.0 uF<br>ESR= 1.0 mOhm<br>VDC= 25.0 V<br>IRMS= 0.0 A    | 1   | \$0.02 | 0805 7 mm <sup>2</sup>  |
| C4   | Taiyo Yuden  | TMK212B7105KG-T<br>Series= X7R    | Cap= 1.0 uF<br>ESR= 1.0 mOhm<br>VDC= 25.0 V<br>IRMS= 0.0 A    | 1   | \$0.02 | 0805 7 mm <sup>2</sup>  |
| C5   | Taiyo Yuden  | TMK212B7105KG-T<br>Series= X7R    | Cap= 1.0 uF<br>ESR= 1.0 mOhm<br>VDC= 25.0 V<br>IRMS= 0.0 A    | 1   | \$0.02 | 0805 7 mm <sup>2</sup>  |
| C6   | MuRata       | GRM55DR72J224KW01L<br>Series= X7R | Cap= 220.0 nF<br>ESR= 1.0 mOhm<br>VDC= 630.0 V<br>IRMS= 0.0 A | 1   | \$0.52 | 2220 54 mm <sup>2</sup> |

| Name | Manufacturer        | Part Number                             | Properties                                                     | Qty | Price   | Footprint                                                                                                                         |
|------|---------------------|-----------------------------------------|----------------------------------------------------------------|-----|---------|-----------------------------------------------------------------------------------------------------------------------------------|
| C7   | TDK                 | CGA4F2C0G1H153J085AA<br>Series= C0G/NP0 | Cap= 15.0 nF<br>VDC= 50.0 V<br>IRMS= 0.0 A                     | 1   | \$0.07  |  0805 7 mm <sup>2</sup>                        |
| C8   | TDK                 | C2012C0G1H152J060AA<br>Series= C0G/NP0  | Cap= 1.5 nF<br>VDC= 50.0 V<br>IRMS= 0.0 A                      | 1   | \$0.02  |  0805 7 mm <sup>2</sup>                        |
| Cin  | TDK                 | B43510A5228M000<br>Series= 2384         | Cap= 2.2 mF<br>ESR= 50.0 mOhm<br>VDC= 450.0 V<br>IRMS= 16.9 A  | 2   | \$39.53 |  B43510_4500x10000_00<br>2209 mm <sup>2</sup>  |
| Clf  | 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>                        |
| Cout | TDK                 | B41607A8907M008<br>Series= 2360         | Cap= 900.0 uF<br>ESR= 50.0 mOhm<br>VDC= 63.0 V<br>IRMS= 10.2 A | 2   | \$4.84  |  B41607_2200x4000_8 576<br>mm <sup>2</sup>   |
| Cref | Kemet               | C0603C104Z3VACTU<br>Series= Y5V         | Cap= 100.0 nF<br>ESR= 1.0 mOhm<br>VDC= 25.0 V<br>IRMS= 0.0 A   | 1   | \$0.01  |  0603 5 mm <sup>2</sup>                      |
| Css  | Kemet               | C0603C104Z3VACTU<br>Series= Y5V         | Cap= 100.0 nF<br>ESR= 1.0 mOhm<br>VDC= 25.0 V<br>IRMS= 0.0 A   | 1   | \$0.01  |  0603 5 mm <sup>2</sup>                      |
| Cvdd | Taiyo Yuden         | TMK212B7105KG-T<br>Series= X7R          | Cap= 1.0 uF<br>ESR= 1.0 mOhm<br>VDC= 25.0 V<br>IRMS= 0.0 A     | 1   | \$0.02  |  0805 7 mm <sup>2</sup>                      |
| Cy   | TDK                 | B81123C1102M<br>Series= B81123          | Cap= 1.0 nF<br>ESR= 1.59 Ohm<br>VDC= 3.0 kV<br>IRMS= 0.0 A     | 1   | \$0.24  |  B81123_1800x500x1050<br>140 mm <sup>2</sup> |
| D1   | SMC Diode Solutions | BAT54WSTR                               | VF@Io= 1.0 V<br>VRRM= 30.0 V                                   | 1   | \$0.02  |  SOD-323 9 mm <sup>2</sup>                   |

| Name  | Manufacturer        | Part Number   | Properties                       | Qty | Price  | Footprint                                                                                                         |
|-------|---------------------|---------------|----------------------------------|-----|--------|-------------------------------------------------------------------------------------------------------------------|
| D10   | ON Semiconductor    | MMSD4148T1G   | VF@Io= 1.0 V<br>VRRM= 100.0 V    | 1   | \$0.02 |  SOD-123 13 mm <sup>2</sup>    |
| D11   | ON Semiconductor    | MMSD4148T1G   | VF@Io= 1.0 V<br>VRRM= 100.0 V    | 1   | \$0.02 |  SOD-123 13 mm <sup>2</sup>    |
| D12   | Diodes Inc.         | MMSZ5242B-7-F | Zener                            | 1   | \$0.04 |  SOD-123 13 mm <sup>2</sup>    |
| D13   | CUSTOM              | CUSTOM        | VF@Io= 500.0 mV<br>VRRM= 580.0 V | 1   | NA     | CUSTOM 0 mm <sup>2</sup>                                                                                          |
| D14   | CUSTOM              | CUSTOM        | VF@Io= 500.0 mV<br>VRRM= 580.0 V | 1   | NA     | CUSTOM 0 mm <sup>2</sup>                                                                                          |
| D15   | SMC Diode Solutions | BAT54WSTR     | VF@Io= 1.0 V<br>VRRM= 30.0 V     | 1   | \$0.02 |  SOD-323 9 mm <sup>2</sup>     |
| D16   | SMC Diode Solutions | BAT54WSTR     | VF@Io= 1.0 V<br>VRRM= 30.0 V     | 1   | \$0.02 |  SOD-323 9 mm <sup>2</sup>     |
| D17   | Bourns              | CD214C-F3600  | VF@Io= 1.12 V<br>VRRM= 600.0 V   | 1   | \$0.23 |  SMC 83 mm <sup>2</sup>        |
| D18   | Bourns              | CD214C-F3600  | VF@Io= 1.12 V<br>VRRM= 600.0 V   | 1   | \$0.23 |  SMC 83 mm <sup>2</sup>        |
| D2    | SMC Diode Solutions | BAT54WSTR     | VF@Io= 1.0 V<br>VRRM= 30.0 V     | 1   | \$0.02 |  SOD-323 9 mm <sup>2</sup>     |
| D3    | Diodes Inc.         | MMSZ5242B-7-F | Zener                            | 1   | \$0.04 |  SOD-123 13 mm <sup>2</sup>   |
| D4    | ON Semiconductor    | MMSD4148T1G   | VF@Io= 1.0 V<br>VRRM= 100.0 V    | 1   | \$0.02 |  SOD-123 13 mm <sup>2</sup>  |
| D5    | ON Semiconductor    | MMSD4148T1G   | VF@Io= 1.0 V<br>VRRM= 100.0 V    | 1   | \$0.02 |  SOD-123 13 mm <sup>2</sup>  |
| D6    | Diodes Inc.         | MMSZ5242B-7-F | Zener                            | 1   | \$0.04 |  SOD-123 13 mm <sup>2</sup>  |
| D7    | SMC Diode Solutions | BAT54WSTR     | VF@Io= 1.0 V<br>VRRM= 30.0 V     | 1   | \$0.02 |  SOD-323 9 mm <sup>2</sup>   |
| D8    | SMC Diode Solutions | BAT54WSTR     | VF@Io= 1.0 V<br>VRRM= 30.0 V     | 1   | \$0.02 |  SOD-323 9 mm <sup>2</sup>   |
| D9    | Diodes Inc.         | MMSZ5242B-7-F | Zener                            | 1   | \$0.04 |  SOD-123 13 mm <sup>2</sup>  |
| Da    | ON Semiconductor    | MMSD4148T1G   | VF@Io= 1.0 V<br>VRRM= 100.0 V    | 1   | \$0.02 |  SOD-123 13 mm <sup>2</sup>  |
| HS_M1 | Aavid               | 529802B02500G | Heatsink                         | 1   | \$0.91 |  529802 1203 mm <sup>2</sup> |

