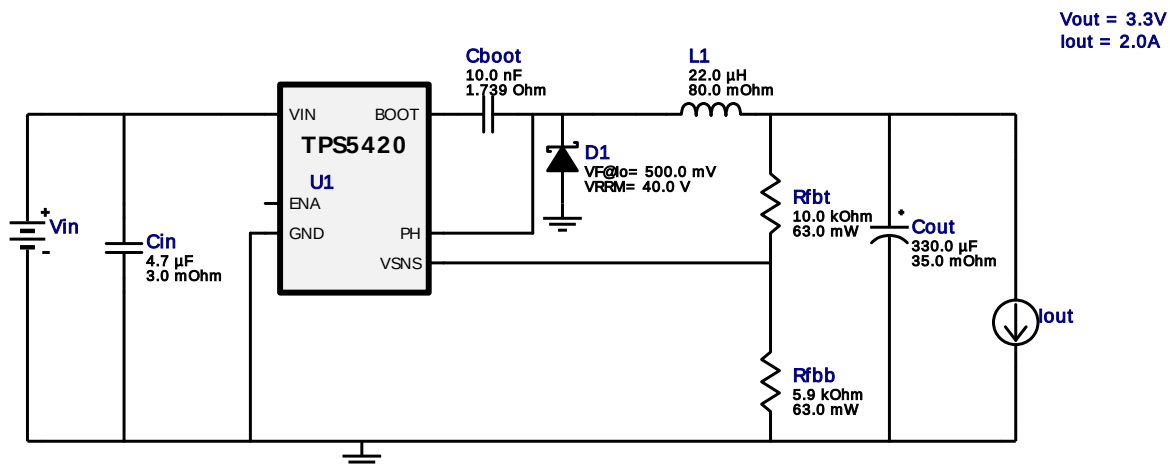
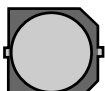


## WEBENCH® Design Report

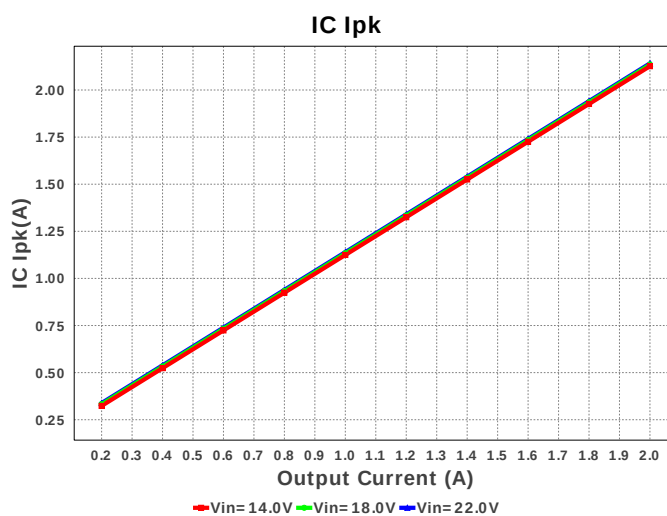
