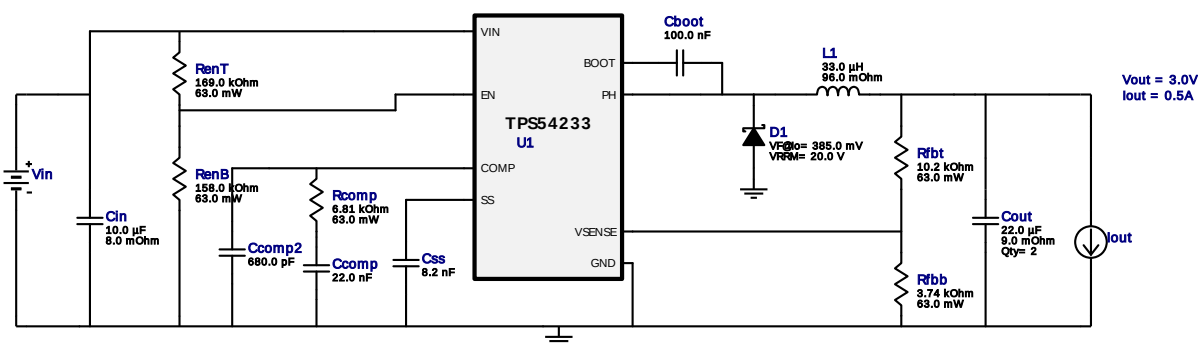


## WEBENCH® Design Report

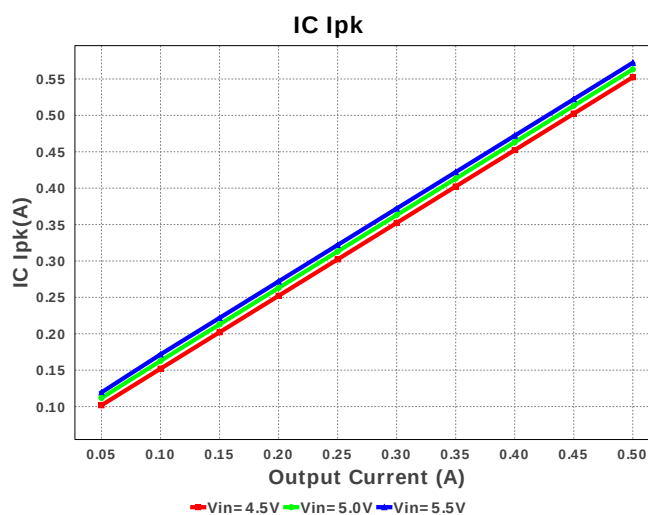
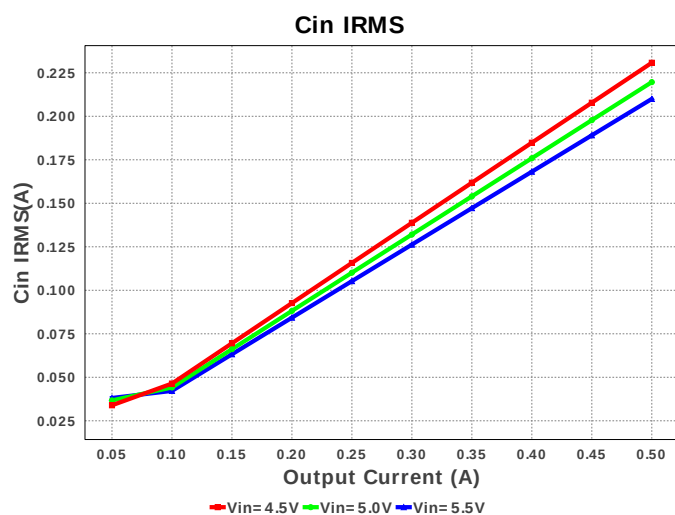
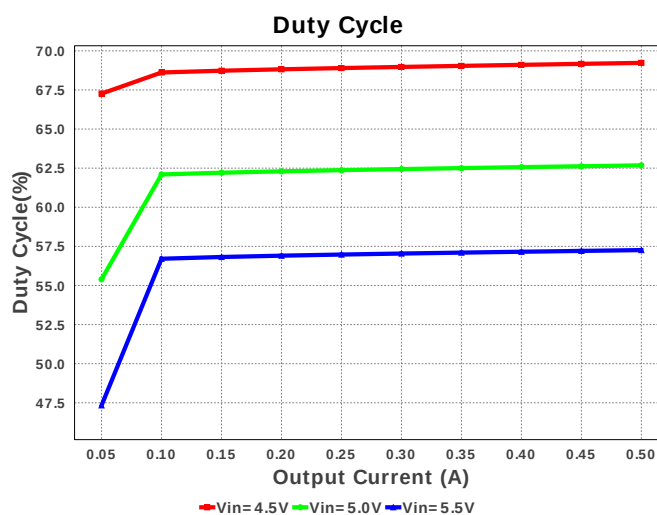
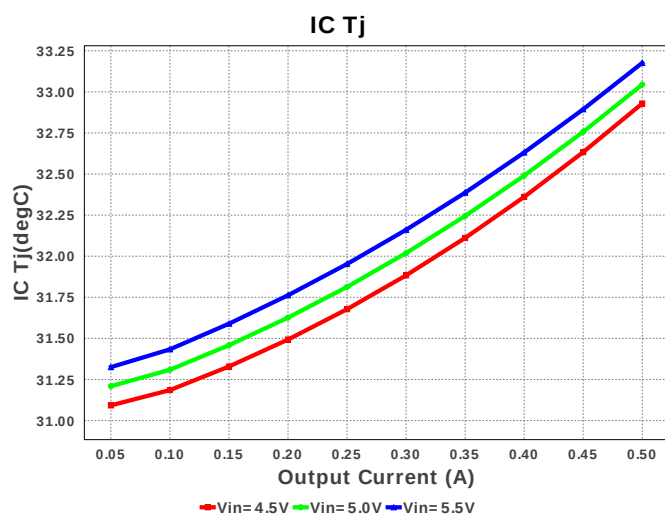
Design : 4742013/163 TPS54233DR  
TPS54233DR 4.5V-5.5V to 3.00V @ 0.5A

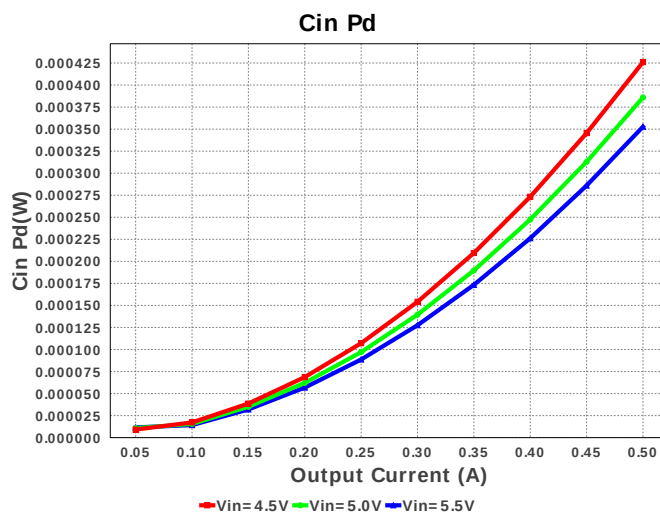
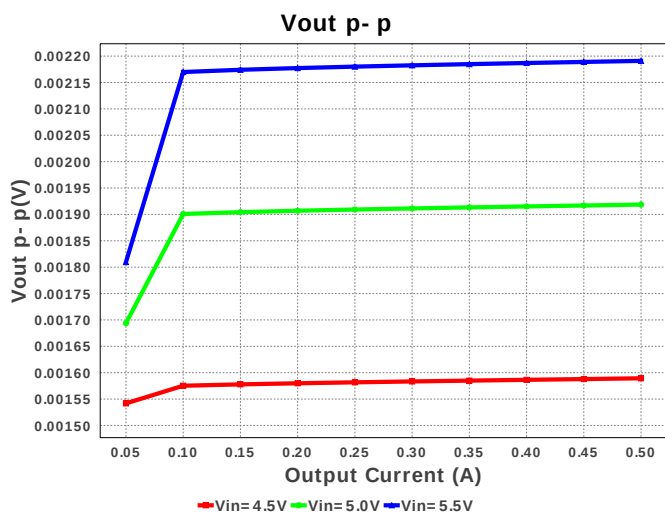
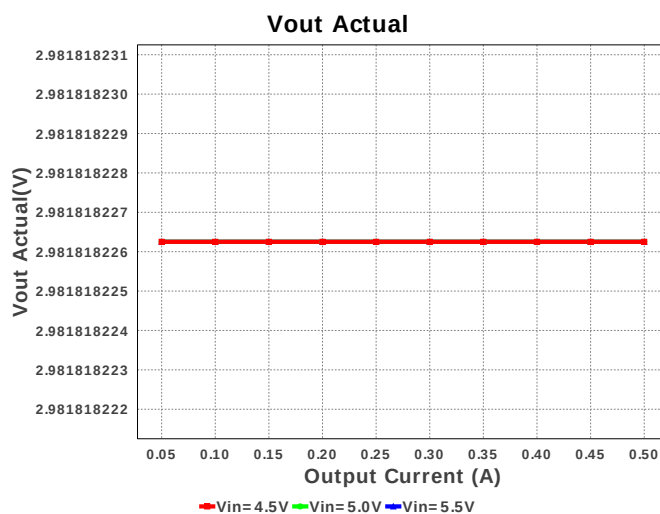
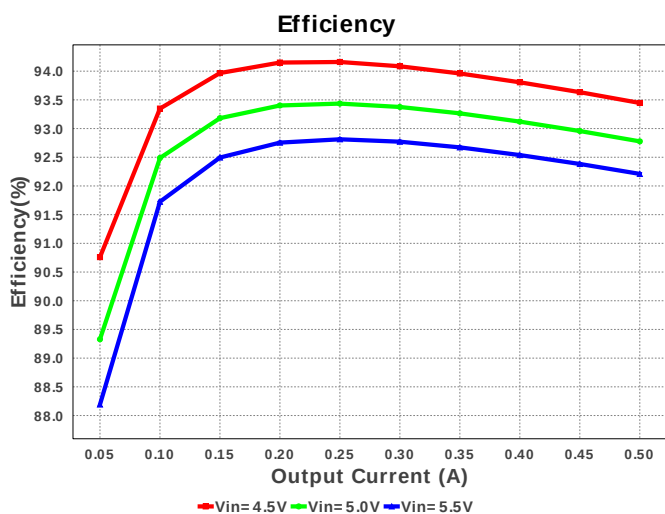
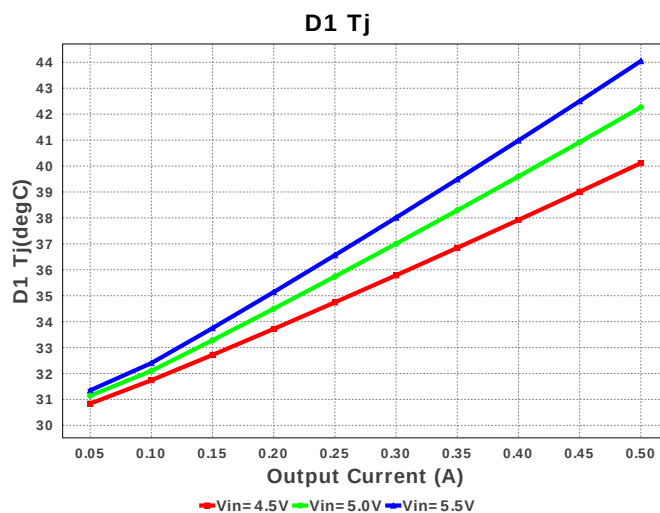
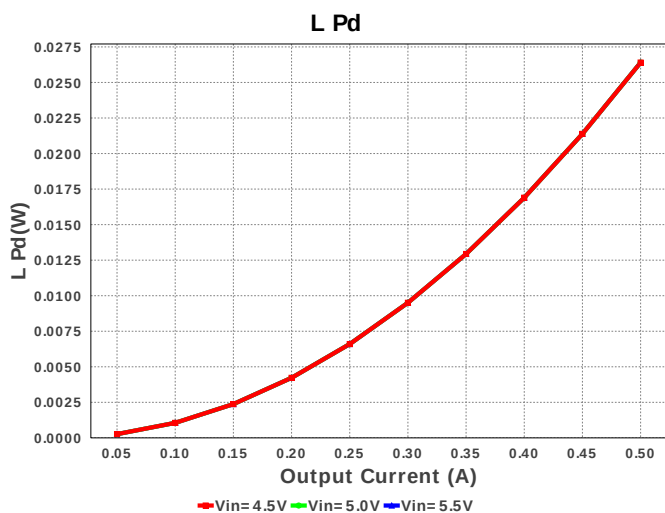


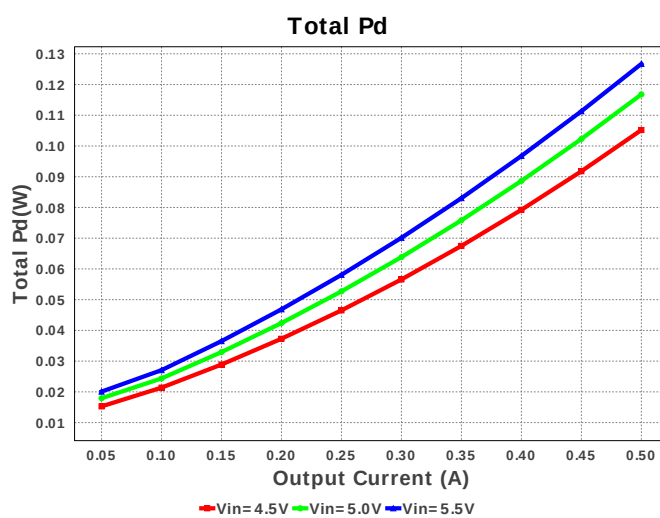
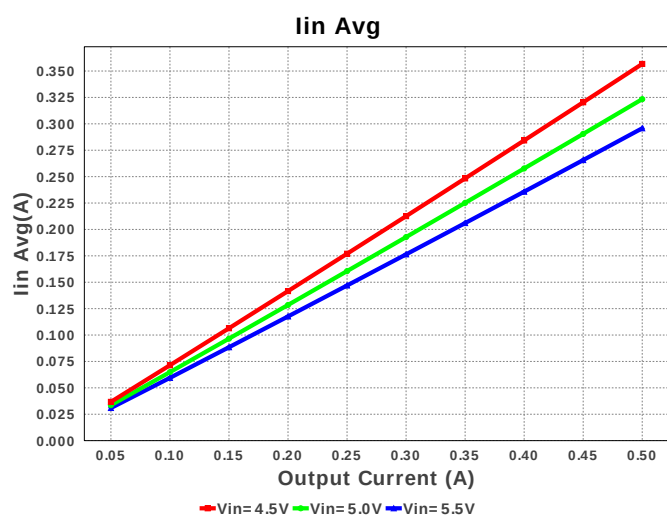
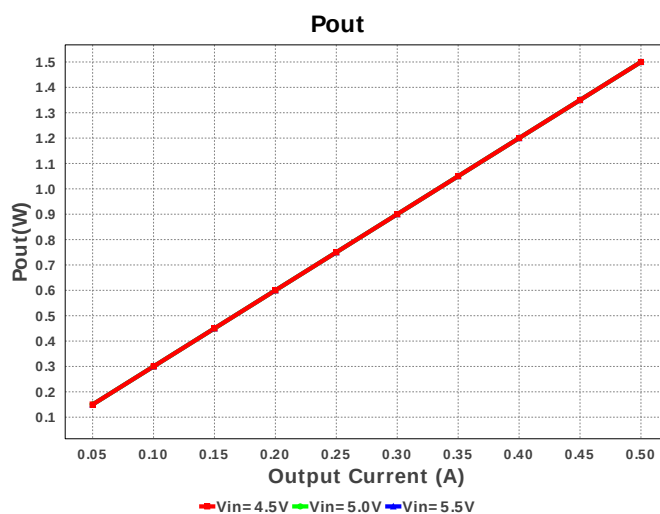
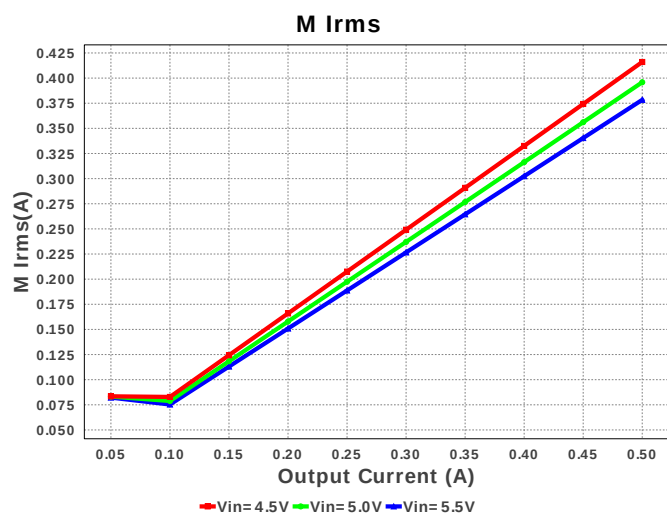
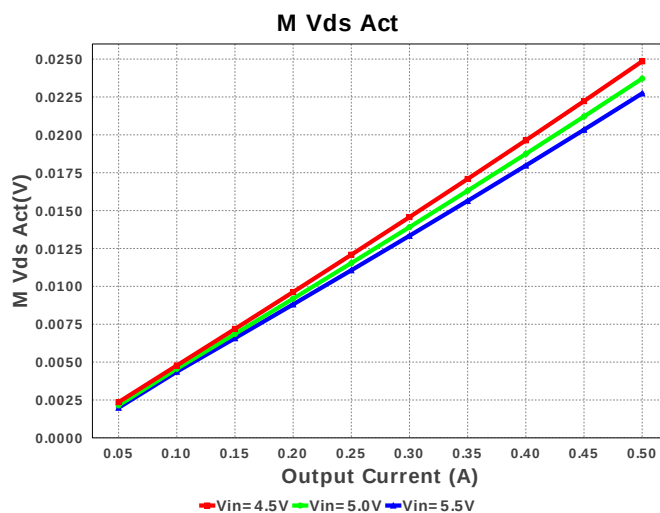
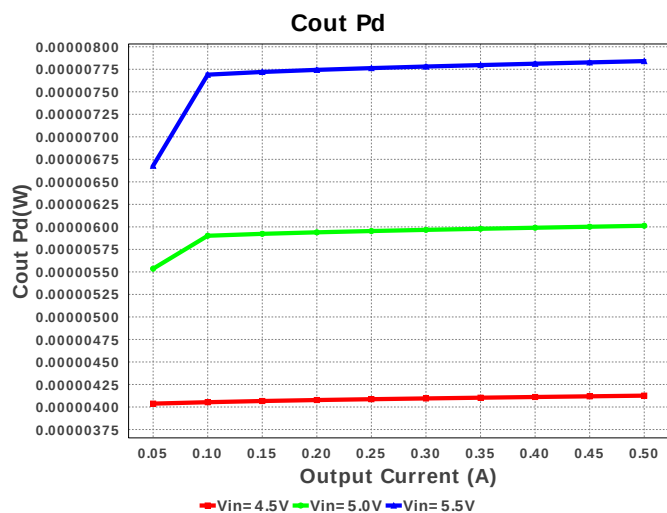
## Electrical BOM

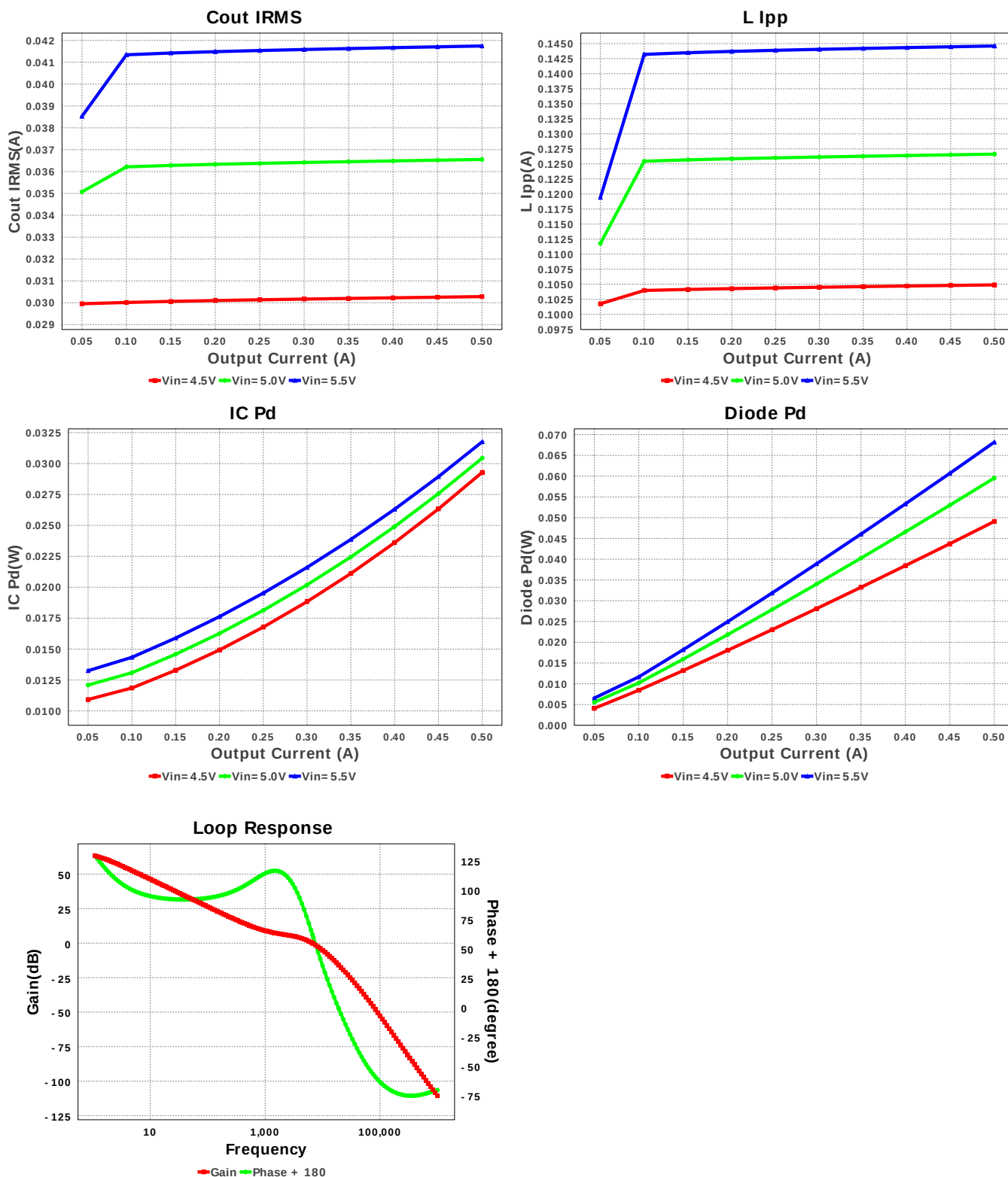
| #   | Name   | Manufacturer     | Part Number                          | Properties                                                  | Qty | Price  | Footprint                  |