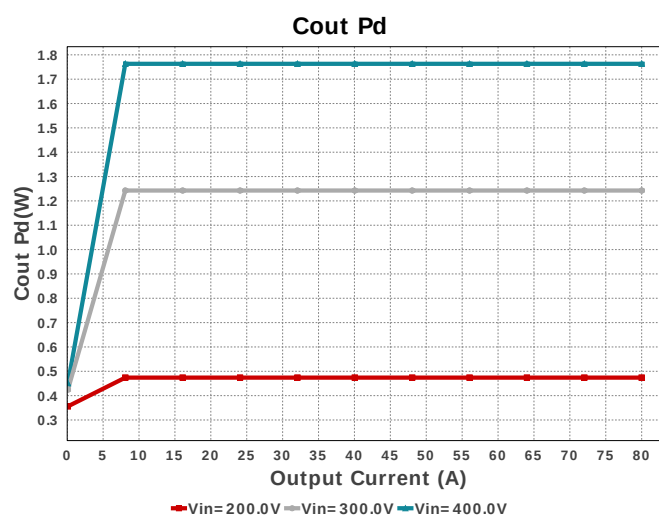
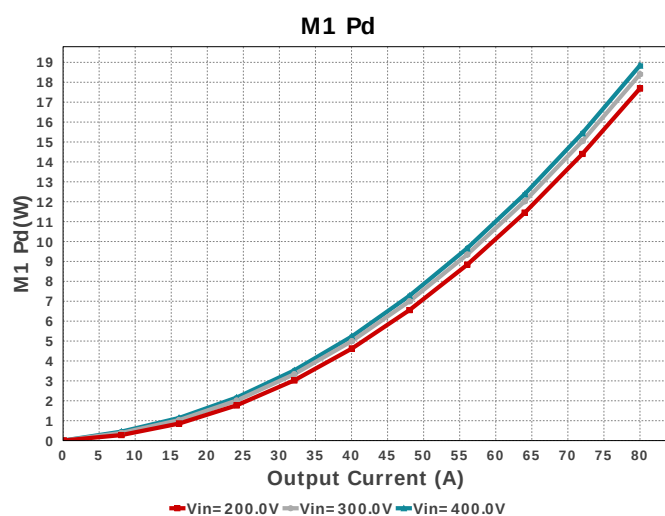
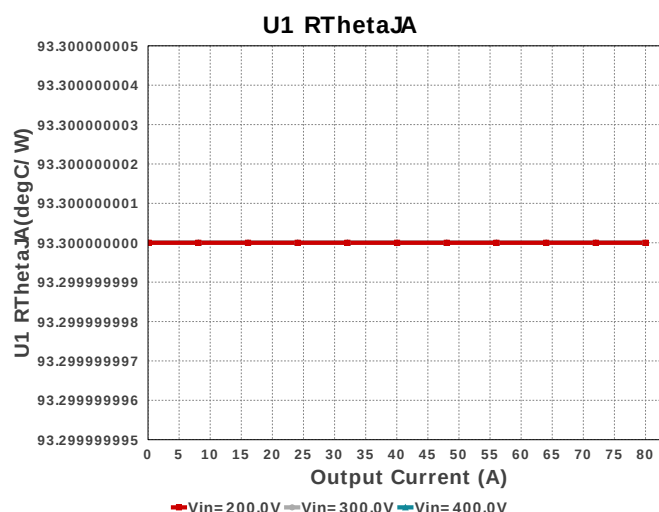
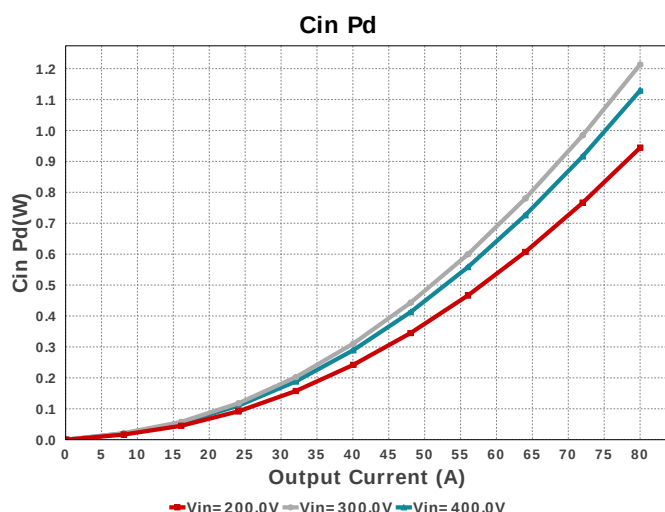
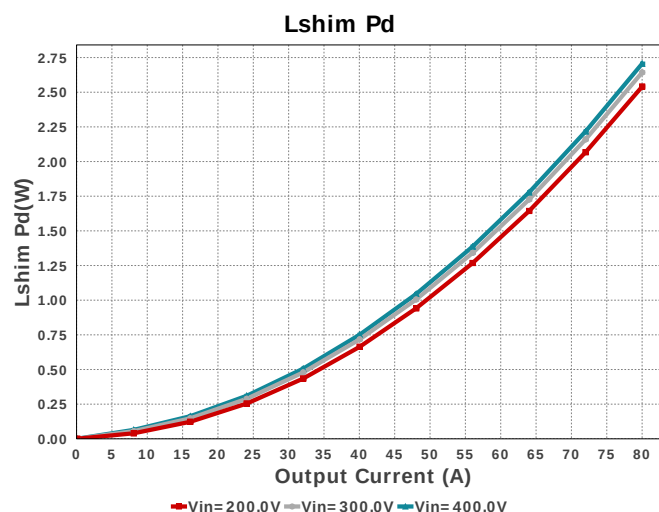
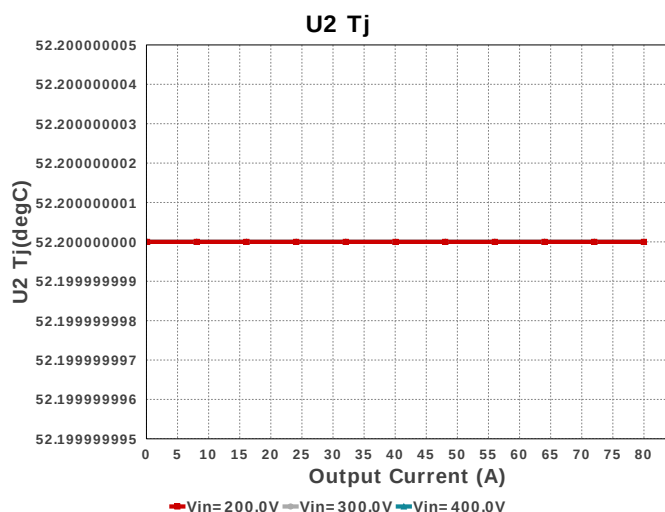
| Name  | Manufacturer | Part Number    | Properties                                                                               | Qty | Price  | Footprint                                                                                                            |
|-------|--------------|----------------|------------------------------------------------------------------------------------------|-----|--------|----------------------------------------------------------------------------------------------------------------------|
| HS_M2 | Aavid        | 529802B02500G  | Heatsink                                                                                 | 1   | \$0.91 | <br>529802 1203 mm <sup>2</sup>   |
| HS_M3 | Aavid        | 529802B02500G  | Heatsink                                                                                 | 1   | \$0.91 | <br>529802 1203 mm <sup>2</sup>  |
| HS_M4 | Aavid        | 529802B02500G  | Heatsink                                                                                 | 1   | \$0.91 | <br>529802 1203 mm <sup>2</sup> |
| L1    | CUSTOM       | CUSTOM         | Lp= 20.0 mH<br>Rp= 84.654 mOhm<br>Leakage_L= 20.0 μH<br>Ns1toNp= 100.0<br>Rs1= 6.0 mOhms | 1   | NA     | CUSTOM 0 mm <sup>2</sup>                                                                                             |
| Lout  | CUSTOM       | CUSTOM         | L= 5.48 μH<br>500.0 μOhm                                                                 | 1   | NA     | CUSTOM 0 mm <sup>2</sup>                                                                                             |
| Lshim | Coilcraft    | XAL6030-102MEB | L= 1.0 μH<br>5.6 mOhm                                                                    | 1   | \$0.65 | <br>XAL6030 72 mm <sup>2</sup>  |

| Name | Manufacturer       | Part Number                          | Properties                                           | Qty | Price  | Footprint                                                                                                          |
|------|--------------------|--------------------------------------|------------------------------------------------------|-----|--------|--------------------------------------------------------------------------------------------------------------------|
| M1   | STMicroelectronics | STP45N65M5                           | VdsMax= 650.0 V<br>IdsMax= 35.0 Amps                 | 1   | \$3.79 | <br>TO-220AB 79 mm <sup>2</sup> |
| M2   | STMicroelectronics | STP45N65M5                           | VdsMax= 650.0 V<br>IdsMax= 35.0 Amps                 | 1   | \$3.79 | <br>TO-220AB 79 mm <sup>2</sup> |
| M3   | STMicroelectronics | STP45N65M5                           | VdsMax= 650.0 V<br>IdsMax= 35.0 Amps                 | 1   | \$3.79 | <br>TO-220AB 79 mm <sup>2</sup> |
| M4   | STMicroelectronics | STP45N65M5                           | VdsMax= 650.0 V<br>IdsMax= 35.0 Amps                 | 1   | \$3.79 | <br>TO-220AB 79 mm <sup>2</sup> |
| M5   | NA                 | IdealFET5                            | VdsMax= 198.0 V<br>IdsMax= 125.0 Amps                | 1   | NA     | NA 0 mm <sup>2</sup>                                                                                               |
| M6   | NA                 | IdealFET6                            | VdsMax= 198.0 V<br>IdsMax= 125.0 Amps                | 1   | NA     | NA 0 mm <sup>2</sup>                                                                                               |
| R1   | Vishay-Dale        | CRCW120622K6FKEA<br>Series= CRCW..e3 | Res= 22.6 kOhm<br>Power= 250.0 mW<br>Tolerance= 1.0% | 1   | \$0.01 | <br>1206 11 mm <sup>2</sup>    |
| R10  | Vishay-Dale        | CRCW04023R01FKED<br>Series= CRCW..e3 | Res= 3.01 Ohm<br>Power= 63.0 mW<br>Tolerance= 1.0%   | 1   | \$0.01 | <br>0402 3 mm <sup>2</sup>    |
| R11  | Yageo              | RC0201FR-0710KL<br>Series= ?         | Res= 10.0 kOhm<br>Power= 50.0 mW<br>Tolerance= 1.0%  | 1   | \$0.01 | <br>0201 2 mm <sup>2</sup>    |
| R12  | Vishay-Dale        | CRCW04023R01FKED<br>Series= CRCW..e3 | Res= 3.01 Ohm<br>Power= 63.0 mW<br>Tolerance= 1.0%   | 1   | \$0.01 | <br>0402 3 mm <sup>2</sup>    |
| R13  | Vishay-Dale        | CRCW04023R01FKED<br>Series= CRCW..e3 | Res= 3.01 Ohm<br>Power= 63.0 mW<br>Tolerance= 1.0%   | 1   | \$0.01 | <br>0402 3 mm <sup>2</sup>    |
| R14  | Vishay-Dale        | CRCW04023R01FKED<br>Series= CRCW..e3 | Res= 3.01 Ohm<br>Power= 63.0 mW<br>Tolerance= 1.0%   | 1   | \$0.01 | <br>0402 3 mm <sup>2</sup>    |
| R15  | Yageo              | RC0201FR-0710KL<br>Series= ?         | Res= 10.0 kOhm<br>Power= 50.0 mW<br>Tolerance= 1.0%  | 1   | \$0.01 | <br>0201 2 mm <sup>2</sup>    |
| R16  | Vishay-Dale        | CRCW04023R01FKED<br>Series= CRCW..e3 | Res= 3.01 Ohm<br>Power= 63.0 mW<br>Tolerance= 1.0%   | 1   | \$0.01 | <br>0402 3 mm <sup>2</sup>    |
| R17  | Yageo              | RC0201FR-0710KL<br>Series= ?         | Res= 10.0 kOhm<br>Power= 50.0 mW<br>Tolerance= 1.0%  | 1   | \$0.01 | <br>0201 2 mm <sup>2</sup>    |
| R18  | Vishay-Dale        | CRCW04023R01FKED<br>Series= CRCW..e3 | Res= 3.01 Ohm<br>Power= 63.0 mW<br>Tolerance= 1.0%   | 1   | \$0.01 | <br>0402 3 mm <sup>2</sup>    |
| R19  | Yageo              | RC0201FR-0710KL<br>Series= ?         | Res= 10.0 kOhm<br>Power= 50.0 mW<br>Tolerance= 1.0%  | 1   | \$0.01 | <br>0201 2 mm <sup>2</sup>    |
| R2   | Vishay-Dale        | CRCW120622K6FKEA<br>Series= CRCW..e3 | Res= 22.6 kOhm<br>Power= 250.0 mW<br>Tolerance= 1.0% | 1   | \$0.01 | <br>1206 11 mm <sup>2</sup>   |