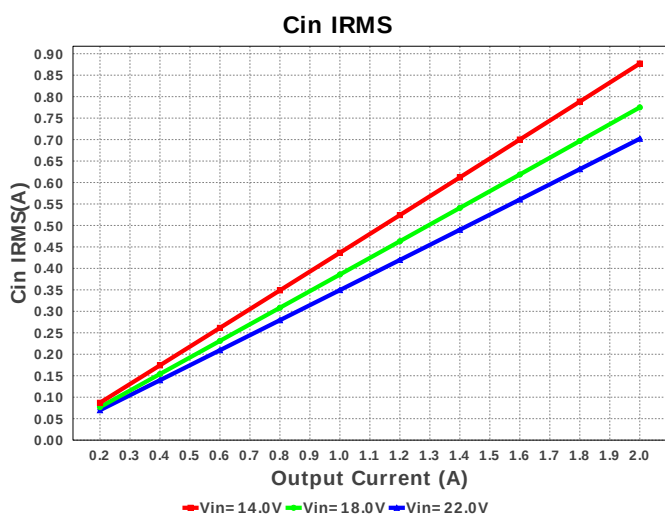
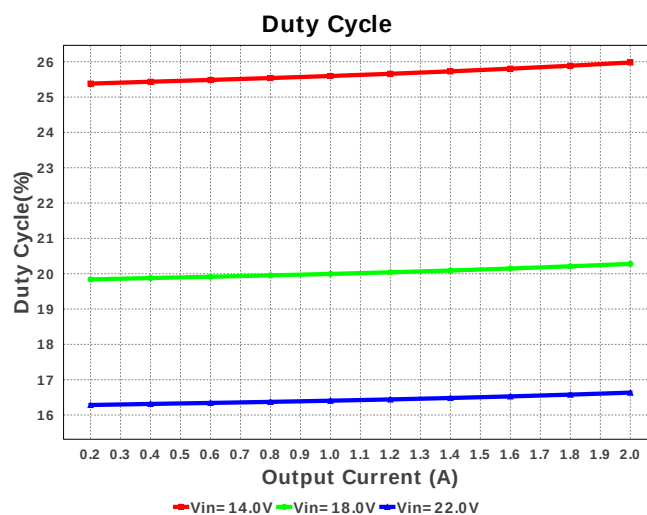
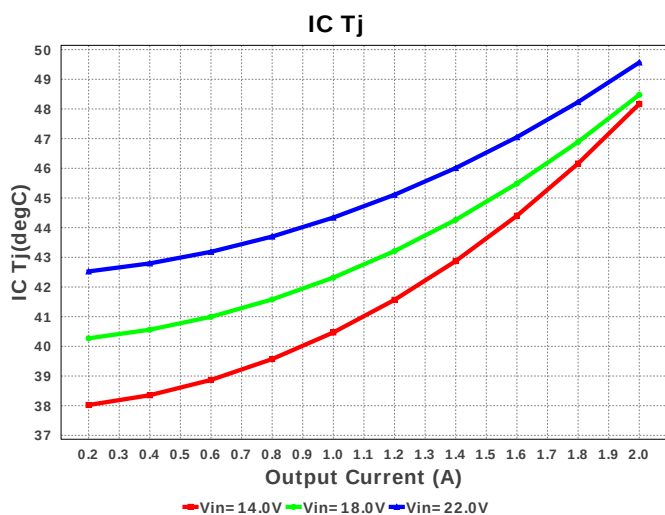
Design : 4807346/5 TPS5420DR  
TPS5420DR 14.0V-22.0V to 3.30V @ 2.0A

