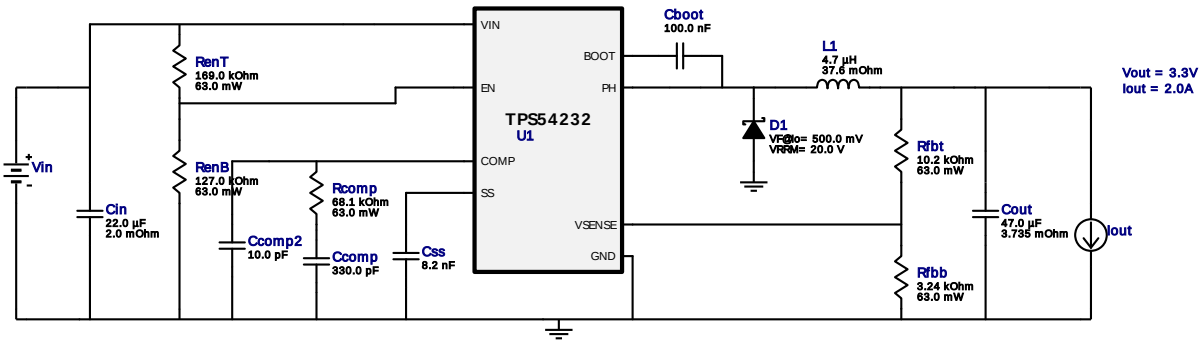


## WEBENCH® Design Report

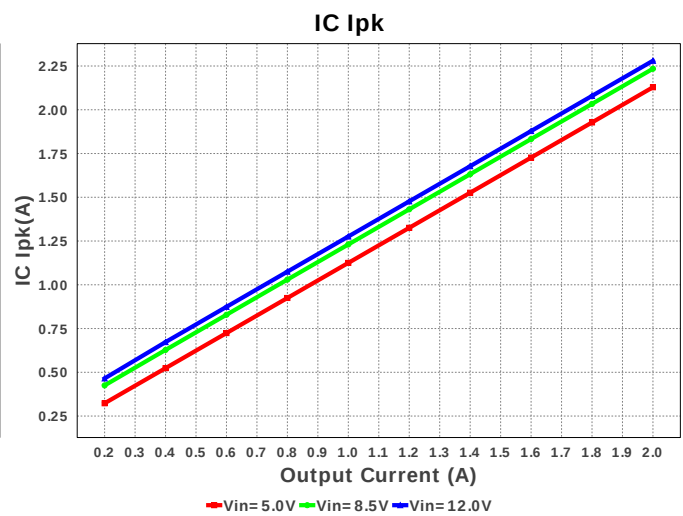
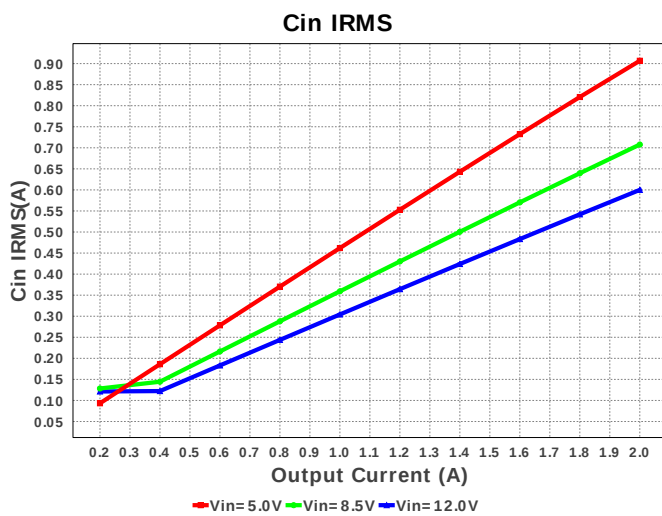
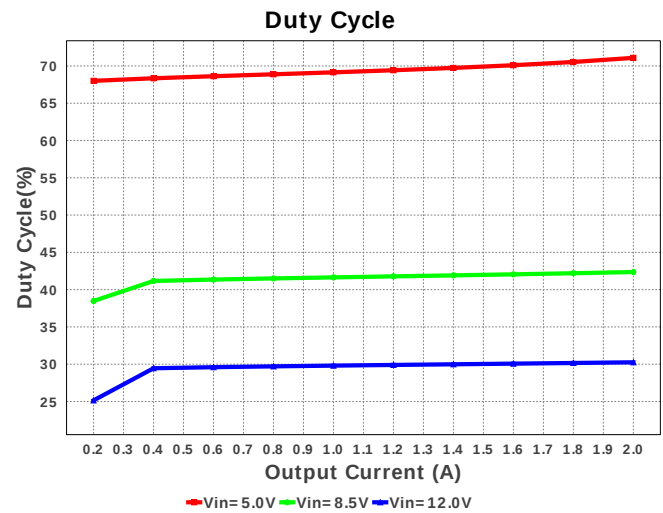
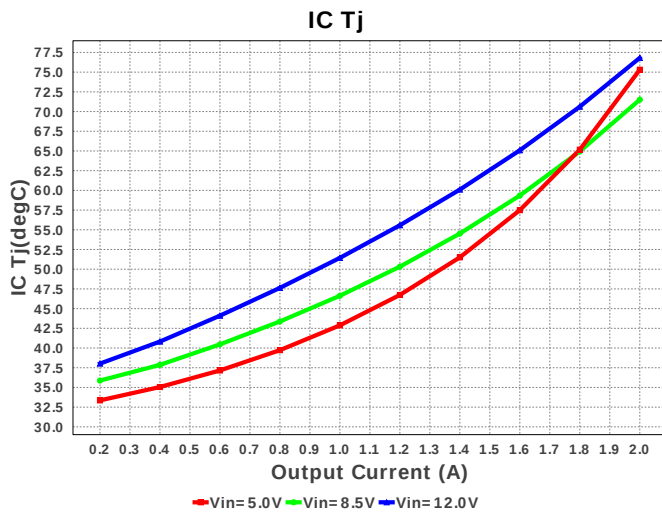
Design : 4372614/16 TPS54232DR  
TPS54232DR 5.0V-12.0V to 3.30V @ 2.0A

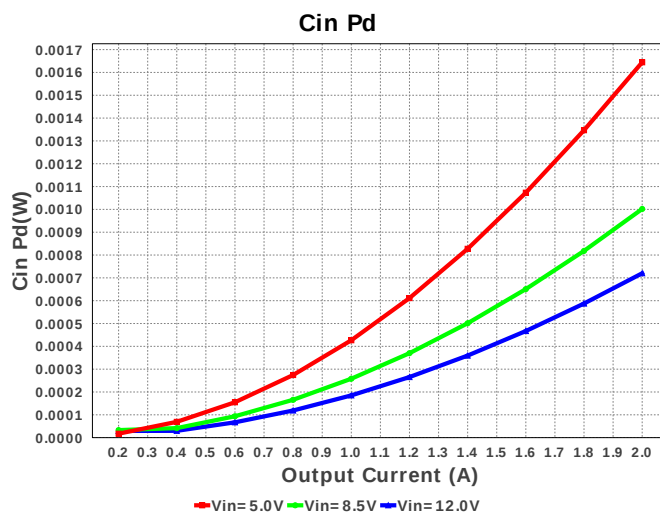
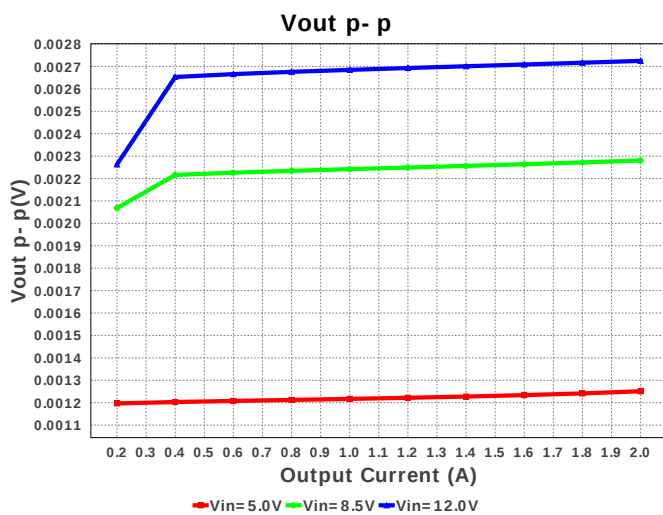
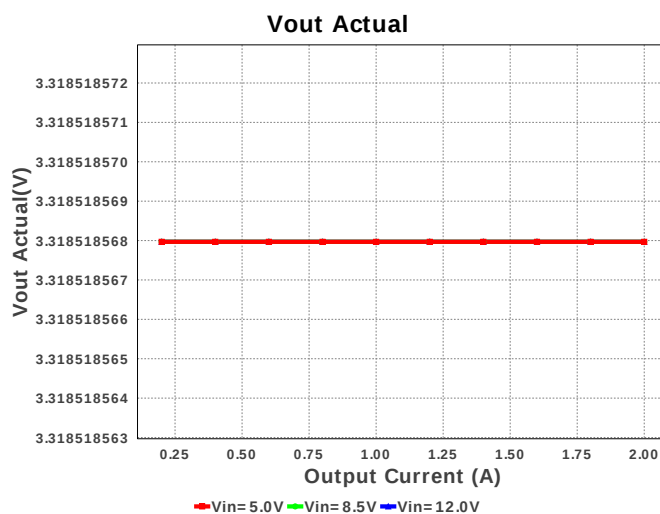
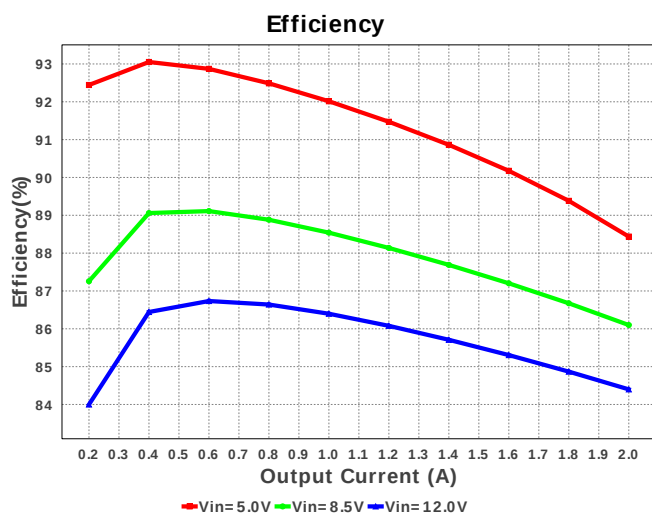
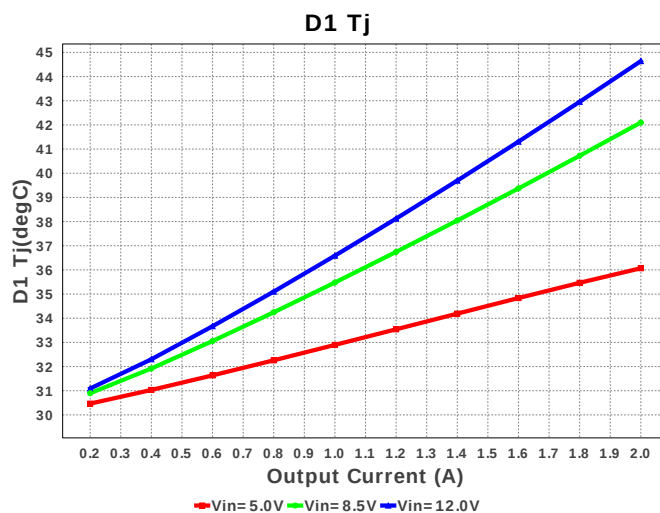
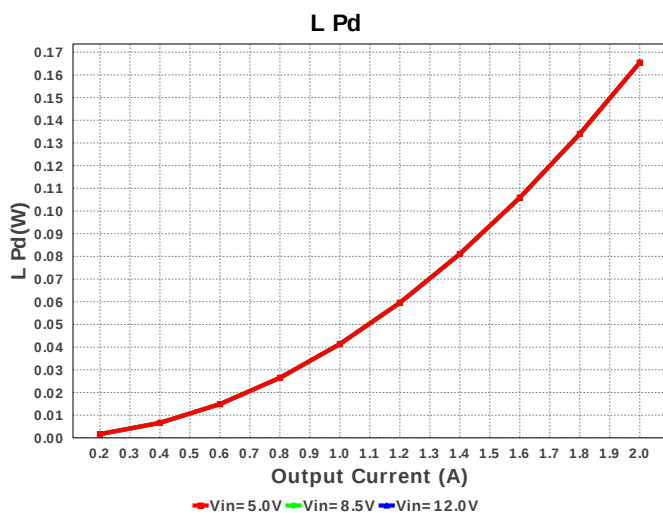


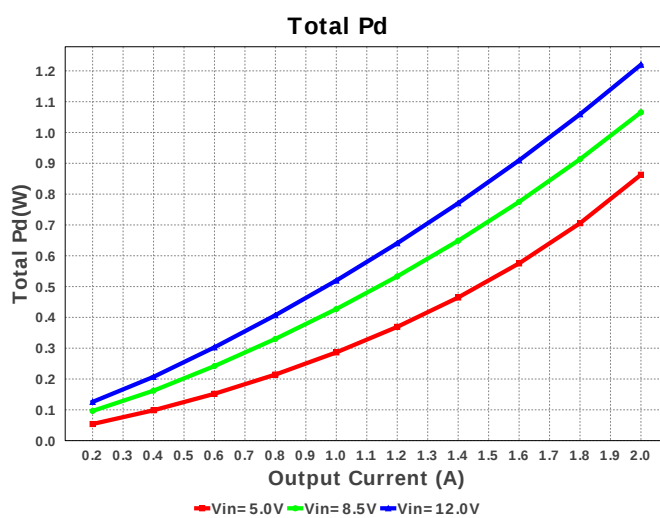
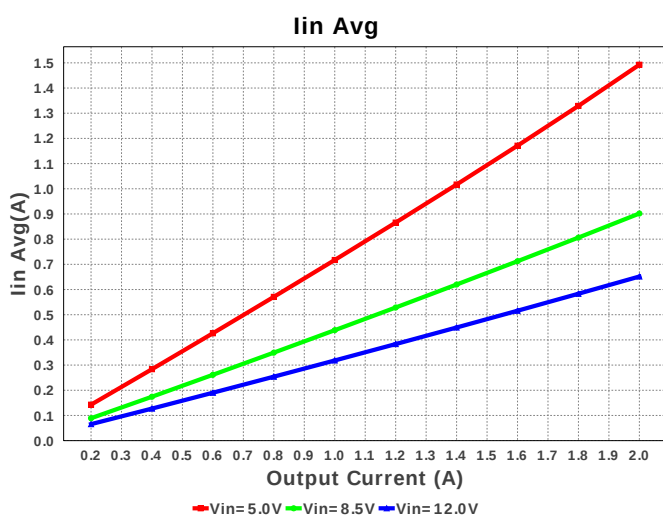
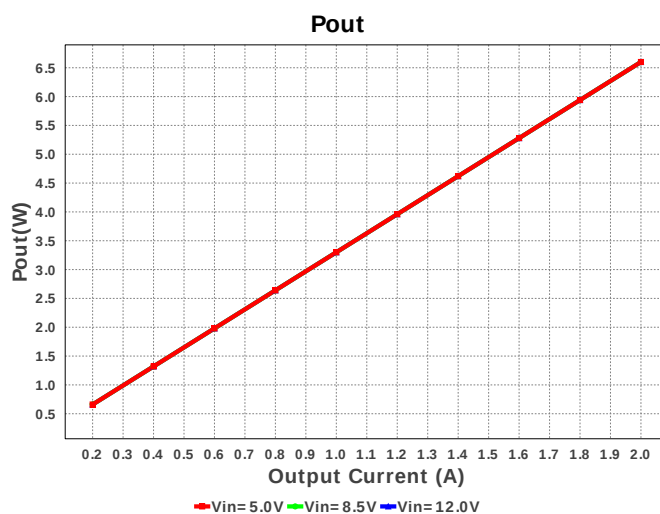
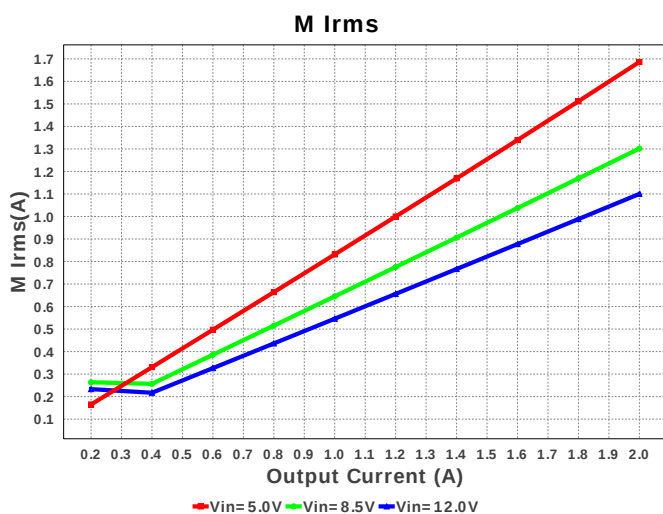
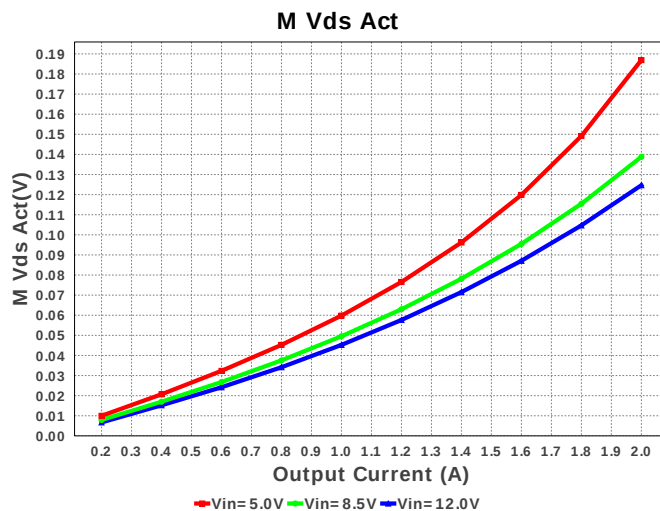
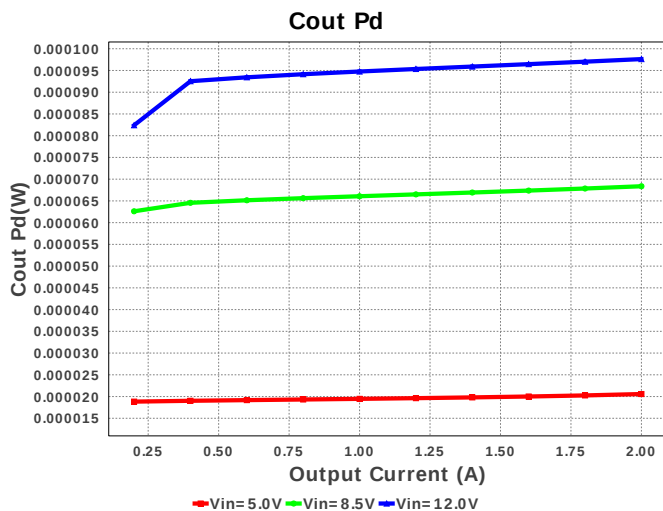
## Electrical BOM

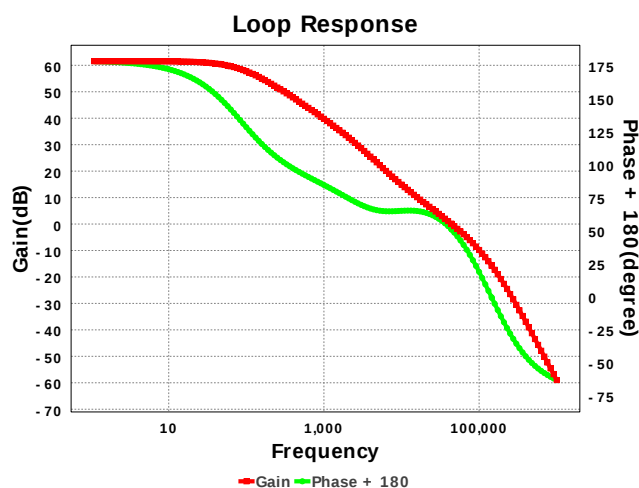
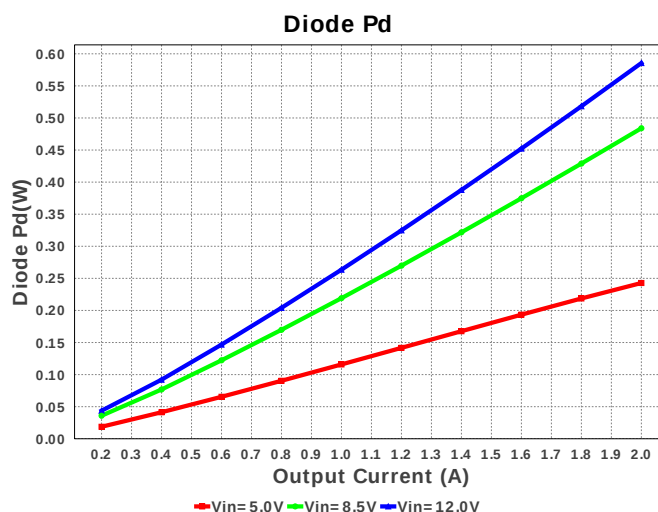
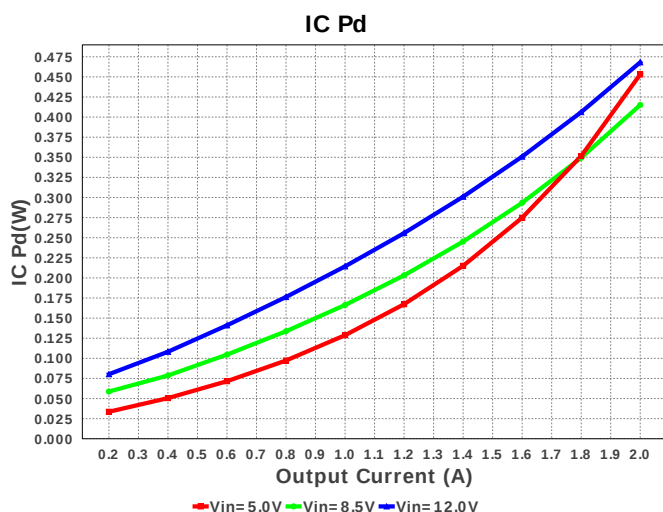
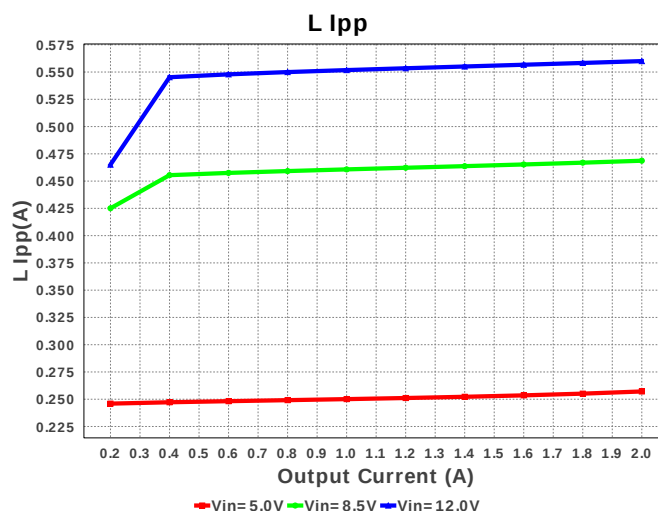
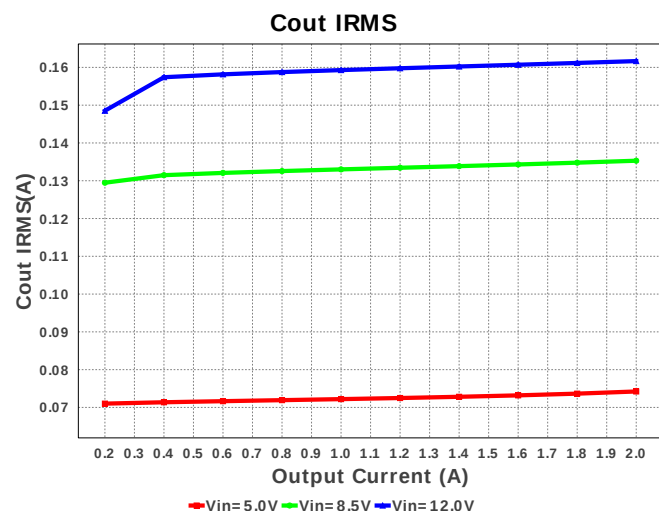