| Name   | Manufacturer | Part Number                          | Properties                                            | Qty | Price  | Footprint                                                                                         |
|--------|--------------|--------------------------------------|-------------------------------------------------------|-----|--------|---------------------------------------------------------------------------------------------------|
| R20    | Vishay-Dale  | CRCW04023R01FKED<br>Series= CRCW..e3 | Res= 3.01 Ohm<br>Power= 63.0 mW<br>Tolerance= 1.0%    | 1   | \$0.01 |  0402 3 mm²    |
| R21    | Yageo        | RC0201FR-0710KL<br>Series= ?         | Res= 10.0 kOhm<br>Power= 50.0 mW<br>Tolerance= 1.0%   | 1   | \$0.01 |  0201 2 mm²    |
| R22    | Vishay-Dale  | CRCW2010110KFKEF<br>Series= CRCW..e3 | Res= 110.0 kOhm<br>Power= 750.0 mW<br>Tolerance= 1.0% | 1   | \$0.03 |  2010 32 mm²   |
| R23    | CUSTOM       | CUSTOM<br>Series= ?                  | Res= 800.0 Ohm<br>Power= 0.0 W<br>Tolerance= 0.0%     | 1   | NA     | CUSTOM 0 mm²                                                                                      |
| R3     | Vishay-Dale  | CRCW120622K6FKEA<br>Series= CRCW..e3 | Res= 22.6 kOhm<br>Power= 250.0 mW<br>Tolerance= 1.0%  | 1   | \$0.01 |  1206 11 mm²   |
| R4     | Vishay-Dale  | CRCW0402976RFKED<br>Series= CRCW..e3 | Res= 976.0 Ohm<br>Power= 63.0 mW<br>Tolerance= 1.0%   | 1   | \$0.01 |  0402 3 mm²    |
| R5     | Vishay-Dale  | CRCW04022K37FKED<br>Series= CRCW..e3 | Res= 2.37 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0%   | 1   | \$0.01 |  0402 3 mm²    |
| R6     | Vishay-Dale  | CRCW04022K37FKED<br>Series= CRCW..e3 | Res= 2.37 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0%   | 1   | \$0.01 |  0402 3 mm²    |
| R7     | Yageo        | RC0201FR-0712K1L<br>Series= ?        | Res= 12.1 kOhm<br>Power= 50.0 mW<br>Tolerance= 1.0%   | 1   | \$0.01 |  0201 2 mm²    |
| R8     | Vishay-Dale  | CRCW04023R01FKED<br>Series= CRCW..e3 | Res= 3.01 Ohm<br>Power= 63.0 mW<br>Tolerance= 1.0%    | 1   | \$0.01 |  0402 3 mm²   |
| R9     | Yageo        | RC0201FR-0710KL<br>Series= ?         | Res= 10.0 kOhm<br>Power= 50.0 mW<br>Tolerance= 1.0%   | 1   | \$0.01 |  0201 2 mm²  |
| Ra     | Vishay-Dale  | CRCW04028K25FKED<br>Series= CRCW..e3 | Res= 8.25 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0%   | 1   | \$0.01 |  0402 3 mm²  |
| Rab    | Vishay-Dale  | CRCW040214K3FKED<br>Series= CRCW..e3 | Res= 14.3 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0%   | 1   | \$0.01 |  0402 3 mm²  |
| Raef   | Vishay-Dale  | CRCW04028K25FKED<br>Series= CRCW..e3 | Res= 8.25 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0%   | 1   | \$0.01 |  0402 3 mm²  |
| Raefhi | Vishay-Dale  | CRCW04028K25FKED<br>Series= CRCW..e3 | Res= 8.25 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0%   | 1   | \$0.01 |  0402 3 mm²  |
| Rahi   | Vishay-Dale  | CRCW04022K00FKED<br>Series= CRCW..e3 | Res= 2.0 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0%    | 1   | \$0.01 |  0402 3 mm²  |
| Rcd    | Vishay-Dale  | CRCW040214K3FKED<br>Series= CRCW..e3 | Res= 14.3 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0%   | 1   | \$0.01 |  0402 3 mm²  |
| Rcs    | Vishay-Dale  | CRCW12069R76FKEA<br>Series= CRCW..e3 | Res= 9.76 Ohm<br>Power= 250.0 mW<br>Tolerance= 1.0%   | 1   | \$0.01 |  1206 11 mm² |
| Rdcm   | 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 mm²  |
| Rdcmhi | Vishay-Dale  | CRCW040213K3FKED<br>Series= CRCW..e3 | Res= 13.3 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0%   | 1   | \$0.01 |  0402 3 mm²  |
| Ref    | Vishay-Dale  | CRCW040214K3FKED<br>Series= CRCW..e3 | Res= 14.3 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0%   | 1   | \$0.01 |  0402 3 mm²  |

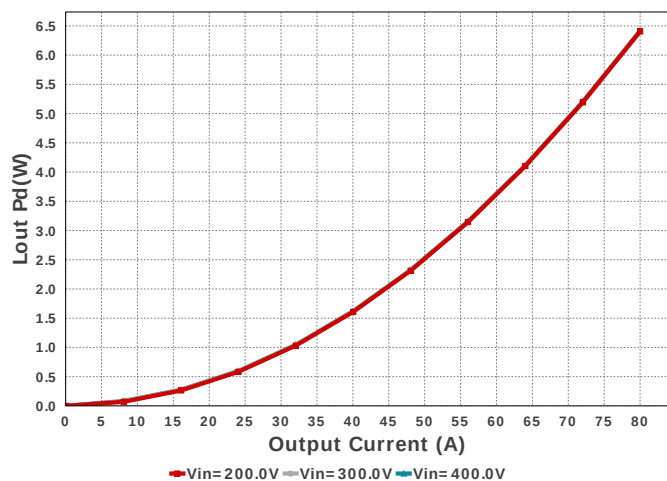
| Name  | Manufacturer      | Part Number                          | Properties                                                                                                                         | Qty | Price  | Footprint                                                                                             |
|-------|-------------------|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|-----|--------|-------------------------------------------------------------------------------------------------------|
| Rlf1  | 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 mm²        |
| Rlf2  | Vishay-Dale       | CRCW040222R6FKED<br>Series= CRCW..e3 | Res= 22.6 Ohm<br>Power= 63.0 mW<br>Tolerance= 1.0%                                                                                 | 1   | \$0.01 |  0402 3 mm²        |
| Ro1   | Vishay-Dale       | CRCW040220K5FKED<br>Series= CRCW..e3 | Res= 20.5 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0%                                                                                | 1   | \$0.01 |  0402 3 mm²        |
| Ro2   | Vishay-Dale       | CRCW04022K37FKED<br>Series= CRCW..e3 | Res= 2.37 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0%                                                                                | 1   | \$0.01 |  0402 3 mm²        |
| Rsum  | Yageo             | RC0201FR-07133KL<br>Series= ?        | Res= 133.0 kOhm<br>Power= 50.0 mW<br>Tolerance= 1.0%                                                                               | 1   | \$0.01 |  0201 2 mm²        |
| Rt    | Vishay-Dale       | CRCW040259K0FKED<br>Series= CRCW..e3 | Res= 59.0 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0%                                                                                | 1   | \$0.01 |  0402 3 mm²        |
| Rtmin | Yageo             | RC0201FR-0718K7L<br>Series= ?        | Res= 18.7 kOhm<br>Power= 50.0 mW<br>Tolerance= 1.0%                                                                                | 1   | \$0.01 |  0201 2 mm²        |
| T1    | CUSTOM            | CUSTOM                               | Lp= 724.368 µH<br>Rp= 0.0 Ohm<br>Leakage_L= 1.087 µH<br>Ns1toNp= 184.615 m<br>Rs1= 6.0 mOhms<br>Ns2toNp= 0.185<br>Rs2= 100.0 mOhms | 1   | NA     | CUSTOM 0 mm²                                                                                          |
| T2    | CUSTOM            | CUSTOM                               | Lp= 1.3 mH<br>Rp= 84.654 mOhm<br>Leakage_L= 1.95 µH<br>Ns1toNp= 1.0<br>Rs1= 6.0 mOhms<br>Ns2toNp= 1.0<br>Rs2= 100.0 mOhms          | 1   | NA     | CUSTOM 0 mm²                                                                                          |
| T3    | CUSTOM            | CUSTOM                               | Lp= 1.3 mH<br>Rp= 84.654 mOhm<br>Leakage_L= 1.95 µH<br>Ns1toNp= 1.0<br>Rs1= 6.0 mOhms<br>Ns2toNp= 1.0<br>Rs2= 100.0 mOhms          | 1   | NA     | CUSTOM 0 mm²                                                                                          |
| U1    | Texas Instruments | UCC28950PWR                          | Switcher                                                                                                                           | 1   | \$2.20 |  0 mm²           |
| U2    | Texas Instruments | UCC27324P                            | Switcher                                                                                                                           | 0   | \$0.45 |  D0008A_N 57 mm² |
| U3    | Texas Instruments | UCC27324P                            | Switcher                                                                                                                           | 0   | \$0.45 |  D0008A_N 57 mm² |

| Name | Manufacturer      | Part Number | Properties | Qty | Price  | Footprint |
|------|-------------------|-------------|------------|-----|--------|-----------|
| U4   | Texas Instruments | UCC27324P   | Switcher   | 0   | \$0.45 |           |

