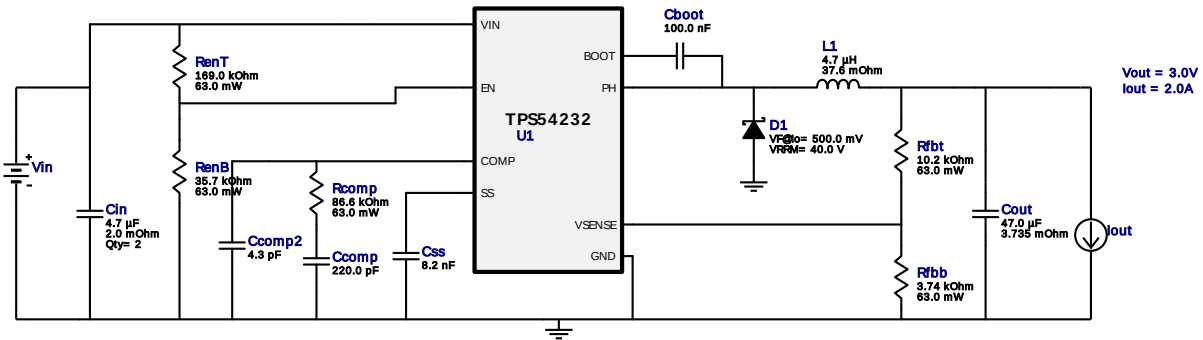


## WEBENCH® Design Report

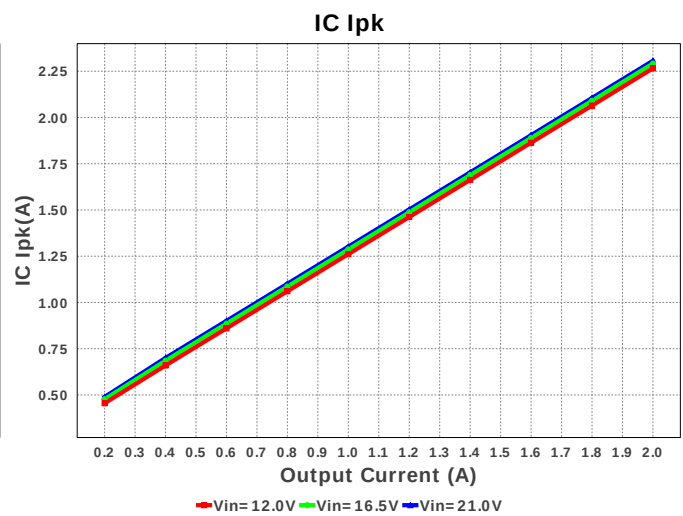
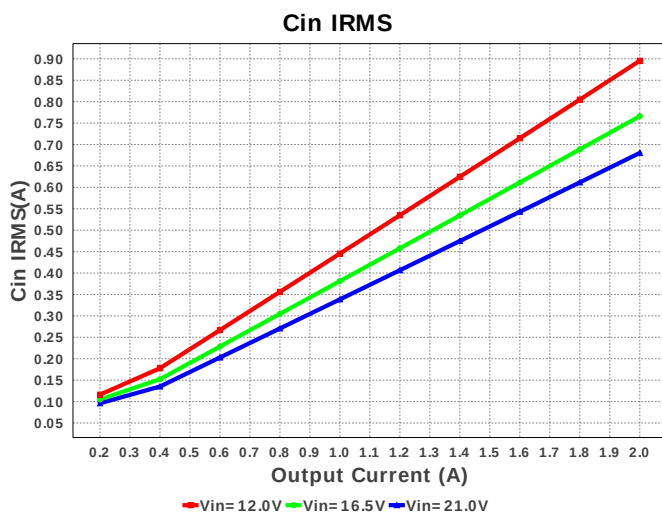
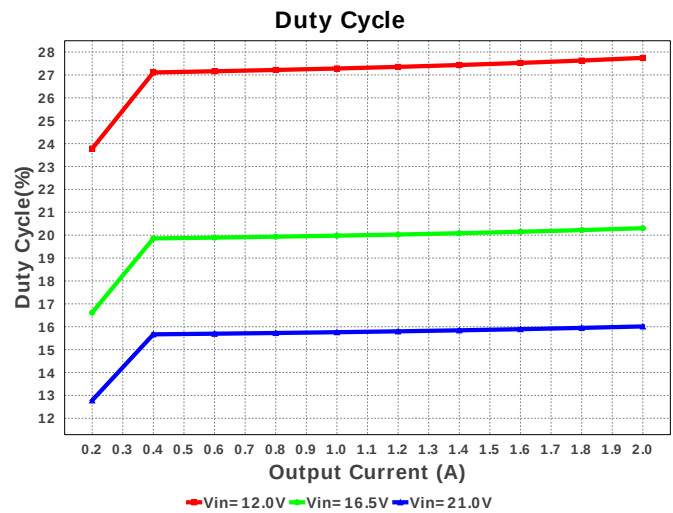
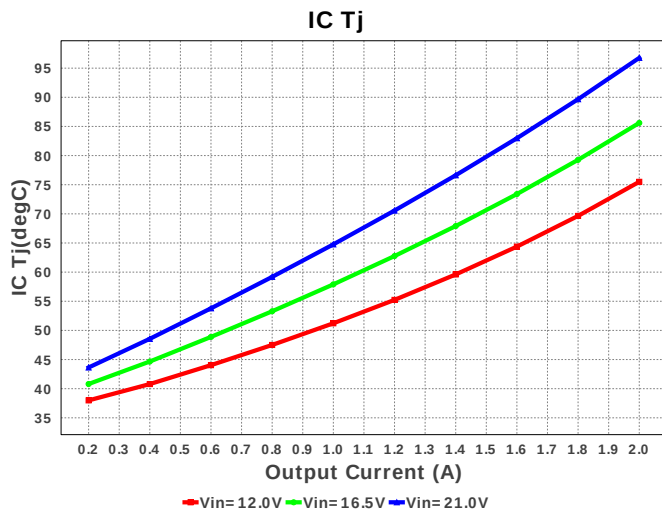
Design : 4648186/18 TPS54232DR  
TPS54232DR 12.0V-21.0V to 3.00V @ 2.0A

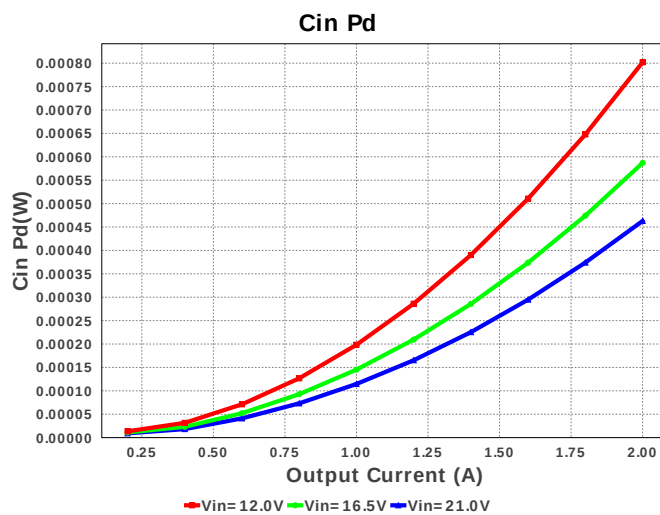
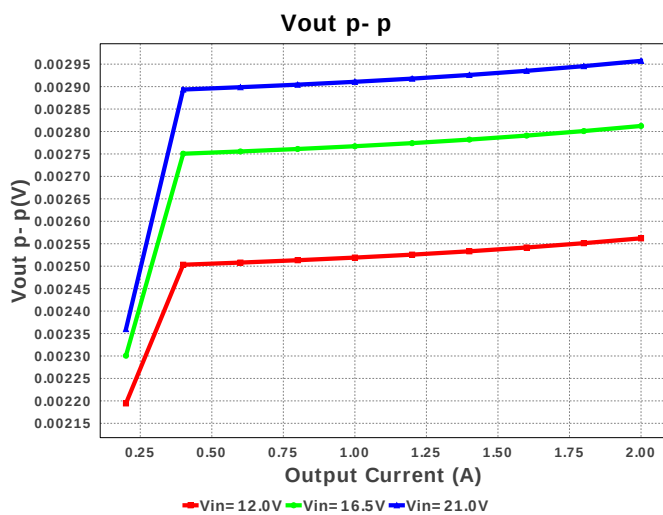
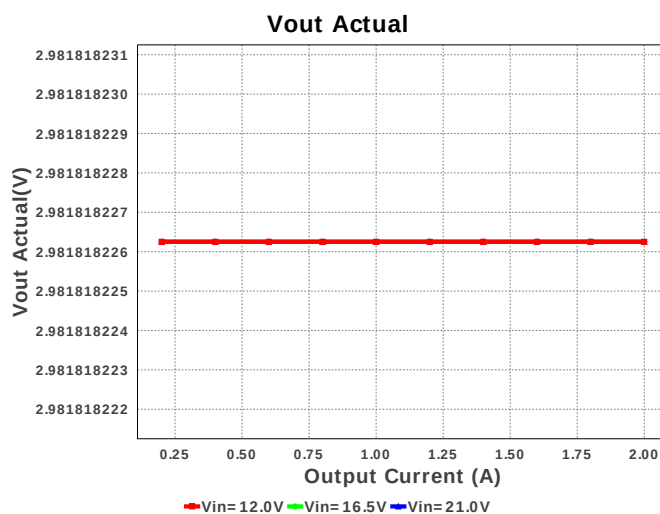
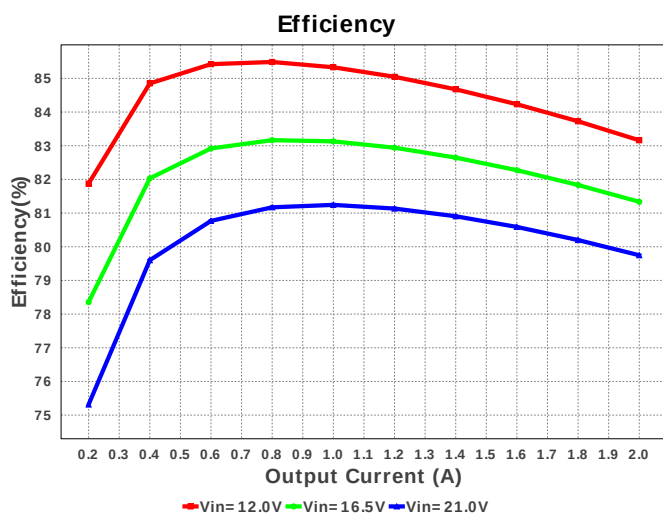
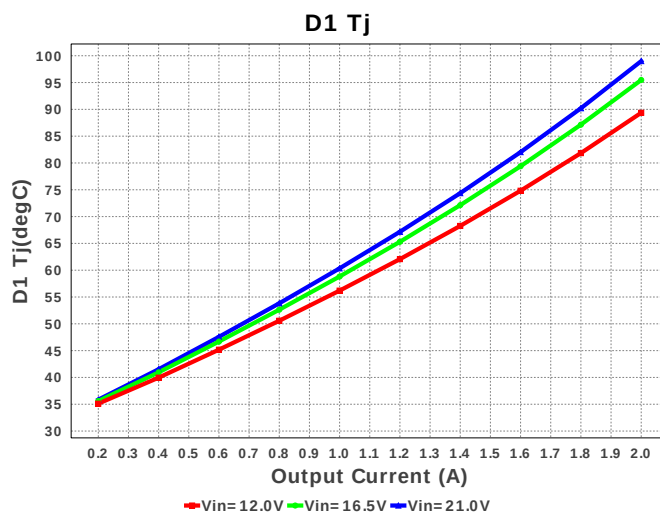
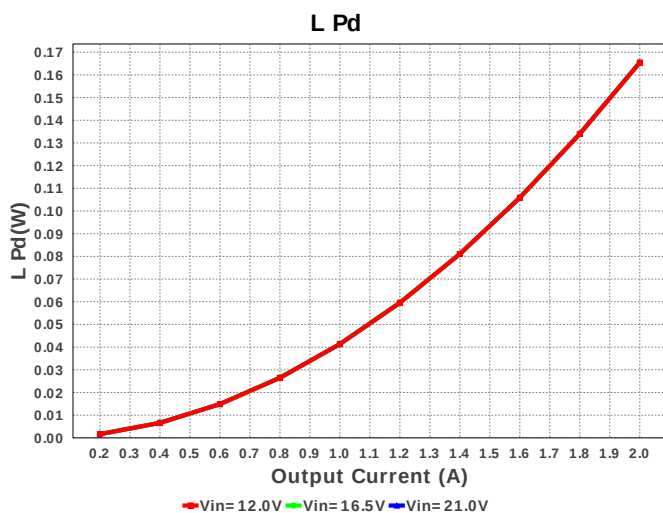


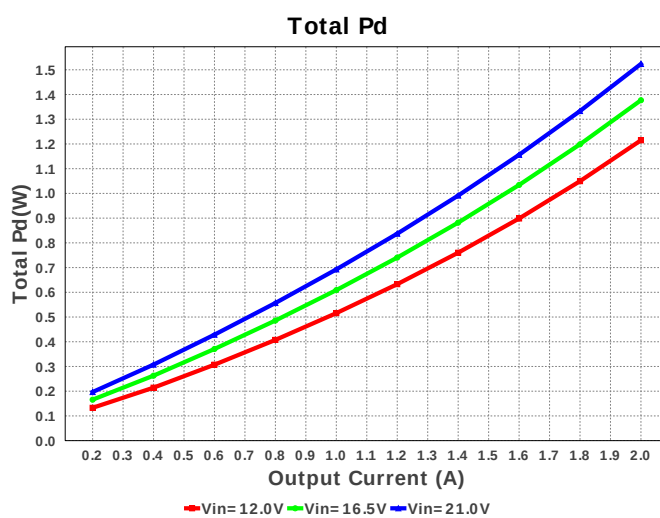
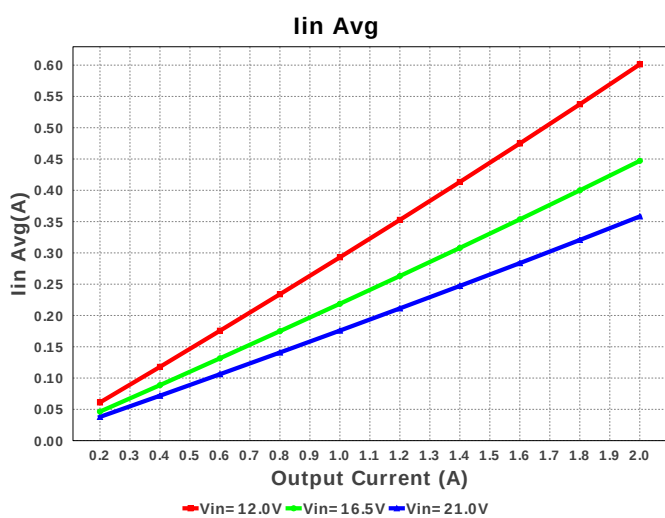
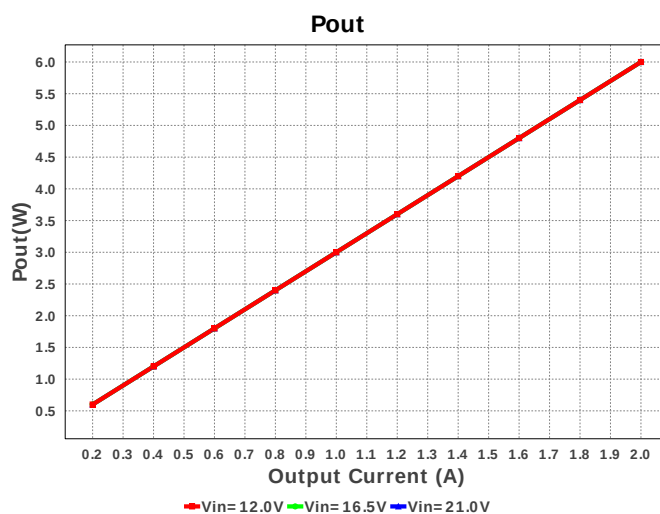
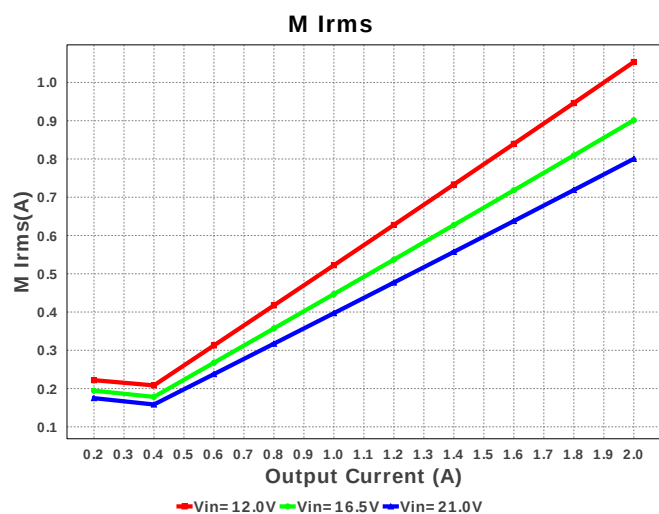
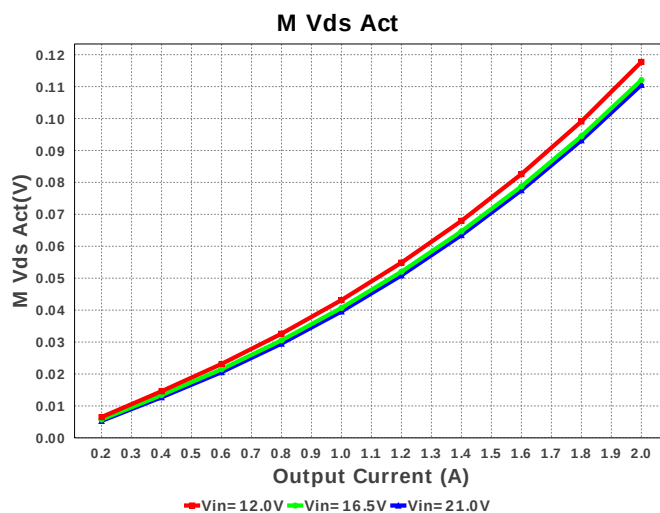
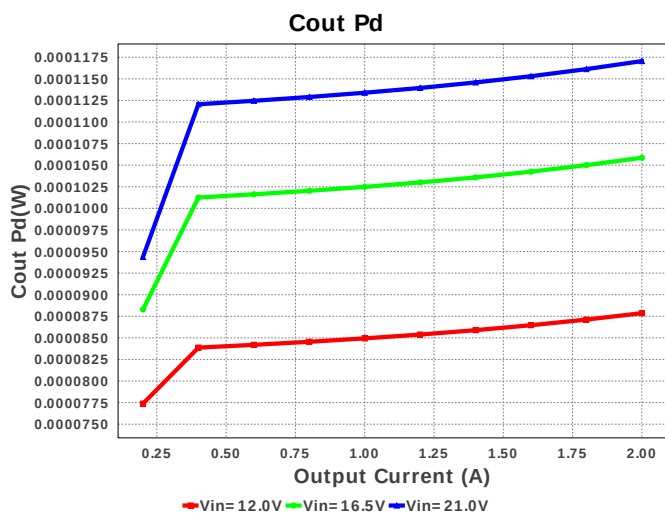
### Electrical BOM

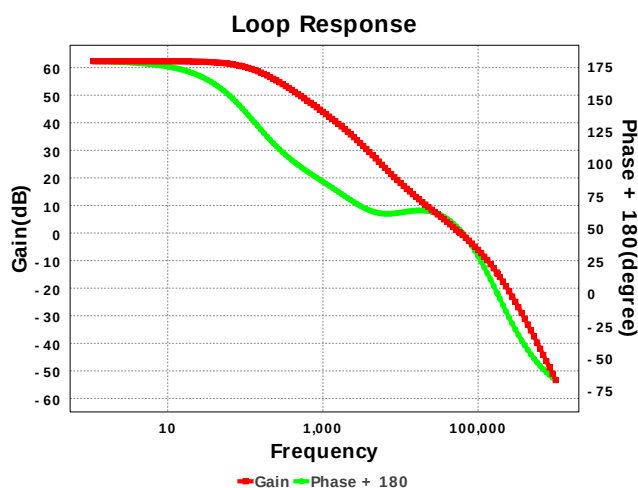
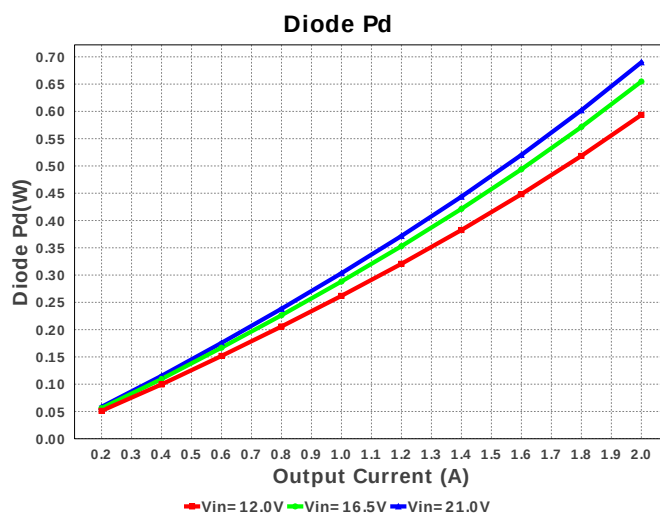
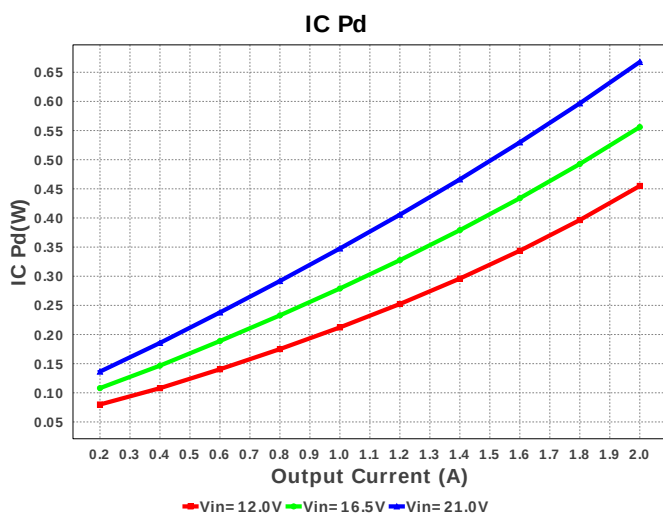
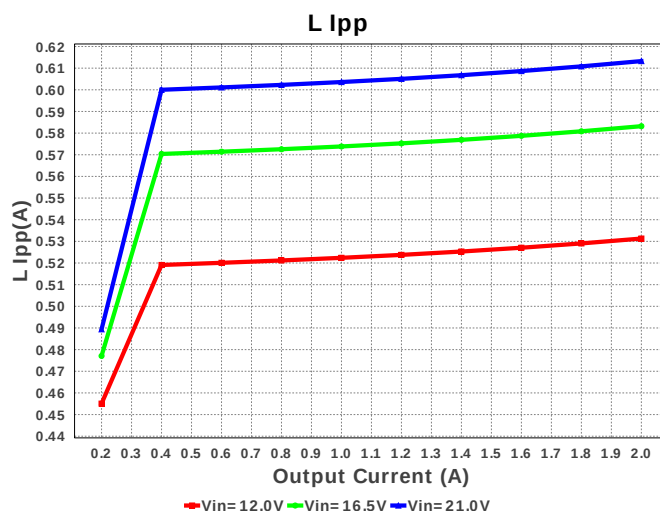
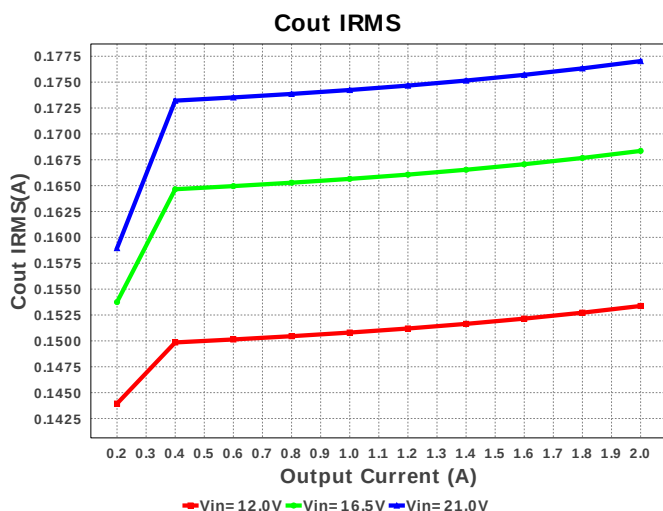
| #   | Name   | Manufacturer  | Part Number                           | Properties                                                      | Qty | Price  | Footprint                                                                                                         |