| #   | Name   | Manufacturer              | Part Number                          | Properties                                                      | Qty | Price  | Footprint                   |
|-----|--------|---------------------------|--------------------------------------|-----------------------------------------------------------------|-----|--------|-----------------------------|
| 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  | Samsung Electro-Mechanics | CL21C331JBANFNC<br>Series= C0G/NP0   | Cap= 330.0 pF<br>VDC= 50.0 V<br>IRMS= 0.0 A                     | 1   | \$0.01 | 0805 7 mm <sup>2</sup>      |
| 3.  | Ccomp2 | Kemet                     | C0805C100K5GACTU<br>Series= C0G/NP0  | Cap= 10.0 pF<br>VDC= 50.0 V<br>IRMS= 0.0 A                      | 1   | \$0.01 | 0805 7 mm <sup>2</sup>      |
| 4.  | Cin    | MuRata                    | GRM32ER61E226KE15L<br>Series= X5R    | Cap= 22.0 uF<br>ESR= 2.0 mOhm<br>VDC= 25.0 V<br>IRMS= 3.67 A    | 1   | \$0.16 | 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.               | B220-13-F                            | VF@Io= 500.0 mV<br>VRRM= 20.0 V                                 | 1   | \$0.08 | SMB 44 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               | CRCW040268K1FKED<br>Series= CRCW..e3 | Res= 68.1 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0%             | 1   | \$0.01 | 0402 3 mm <sup>2</sup>      |
| 10. | RenB   | Vishay-Dale               | CRCW0402127KFKED<br>Series= CRCW..e3 | Res= 127.0 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       | CRCW04023K24FKED<br>Series= CRCW..e3 | Res= 3.24 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  | 600.027 mA            | Current  | Input capacitor RMS ripple current      |
| 2.  | Cout IRMS | 161.666 mA            | Current  | Output capacitor RMS ripple current     |
| 3.  | IC Ipk    | 2.28 A                | Current  | Peak switch current in IC               |