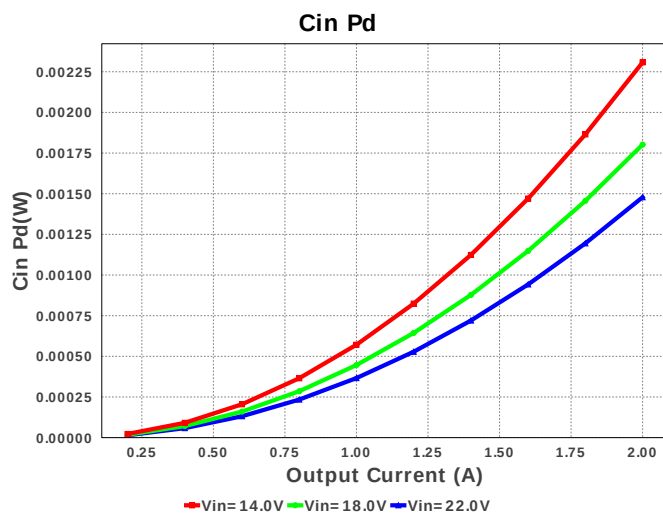
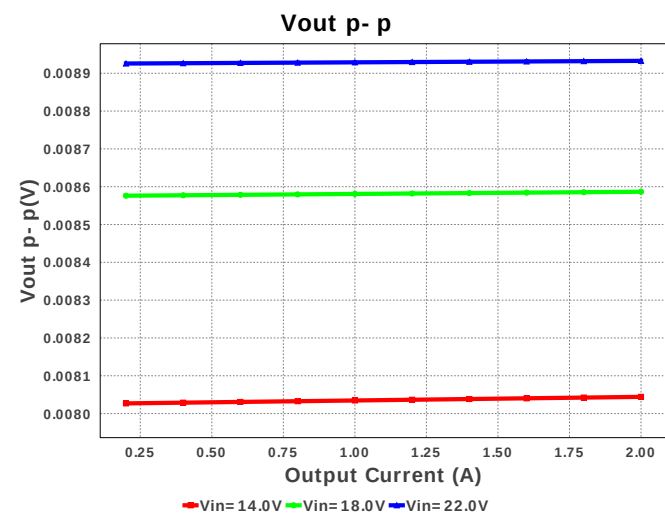
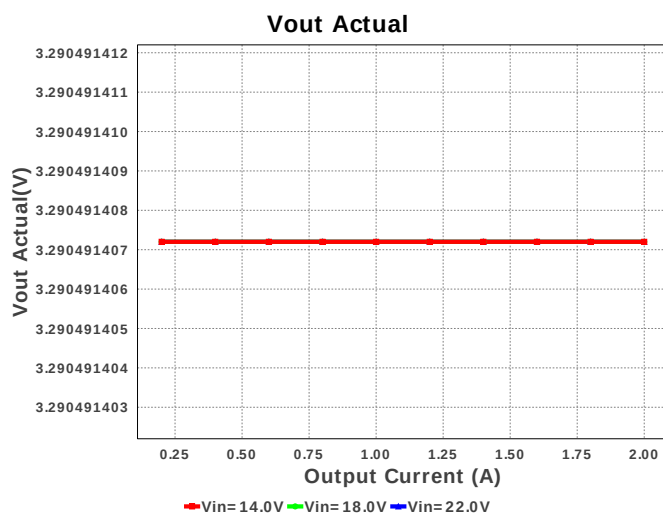
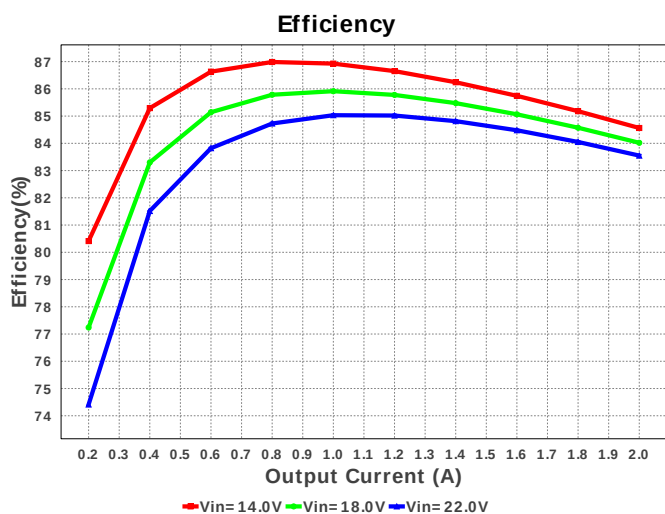