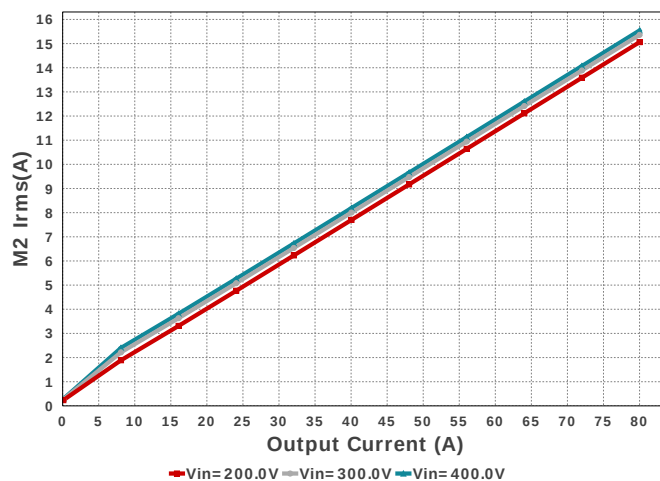
D0008A\_N 57 mm<sup>2</sup>



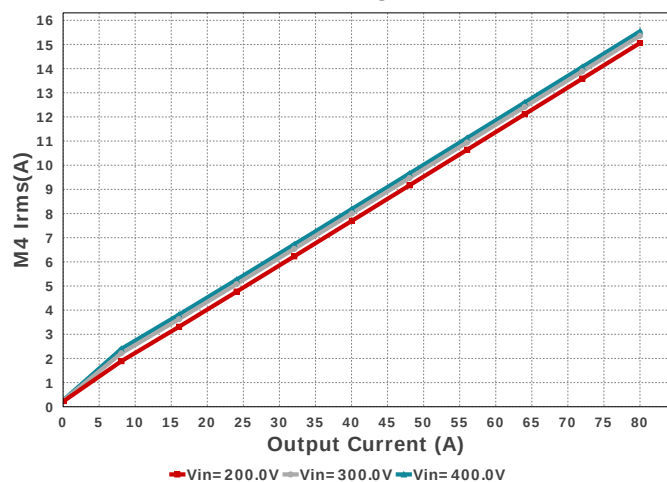
Lout Pd



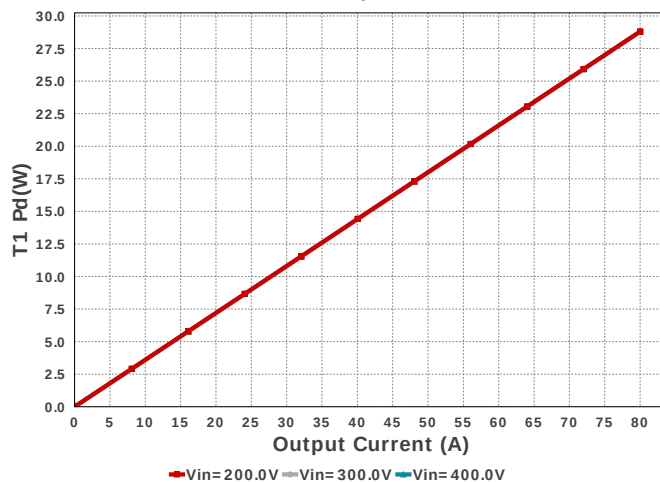
M2 Irms



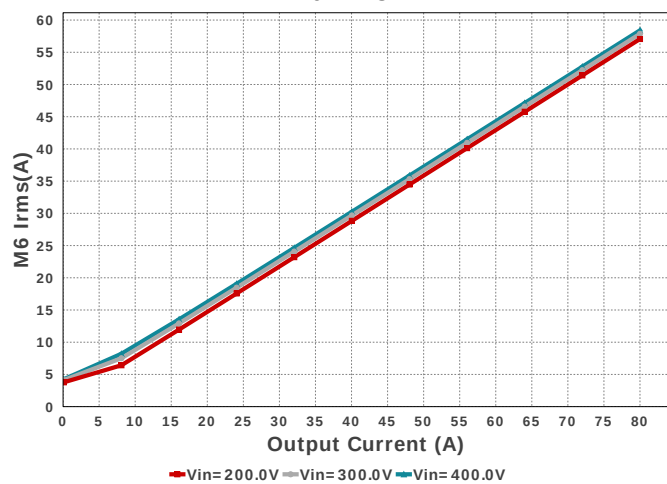
M4 Irms



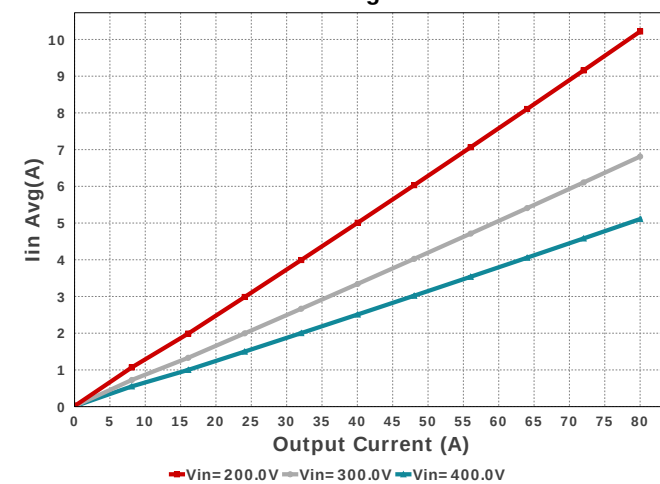
T1 Pd

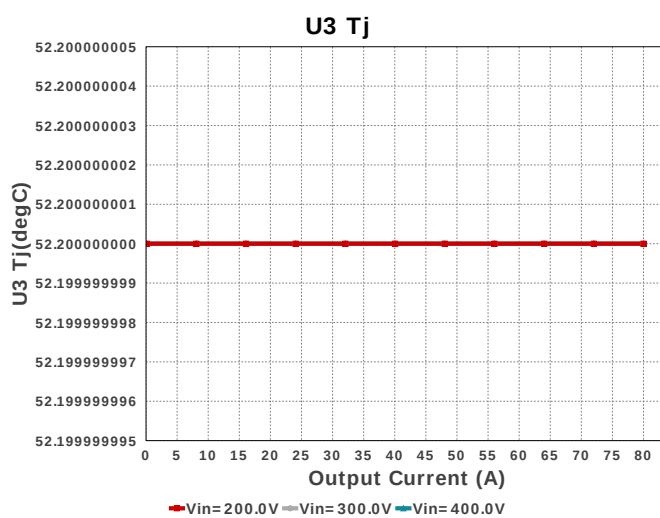
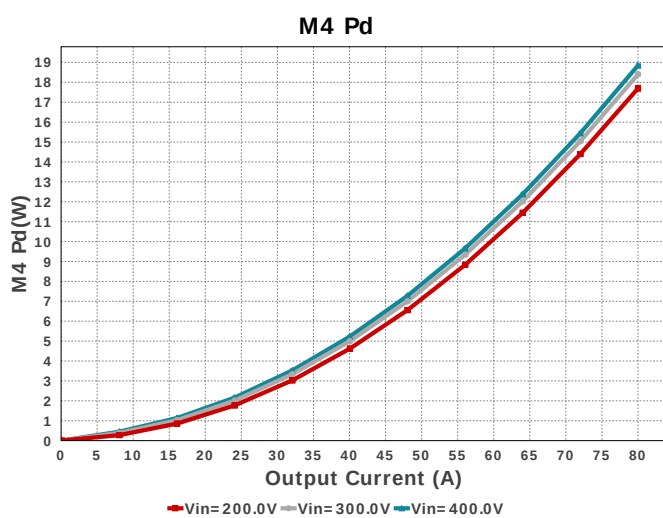
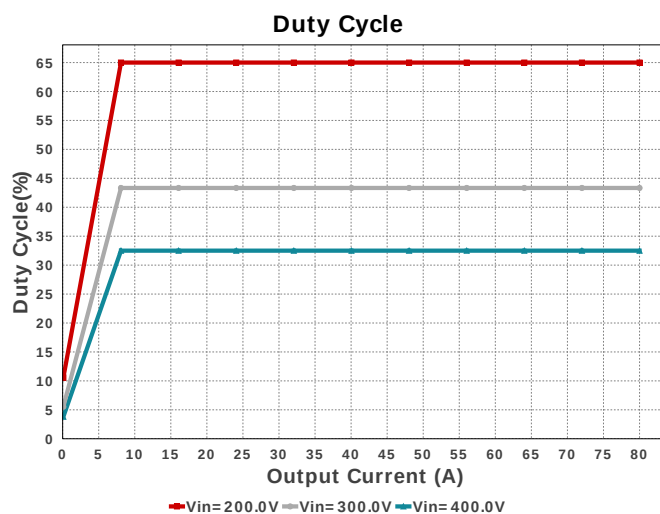