| 4.  | Iin Avg   | 651.66 mA             | Current  | Average input current                   |
| 5.  | L Ipp     | 560.03 mA             | Current  | Peak-to-peak inductor ripple current    |
| 6.  | M1 Irms   | 1.1 A                 | Current  | Q lavg                                  |
| 7.  | BOM Count | 14                    | General  | Total Design BOM count                  |
| 8.  | FootPrint | 224.0 mm <sup>2</sup> | General  | Total Foot Print Area of BOM components |
| 9.  | Frequency | 1000.0 kHz            | General  | Switching frequency                     |
| 10. | M Vds Act | 124.665 mV            | General  | Voltage drop across the MosFET          |
| 11. | Pout      | 6.6 W                 | General  | Total output power                      |

| #   | Name           | Value        | Category | Description                                                                                |
|-----|----------------|--------------|----------|--------------------------------------------------------------------------------------------|
| 12. | Total BOM      | \$1.14       | General  | Total BOM Cost                                                                             |
| 13. | D1 Tj          | 44.64 degC   | Op_Point | D1 junction temperature                                                                    |
| 14. | Low Freq Gain  | 61.551 dB    | Op_Point | Gain at 10Hz                                                                               |
| 15. | Vout Actual    | 3.319 V      | Op_Point | Vout Actual calculated based on selected voltage divider resistors                         |
| 16. | Vout OP        | 3.3 V        | Op_Point | Operational Output Voltage                                                                 |
| 17. | Cross Freq     | 44.343 kHz   | Op_point | Bode plot crossover frequency                                                              |
| 18. | Duty Cycle     | 30.254 %     | Op_point | Duty cycle                                                                                 |