|-----|--------|---------------|---------------------------------------|-----------------------------------------------------------------|-----|--------|-------------------------------------------------------------------------------------------------------------------|
| 1.  | Cboot  | MuRata        | GRM155R61A104KA01D<br>Series= X5R     | Cap= 100.0 nF<br>VDC= 10.0 V<br>IRMS= 0.0 A                     | 1   | \$0.01 |  0402 3 mm <sup>2</sup>        |
| 2.  | Ccomp  | Yageo America | CC0805JRNPO9BN221<br>Series= C0G/NP0  | Cap= 220.0 pF<br>VDC= 50.0 V<br>IRMS= 0.0 A                     | 1   | \$0.01 |  0805 7 mm <sup>2</sup>      |
| 3.  | Ccomp2 | MuRata        | GRM1555C1H4R3CA01D<br>Series= C0G/NP0 | Cap= 4.3 pF<br>VDC= 50.0 V<br>IRMS= 0.0 A                       | 1   | \$0.01 |  0402 3 mm <sup>2</sup>      |
| 4.  | Cin    | MuRata        | GRM32ER71H475KA88L<br>Series= X7R     | Cap= 4.7 uF<br>ESR= 2.0 mOhm<br>VDC= 50.0 V<br>IRMS= 5.35 A     | 2   | \$0.19 |  1210 15 mm <sup>2</sup>     |
| 5.  | Cout   | MuRata        | GRM31CC80J476KE18L<br>Series= X6S     | Cap= 47.0 uF<br>ESR= 3.735 mOhm<br>VDC= 6.3 V<br>IRMS= 4.0522 A | 1   | \$0.10 |  1206_190 11 mm <sup>2</sup> |