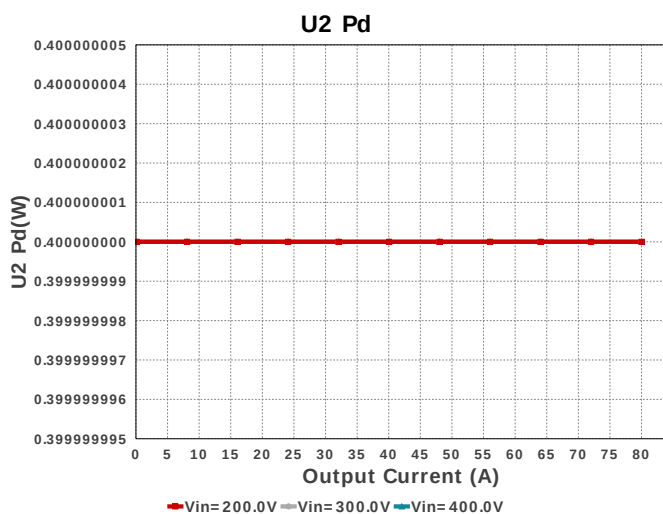
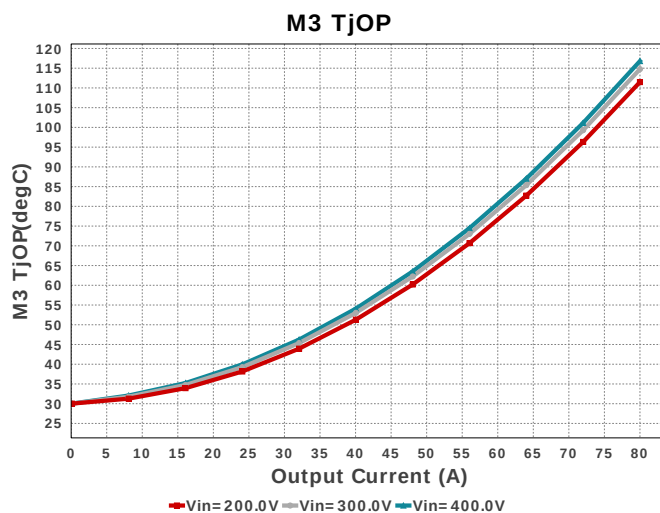
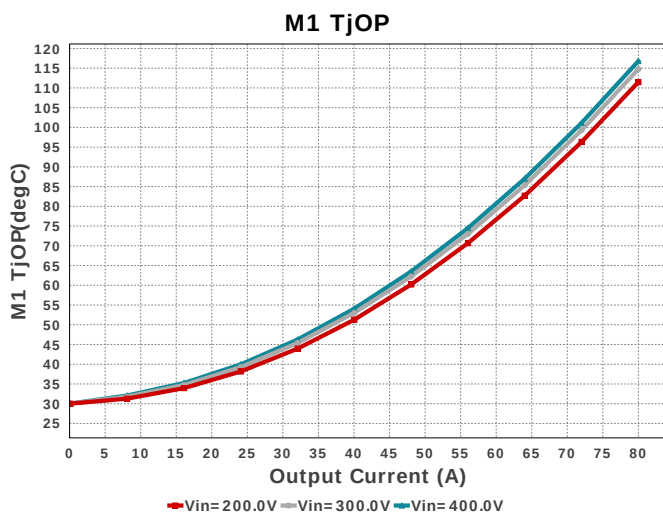


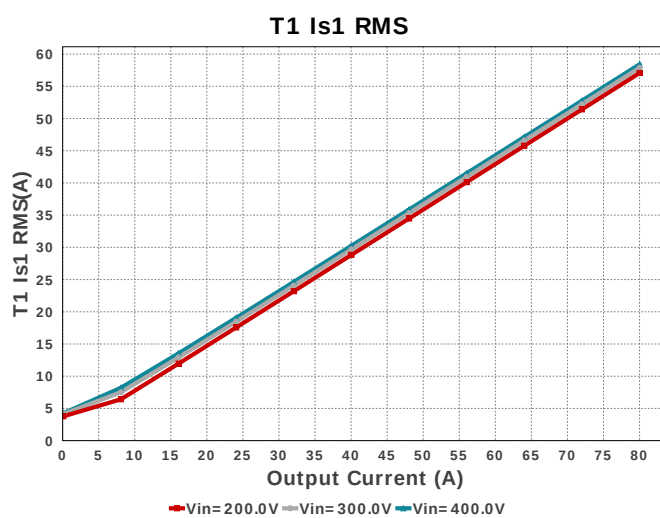
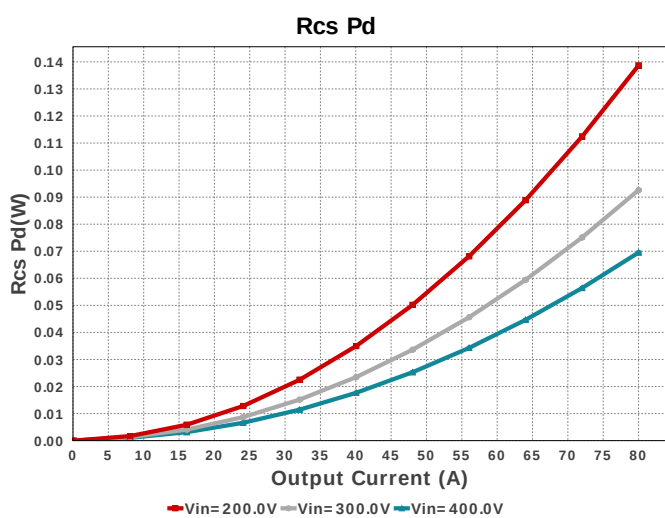
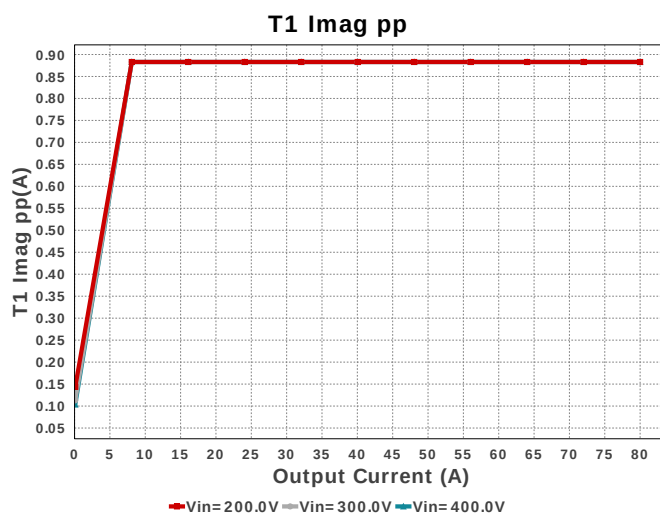
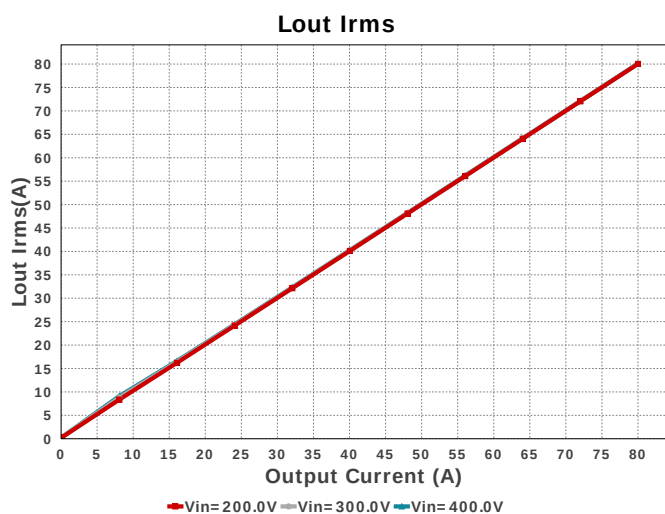
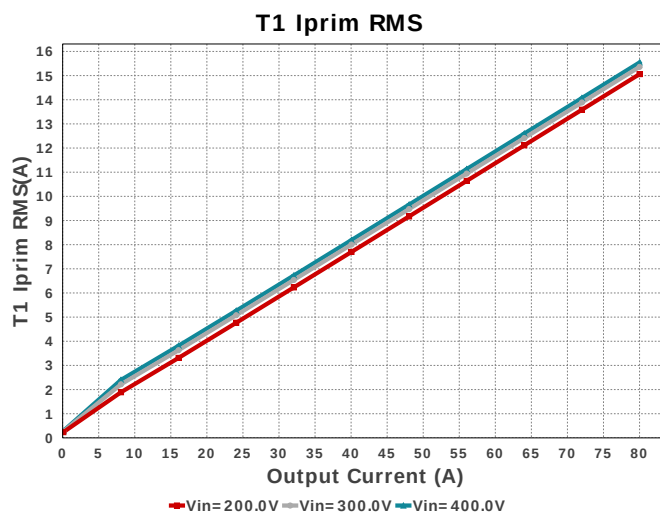
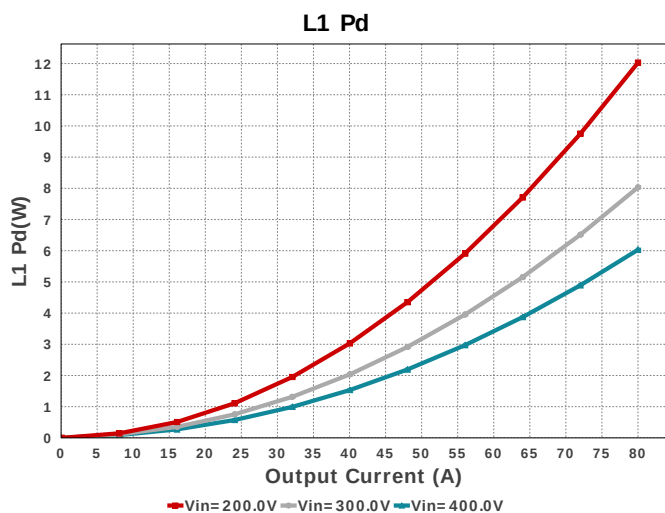
M6 Irms