| 19. | Efficiency     | 84.399 %     | Op_point | Steady state efficiency                                                                    |
| 20. | Gain Marg      | -15.835 dB   | Op_point | Bode Plot Gain Margin                                                                      |
| 21. | IC Tj          | 76.81 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     | 51.638 deg   | Op_point | Bode Plot Phase Margin                                                                     |
| 25. | VIN_OP         | 12.0 V       | Op_point | Vin operating point                                                                        |
| 26. | Vout p-p       | 2.725 mV     | Op_point | Peak-to-peak output ripple voltage                                                         |
| 27. | Cin Pd         | 720.066 µW   | Power    | Input capacitor power dissipation                                                          |
| 28. | Cout Pd        | 97.617 µW    | Power    | Output capacitor power dissipation                                                         |
| 29. | Diode Pd       | 585.595 mW   | Power    | Diode power dissipation                                                                    |
| 30. | IC Pd          | 468.102 mW   | Power    | IC power dissipation                                                                       |
| 31. | L Pd           | 165.44 mW    | Power    | Inductor power dissipation                                                                 |
| 32. | Total Pd       | 1.22 W       | Power    | Total Power Dissipation                                                                    |
| 33. | Vout Tolerance | 5.087 %      |          | 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  | 12.0     | Maximum input voltage  |
| 3. | VinMin  | 5.0      | Minimum input voltage  |
| 4. | Vout    | 3.3      | 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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