| 6.  | Css    | MuRata        | GRM033R61A822KA01D<br>Series= X5R     | Cap= 8.2 nF<br>VDC= 10.0 V<br>IRMS= 0.0 A                       | 1   | \$0.01 |  0201 2 mm <sup>2</sup>      |
| 7.  | D1     | Diodes Inc.   | B340A-13-F                            | VF@Io= 500.0 mV<br>VRRM= 40.0 V                                 | 1   | \$0.11 |  SMA 37 mm <sup>2</sup>      |
| 8.  | L1     | Bourns        | SRN6045-4R7Y                          | L= 4.7 uH<br>DCR= 37.6 mOhm                                     | 1   | \$0.16 |  SRN6045 64 mm <sup>2</sup>  |
| 9.  | Rcomp  | Vishay-Dale   | CRCW040286K6FKED<br>Series= CRCW..e3  | Res= 86.6 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0%             | 1   | \$0.01 |  0402 3 mm <sup>2</sup>      |
| 10. | RenB   | Vishay-Dale   | CRCW040235K7FKED<br>Series= CRCW..e3  | Res= 35.7 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0%             | 1   | \$0.01 |  0402 3 mm <sup>2</sup>      |
| 11. | RenT   | Vishay-Dale   | CRCW0402169KFKED<br>Series= CRCW..e3  | Res= 169.0 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              |