|-----|--------|------------------|--------------------------------------|-------------------------------------------------------------|-----|--------|----------------------------|
| 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    | 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>     |
| 3.  | Ccomp2 | Yageo America    | CC0805KRX7R9BB681<br>Series= X7R     | Cap= 680.0 pF<br>VDC= 50.0 V<br>IRMS= 0.0 A                 | 1   | \$0.01 | 0805 7 mm <sup>2</sup>     |
| 4.  | Cin    | Kemet            | C1210C106K8PACTU<br>Series= X5R      | Cap= 10.0 uF<br>ESR= 8.0 mOhm<br>VDC= 10.0 V<br>IRMS= 6.9 A | 1   | \$0.18 | 1210 15 mm <sup>2</sup>    |
| 5.  | Cout   | MuRata           | GRM21BR60J226ME39L<br>Series= X5R    | Cap= 22.0 uF<br>ESR= 9.0 mOhm<br>VDC= 6.3 V<br>IRMS= 3.5 A  | 2   | \$0.04 | 0805 7 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     | ON Semiconductor | MBR0520LT1G                          | VF@Io= 385.0 mV<br>VRRM= 20.0 V                             | 1   | \$0.06 | SOD-123 13 mm <sup>2</sup> |
| 8.  | L1     | TDK              | SLF7045T-330MR82-PF                  | L= 33.0 uH<br>DCR= 96.0 mOhm                                | 1   | \$0.45 | SLF7045 81 mm <sup>2</sup> |
| 9.  | Rcomp  | Vishay-Dale      | CRCW04026K81FKED<br>Series= CRCW..e3 | Res= 6.81 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0%         | 1   | \$0.01 | 0402 3 mm <sup>2</sup>     |
| 10. | RenB   | Vishay-Dale      | CRCW0402158KFKED<br>Series= CRCW..e3 | Res= 158.0 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       | 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 | TPS54233DR                           | Switcher                                            | 1   | \$0.55 |                        |

D0008A 57 mm<sup>2</sup>







## Operating Values

| #   | Name      | Value                 | Category | Description                             |
|-----|-----------|-----------------------|----------|-----------------------------------------|
| 1.  | Cin IRMS  | 209.979 mA            | Current  | Input capacitor RMS ripple current      |
| 2.  | Cout IRMS | 41.743 mA             | Current  | Output capacitor RMS ripple current     |