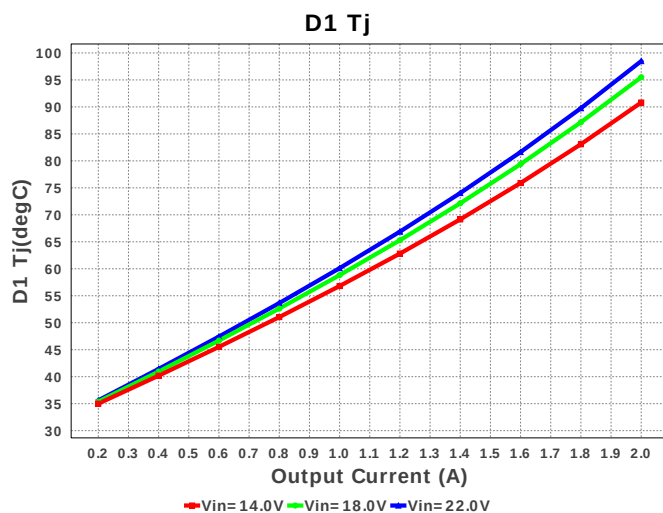
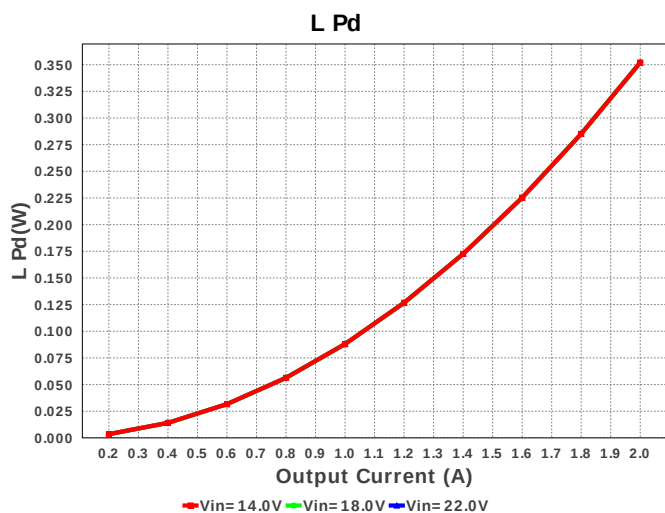


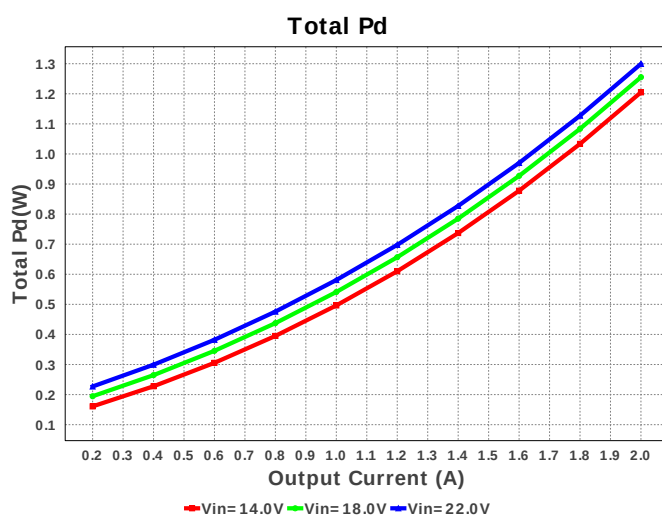
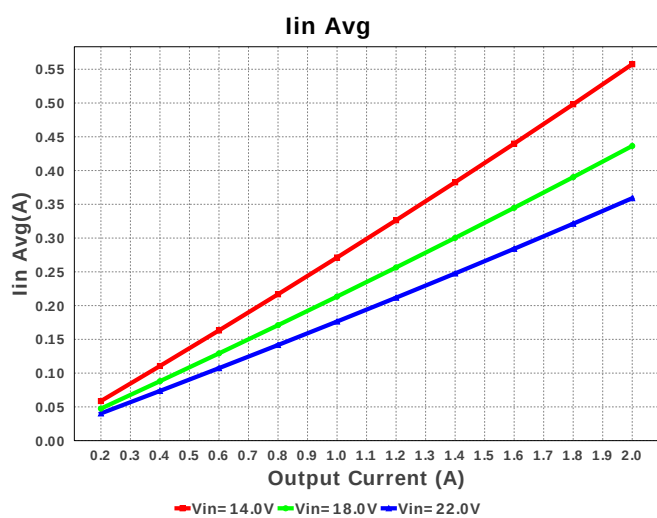