|-----|------|-------------------|--------------------------------------|-----------------------------------------------------|-----|--------|------------------------|
| 12. | Rfbb | Vishay-Dale       | CRCW04023K74FKED<br>Series= CRCW..e3 | Res= 3.74 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1   | \$0.01 | 0402 3 mm <sup>2</sup> |
| 13. | Rfbt | Vishay-Dale       | CRCW040210K2FKED<br>Series= CRCW..e3 | Res= 10.2 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1   | \$0.01 | 0402 3 mm <sup>2</sup> |
| 14. | U1   | Texas Instruments | TPS54232DR                           | Switcher                                            | 1   | \$0.55 |                        |

D0008A 57 mm<sup>2</sup>







## Operating Values

| #   | Name      | Value                 | Category | Description                             |
|-----|-----------|-----------------------|----------|-----------------------------------------|
| 1.  | Cin IRMS  | 680.37 mA             | Current  | Input capacitor RMS ripple current      |
| 2.  | Cout IRMS | 177.032 mA            | Current  | Output capacitor RMS ripple current     |
| 3.  | IC Ipk    | 2.307 A               | Current  | Peak switch current in IC               |
| 4.  | Iin Avg   | 358.27 mA             | Current  | Average input current                   |
| 5.  | L Ipp     | 613.26 mA             | Current  | Peak-to-peak inductor ripple current    |
| 6.  | M1 Irms   | 800.322 mA            | Current  | Q lavg                                  |
| 7.  | BOM Count | 15                    | General  | Total Design BOM count                  |
| 8.  | FootPrint | 228.0 mm <sup>2</sup> | General  | Total Foot Print Area of BOM components |
| 9.  | Frequency | 1000.0 kHz            | General  | Switching frequency                     |
| 10. | M Vds Act | 110.55 mV             | General  | Voltage drop across the MosFET          |
| 11. | Pout      | 6.0 W                 | General  | Total output power                      |

| #   | Name           | Value           | Category | Description                                                                                |
|-----|----------------|-----------------|----------|--------------------------------------------------------------------------------------------|
| 12. | Total BOM      | \$1.39          | General  | Total BOM Cost                                                                             |