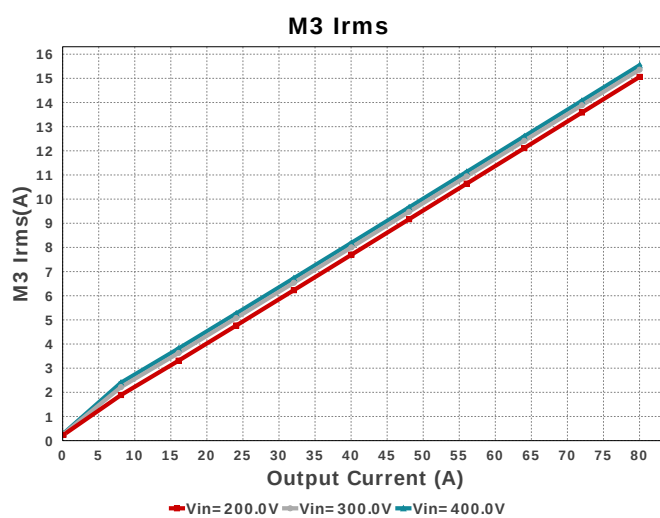
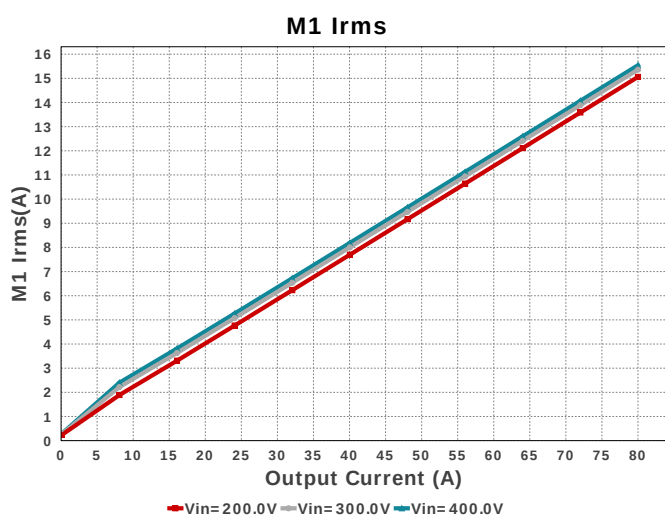
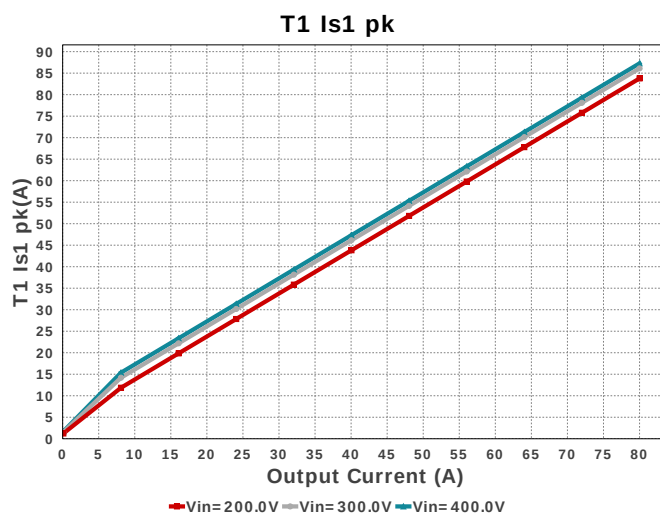
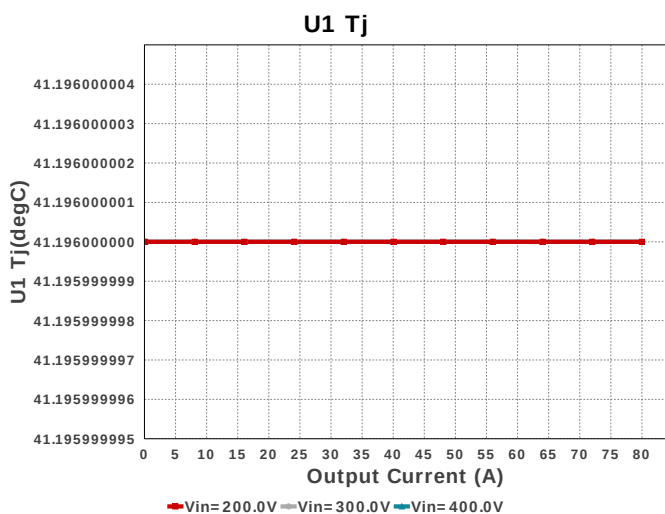
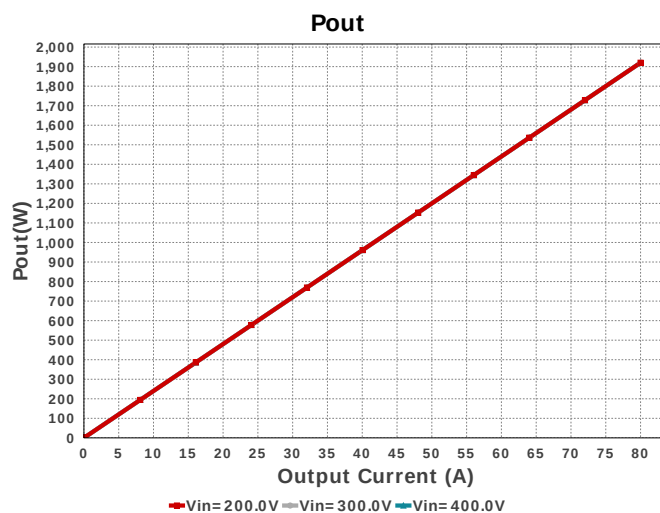
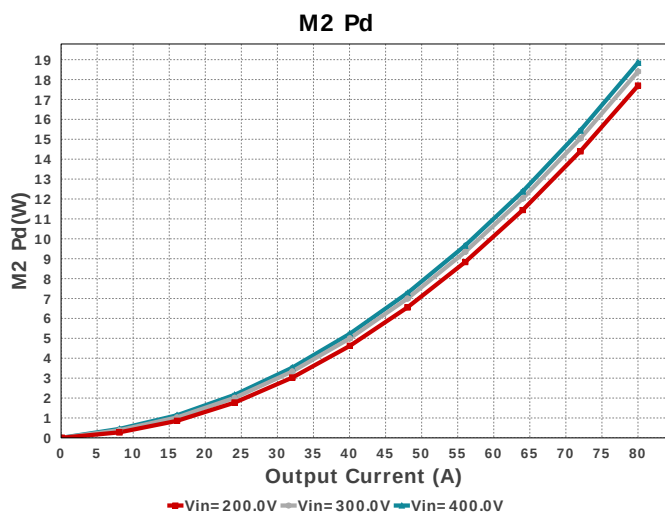