| 3.  | IC Ipk    | 572.3 mA              | Current  | Peak switch current in IC               |
| 4.  | Iin Avg   | 295.77 mA             | Current  | Average input current                   |
| 5.  | L Ipp     | 144.6 mA              | Current  | Peak-to-peak inductor ripple current    |
| 6.  | M1 Irms   | 378.357 mA            | Current  | Q lavg                                  |
| 7.  | BOM Count | 15                    | General  | Total Design BOM count                  |
| 8.  | FootPrint | 212.0 mm <sup>2</sup> | General  | Total Foot Print Area of BOM components |
| 9.  | Frequency | 300.0 kHz             | General  | Switching frequency                     |
| 10. | M Vds Act | 22.735 mV             | General  | Voltage drop across the MosFET          |
| 11. | Pout      | 1.5 W                 | General  | Total output power                      |

| #   | Name           | Value           | Category | Description                                                                                |
|-----|----------------|-----------------|----------|--------------------------------------------------------------------------------------------|
| 12. | Total BOM      | \$1.41          | General  | Total BOM Cost                                                                             |
| 13. | D1 Tj          | 44.047 degC     | Op_Point | D1 junction temperature                                                                    |
| 14. | Low Freq Gain  | 63.334 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     | 6.687 kHz       | Op_point | Bode plot crossover frequency                                                              |
| 18. | Duty Cycle     | 57.262 %        | Op_point | Duty cycle                                                                                 |
| 19. | Efficiency     | 92.21 %         | Op_point | Steady state efficiency                                                                    |
| 20. | Gain Marg      | -15.765 dB      | Op_point | Bode Plot Gain Margin                                                                      |
| 21. | IC Tj          | 33.176 degC     | Op_point | IC junction temperature                                                                    |