| 13. | D1 Tj          | 99.0 degC       | Op_Point | D1 junction temperature                                                                    |
| 14. | Low Freq Gain  | 62.327 dB       | Op_Point | Gain at 10Hz                                                                               |
| 15. | Vout Actual    | 2.982 V         | Op_Point | Vout Actual calculated based on selected voltage divider resistors                         |
| 16. | Vout OP        | 3.0 V           | Op_Point | Operational Output Voltage                                                                 |
| 17. | Cross Freq     | 59.264 kHz      | Op_point | Bode plot crossover frequency                                                              |
| 18. | Duty Cycle     | 16.013 %        | Op_point | Duty cycle                                                                                 |
| 19. | Efficiency     | 79.748 %        | Op_point | Steady state efficiency                                                                    |
| 20. | Gain Marg      | -14.754 dB      | Op_point | Bode Plot Gain Margin                                                                      |
| 21. | IC Tj          | 96.766 degC     | Op_point | IC junction temperature                                                                    |
| 22. | ICThetaJA      | 100.0 degC/W    | Op_point | IC junction-to-ambient thermal resistance                                                  |
| 23. | IOUT_OP        | 2.0 A           | Op_point | Iout operating point                                                                       |
| 24. | Phase Marg     | 48.741 deg      | Op_point | Bode Plot Phase Margin                                                                     |
| 25. | VIN_OP         | 21.0 V          | Op_point | Vin operating point                                                                        |
| 26. | Vout p-p       | 2.957 mV        | Op_point | Peak-to-peak output ripple voltage                                                         |
| 27. | Cin Pd         | 462.904 $\mu$ W | Power    | Input capacitor power dissipation                                                          |
| 28. | Cout Pd        | 117.057 $\mu$ W | Power    | Output capacitor power dissipation                                                         |
| 29. | Diode Pd       | 689.998 mW      | Power    | Diode power dissipation                                                                    |
| 30. | IC Pd          | 667.657 mW      | Power    | IC power dissipation                                                                       |
| 31. | L Pd           | 165.44 mW       | Power    | Inductor power dissipation                                                                 |
| 32. | Total Pd       | 1.524 W         | Power    | Total Power Dissipation                                                                    |
| 33. | Vout Tolerance | 5.03 %          |          | Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable |

## Design Inputs

| #  | Name    | Value    | Description            |
|----|---------|----------|------------------------|
| 1. | Iout    | 2.0      | Maximum Output Current |
| 2. | VinMax  | 21.0     | Maximum input voltage  |
| 3. | VinMin  | 12.0     | Minimum input voltage  |
| 4. | Vout    | 3.0      | Output Voltage         |
| 5. | base_pn | TPS54232 | Base Product Number    |
| 6. | source  | DC       | Input Source Type      |
| 7. | Ta      | 30.0     | Ambient temperature    |

## Design Assistance

1. **TPS54232** Product Folder : <http://www.ti.com/product/TPS54232> : contains the data sheet and other resources.

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