Iin Avg

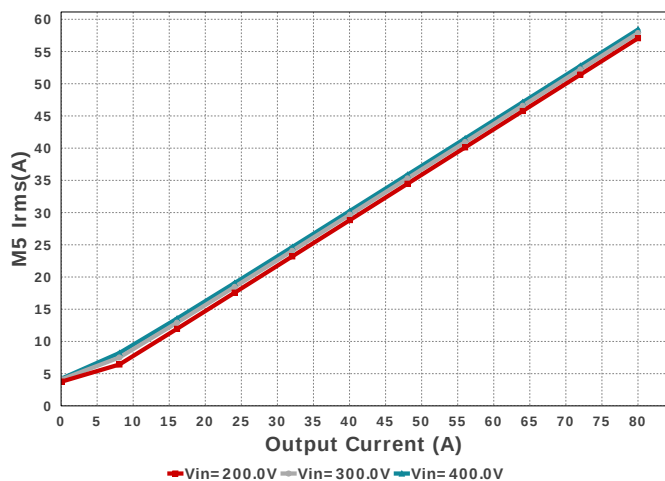




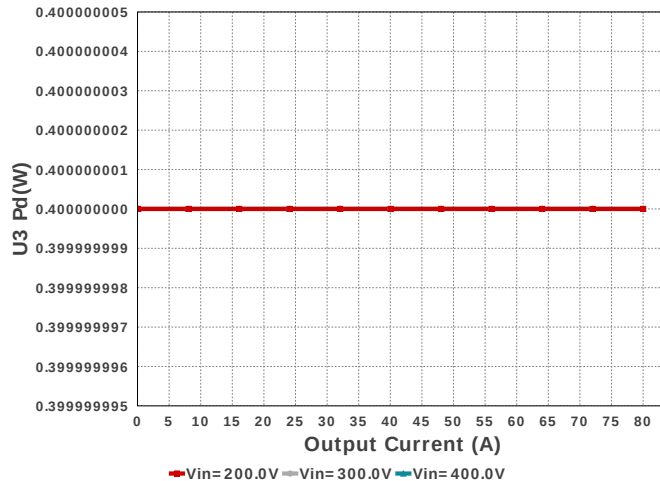




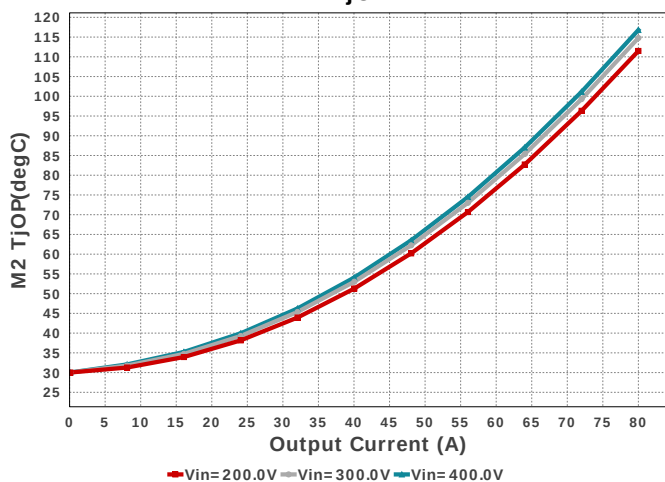
M5 Irms



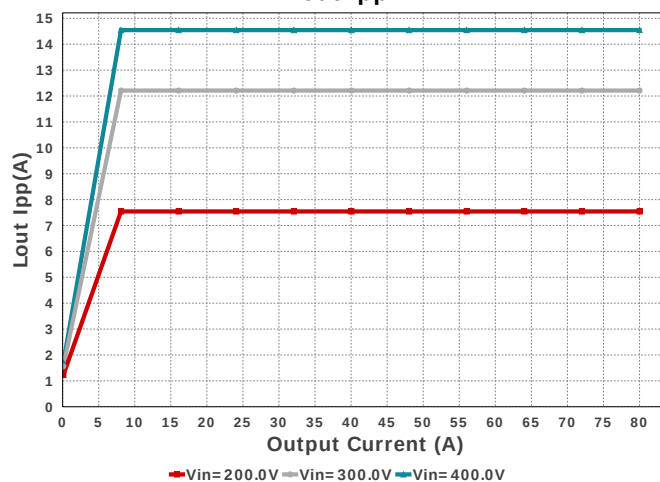
U3 Pd



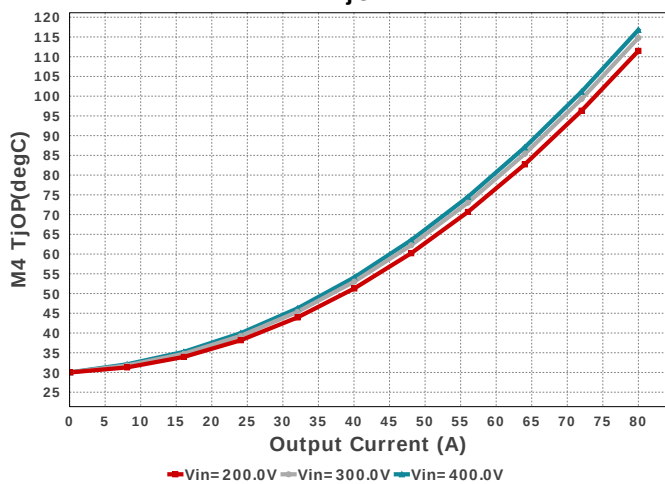
M2 TjOP



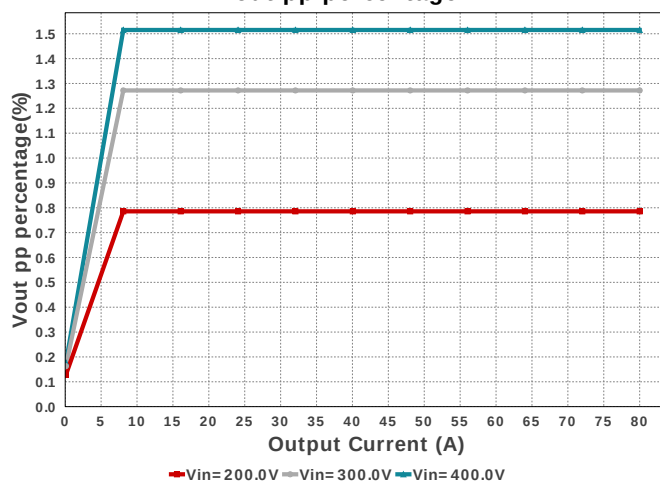
Lout Ipp

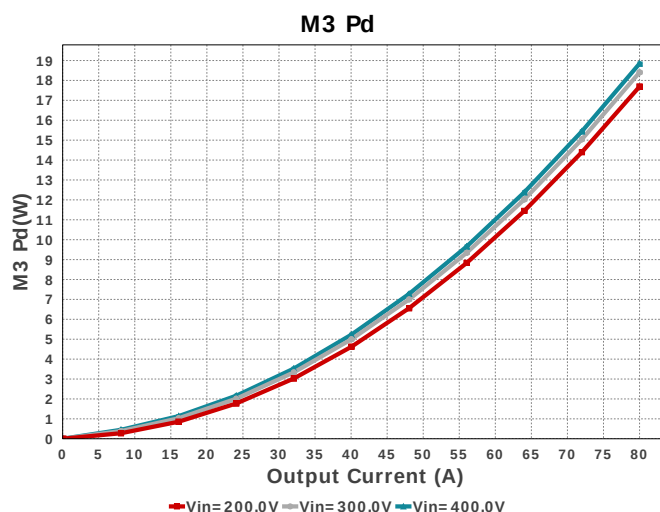
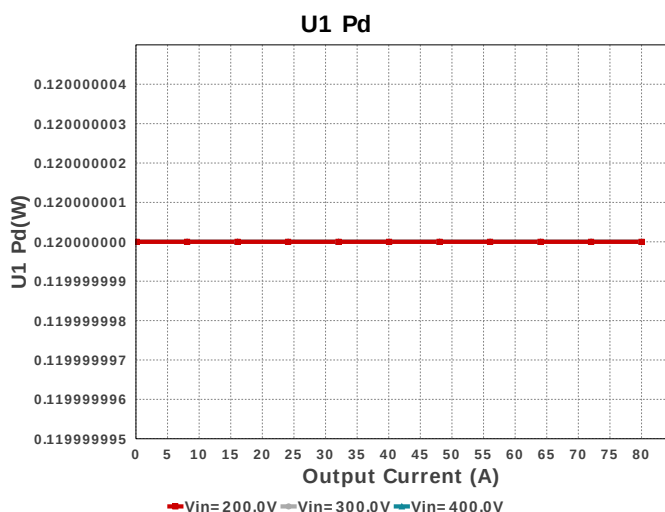
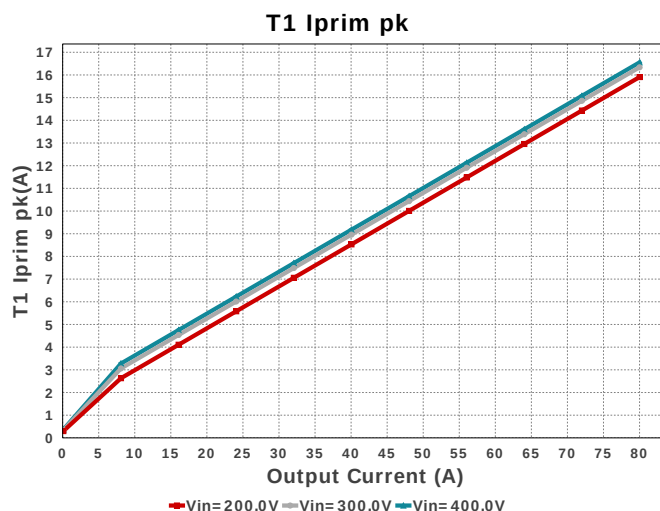
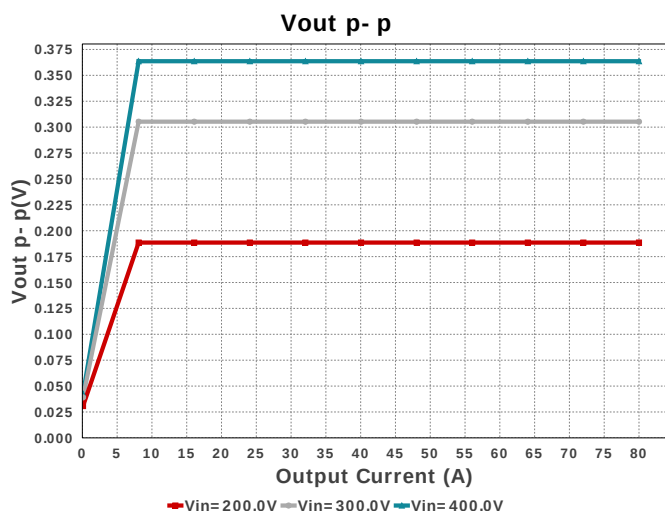