| 22. | ICThetaJA      | 100.0 degC/W    | Op_point | IC junction-to-ambient thermal resistance                                                  |
| 23. | IOUT_OP        | 500.0 mA        | Op_point | Iout operating point                                                                       |
| 24. | Phase Marg     | 62.648 deg      | Op_point | Bode Plot Phase Margin                                                                     |
| 25. | VIN_OP         | 5.5 V           | Op_point | Vin operating point                                                                        |
| 26. | Vout p-p       | 2.191 mV        | Op_point | Peak-to-peak output ripple voltage                                                         |
| 27. | Cin Pd         | 352.729 $\mu$ W | Power    | Input capacitor power dissipation                                                          |
| 28. | Cout Pd        | 7.841 $\mu$ W   | Power    | Output capacitor power dissipation                                                         |
| 29. | Diode Pd       | 68.188 mW       | Power    | Diode power dissipation                                                                    |
| 30. | IC Pd          | 31.764 mW       | Power    | IC power dissipation                                                                       |
| 31. | L Pd           | 26.4 mW         | Power    | Inductor power dissipation                                                                 |
| 32. | Total Pd       | 126.723 mW      | 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    | 500.0 m  | Maximum Output Current |
| 2. | VinMax  | 5.5      | Maximum input voltage  |
| 3. | VinMin  | 4.5      | Minimum input voltage  |
| 4. | Vout    | 3.0      | Output Voltage         |
| 5. | base_pn | TPS54233 | Base Product Number    |
| 6. | source  | DC       | Input Source Type      |
| 7. | Ta      | 30.0     | Ambient temperature    |

## Design Assistance

1. **TPS54233** Product Folder : <http://www.ti.com/product/TPS54233> : contains the data sheet and other resources.

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