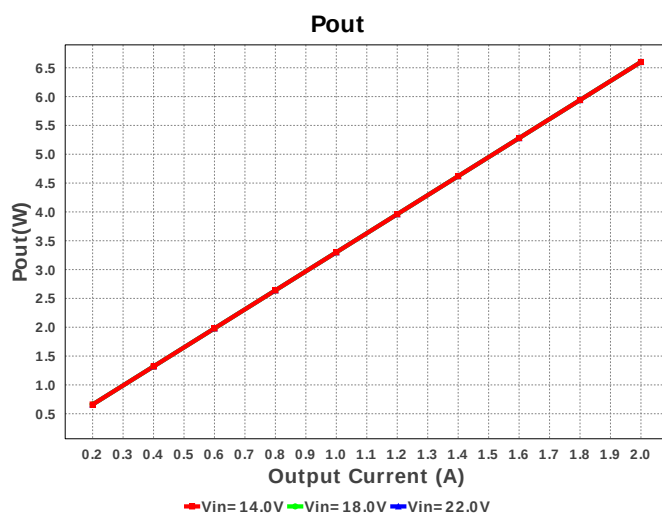
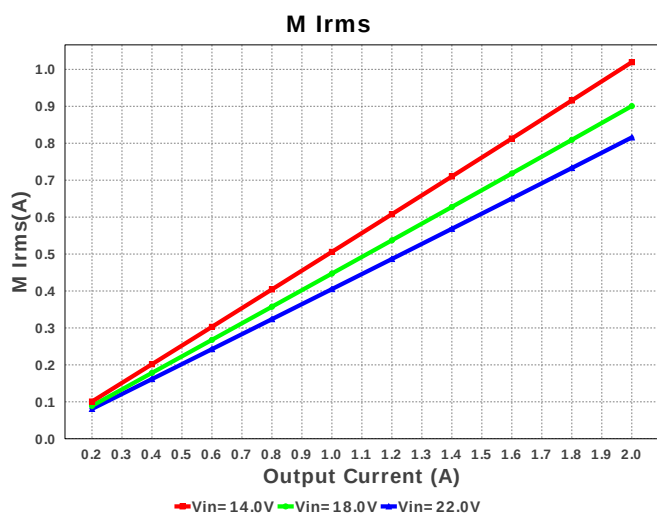
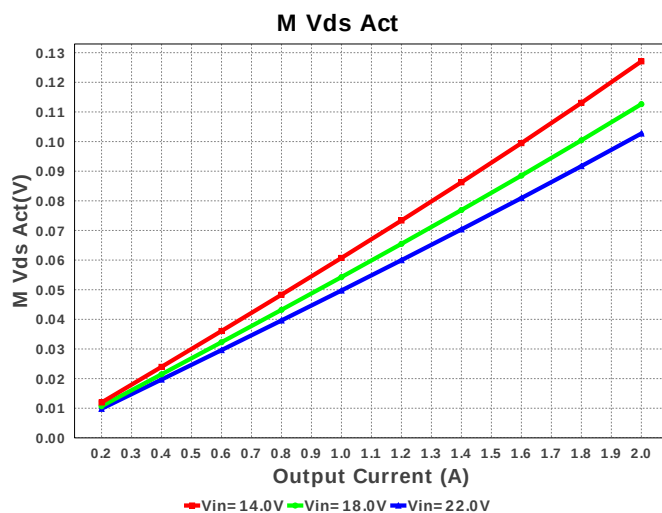
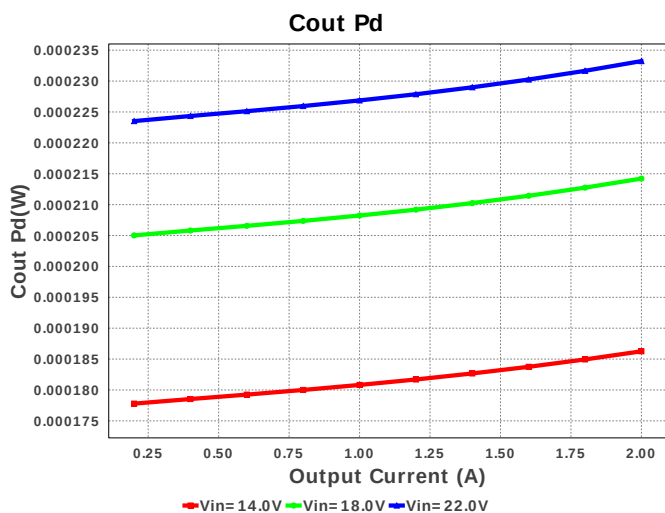