M4 TjOP



Vout pp percentage





## Operating Values

| #   | Name        | Value       | Category  | Description                                  |
|-----|-------------|-------------|-----------|----------------------------------------------|
| 1.  | Cin Pd      | 944.11 mW   | Capacitor | Input capacitor power dissipation            |
| 2.  | Cout Pd     | 474.03 mW   | Capacitor | Output capacitor power dissipation           |
| 3.  | Lout Irms   | 80.03 A     | Current   | Lout ripple current                          |
| 4.  | Iin Avg     | 10.218 A    | IC        | Average input current                        |
| 5.  | U1 RThetaJA | 93.3 degC/W | IC        | U1 IC junction-to-ambient thermal resistance |
| 6.  | L1 Pd       | 12.026 W    | Inductor  | Power Dissipation in the Inductor            |
| 7.  | Lout Ipp    | 7.542 A     | Inductor  | Peak-to-peak output inductor ripple current  |
| 8.  | Lshim Pd    | 2.54 W      | Inductor  | Power Dissipation in Shim Inductor           |
| 9.  | M1 Irms     | 15.06 A     | Mosfet    | M1 MOSFET Irms                               |
| 10. | M1 Pd       | 17.691 W    | Mosfet    | M1 MOSFET total power dissipation            |
| 11. | M1 TjOP     | 111.48 degC | Mosfet    | M1 MOSFET junction temperature               |
| 12. | M2 Irms     | 15.06 A     | Mosfet    | M2 MOSFET Irms                               |
| 13. | M2 Pd       | 17.691 W    | Mosfet    | M2 MOSFET total power dissipation            |
| 14. | M2 TjOP     | 111.48 degC | Mosfet    | M2 MOSFET junction temperature               |
| 15. | M3 Irms     | 15.06 A     | Mosfet    | M3 MOSFET Irms                               |
| 16. | M3 Pd       | 17.691 W    | Mosfet    | M3 MOSFET total power dissipation            |
| 17. | M3 TjOp     | 111.48 degC | Mosfet    | M3 MOSFET junction temperature               |
| 18. | M4 Irms     | 15.06 A     | Mosfet    | M4 MOSFET Irms                               |
| 19. | M4 Pd       | 17.691 W    | Mosfet    | M4 MOSFET total power dissipation            |
| 20. | M4 TjOp     | 111.48 degC | Mosfet    | M4 MOSFET junction temperature               |
| 21. | M5 Irms     | 57.061 A    | Mosfet    | M5 MOSFET Irms                               |
| 22. | M6 Irms     | 57.061 A    | Mosfet    | M6 MOSFET Irms                               |
| 23. | Cin Pd      | 944.11 mW   | Power     | Input capacitor power dissipation            |
| 24. | Cout Pd     | 474.03 mW   | Power     | Output capacitor power dissipation           |
| 25. | L1 Pd       | 12.026 W    | Power     | Power Dissipation in the Inductor            |
| 26. | Lout Pd     | 6.405 W     | Power     | Lout power dissipation                       |
| 27. | Lshim Pd    | 2.54 W      | Power     | Power Dissipation in Shim Inductor           |
| 28. | M1 Pd       | 17.691 W    | Power     | M1 MOSFET total power dissipation            |
| 29. | M2 Pd       | 17.691 W    | Power     | M2 MOSFET total power dissipation            |
| 30. | M3 Pd       | 17.691 W    | Power     | M3 MOSFET total power dissipation            |
| 31. | M4 Pd       | 17.691 W    | Power     | M4 MOSFET total power dissipation            |
| 32. | Rcs Pd      | 138.66 mW   | Power     | Power Dissipation in Current Sense Resistors |



| #   | Name               | Value                    | Category    | Description                                  |
|-----|--------------------|--------------------------|-------------|----------------------------------------------|
| 33. | T1 Pd              | 28.8 W                   | Power       | Estimated Losses in Transformer              |
| 34. | U1 Pd              | 120.0 mW                 | Power       | U1 Power Dissipation                         |
| 35. | U2 Pd              | 400.0 mW                 | Power       | U2 Power Dissipation                         |
| 36. | U3 Pd              | 400.0 mW                 | Power       | U3 Power Dissipation                         |
| 37. | Rcs Pd             | 138.66 mW                | Resistor    | Power Dissipation in Current Sense Resistors |
| 38. | BOM Count          | 96                       | System      | Total Design BOM count                       |
| 39. | Duty Cycle         | 65.0 %                   | Information | Duty cycle                                   |
| 40. | FootPrint          | 12.187 k mm <sup>2</sup> | System      | Total Foot Print Area of BOM components      |
| 41. | Frequency          | 101.626 kHz              | Information | Switching frequency                          |
| 42. | Iout               | 80.0 A                   | System      | Iout operating point                         |
| 43. | Mode               | FET Conduction Mode      | Information | Conduction Mode                              |
| 44. | Pout               | 1.92 kW                  | System      | Total output power                           |
| 45. | Total BOM          | NA                       | Information | Total BOM Cost                               |
| 46. | U1 Tj              | 41.196 degC              | System      | U1 junction temperature                      |
| 47. | U2 Tj              | 52.2 degC                | Information | U2 junction temperature                      |
| 48. | U3 Tj              | 52.2 degC                | System      | U3 junction temperature                      |
| 49. | Vin                | 200.0 V                  | Information | Vin operating point                          |
| 50. | Vout               | 24.0 V                   | System      | Operational Output Voltage                   |
| 51. | Vout p-p           | 188.552 mV               | Information | Peak-to-peak output ripple voltage           |
| 52. | Vout pp percentage | 785.634 m%               | System      | Output Voltage ripple percentage             |
| 53. | T1 Imag pp         | 882.976 mA               | Information | Transformer peak to peak magnetising current |
| 54. | T1 Iprim RMS       | 15.06 A                  | Transformer | Transformer Primary RMS Current              |
| 55. | T1 Iprim pk        | 15.907 A                 | Transformer | Transformer Primary Peak Current             |
| 56. | T1 Is1 RMS         | 57.061 A                 | Transformer | Transformer Secondary1 RMS Current           |
| 57. | T1 Is1 pk          | 83.771 A                 | Transformer | Transformer Secondary1 Peak Current          |
| 58. | T1 Pd              | 28.8 W                   | Transformer | Estimated Losses in Transformer              |

## Design Inputs

| Name    | Value    | Description            |
|---------|----------|------------------------|
| Iout    | 80.0     | Maximum Output Current |
| VinMax  | 400.0    | Maximum input voltage  |
| VinMin  | 200.0    | Minimum input voltage  |
| Vout    | 24.0     | Output Voltage         |
| base_pn | UCC28950 | Base Product Number    |
| source  | DC       | Input Source Type      |
| Ta      | 30.0     | Ambient temperature    |

## WEBENCH® Assembly

### Component Testing

Some published data on components in datasheets such as Capacitor ESR and Inductor DC resistance is based on conservative values that will guarantee that the components always exceed the specification. For design purposes it is usually better to work with typical values. Since this data is not always available it is a good practice to measure the Capacitance and ESR values of  $C_{in}$  and  $C_{out}$ , and the inductance and DC resistance of  $L1$  before assembly of the board. Any large discrepancies in values should be electrically simulated in WEBENCH to check for instabilities and thermally simulated in WebTHERM to make sure critical temperatures are not exceeded.

### Soldering Component to Board

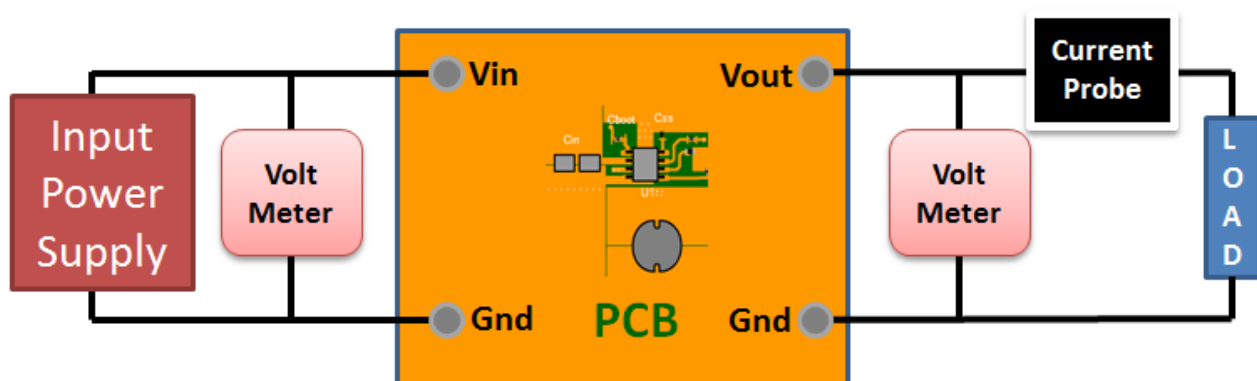
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. To solder the tab down to the board place the iron down on the board while resting against the tab, heating both surfaces simultaneously. Apply light pressure to the top of the plastic case until the solder flows around the part and the part is flush with the PCB. If the solder is not flowing around the board you may need a higher wattage iron (generally 25W to 30W is enough).

### Initial Startup of Circuit

It is best to initially power up the board by setting the input supply voltage to the lowest operating input voltage 200.0V and set the input supply's current limit to zero. With the input supply off connect up the input supply to  $V_{in}$  and GND. Connect a digital volt meter and a load if needed to set the minimum load of the design from  $V_{out}$  and GND. Turn on the input supply and slowly turn up the current limit on the input supply. If the voltage starts to rise on the input supply continue increasing the input supply current limit while watching the output voltage. If the current increases on the input supply, but the voltage remains near zero, then there may be a short or a component misplaced on the board. Power down the board and visually inspect for solder bridges and recheck the diode and capacitor polarities. Once the power supply circuit is operational then more extensive testing may include full load testing, transient load and line tests to compare with simulation results.

### Load Testing

The setup is the same as the initial startup, except that an additional digital voltmeter is connected between  $V_{in}$  and GND, a load is connected between  $V_{out}$  and GND and a current meter is connected in series between  $V_{out}$  and the load. The load must be able to handle at least rated output power + 50% ( 7.5 watts for this design). Ideally the load is supplied in the form of a variable load test unit. It can also be done in the form of suitably large power resistors. When using an oscilloscope to measure waveforms on the prototype board, the ground leads of the oscilloscope probes should be as short as possible and the area of the loop formed by the ground lead should be kept to a minimum. This will help reduce ground lead inductance and eliminate EMI noise that is not actually present in the circuit.



### Design Assistance

1. Master key : E3FFE8A061E935C1[v1]
2. **UCC28950** Product Folder : <http://www.ti.com/product/UCC28950> : contains the data sheet and other resources.



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