## Electrical BOM

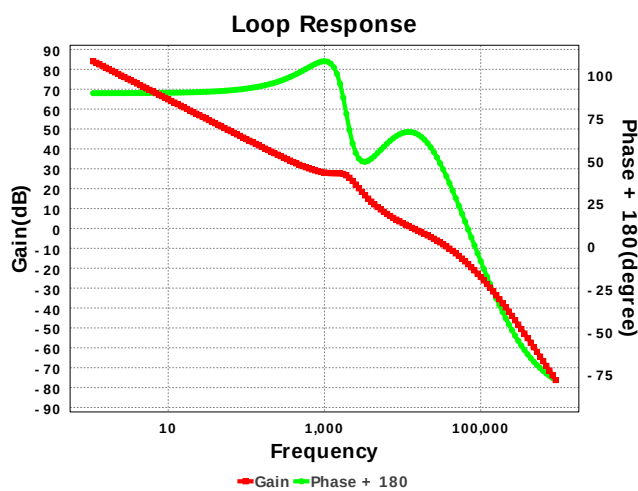
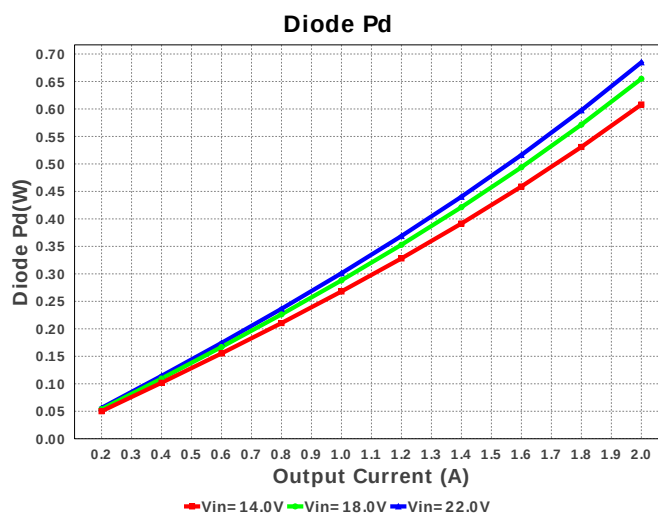
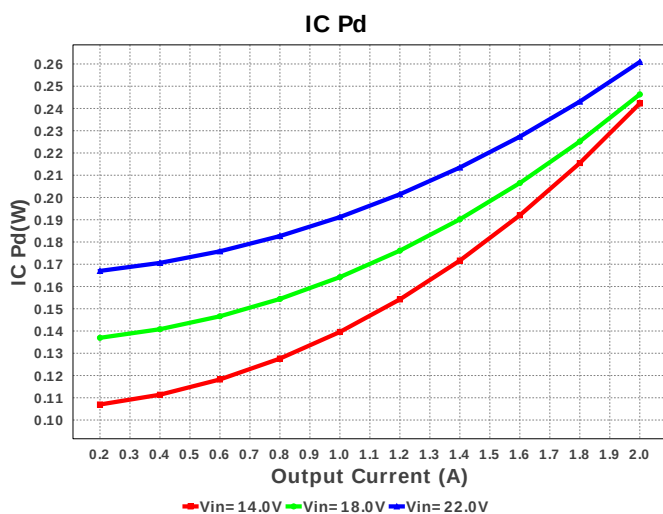
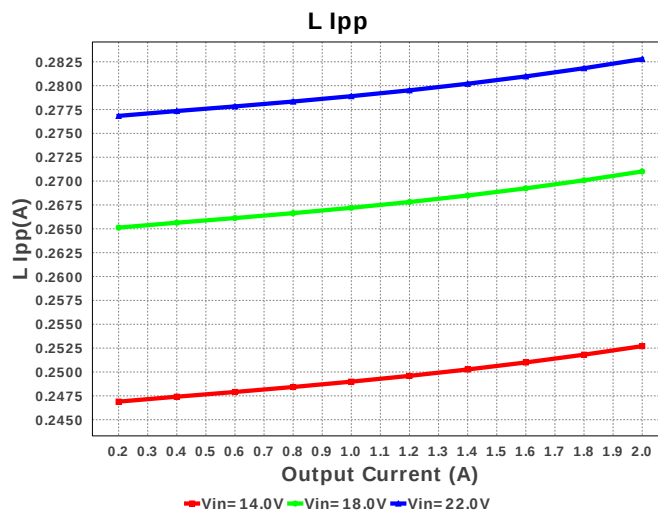
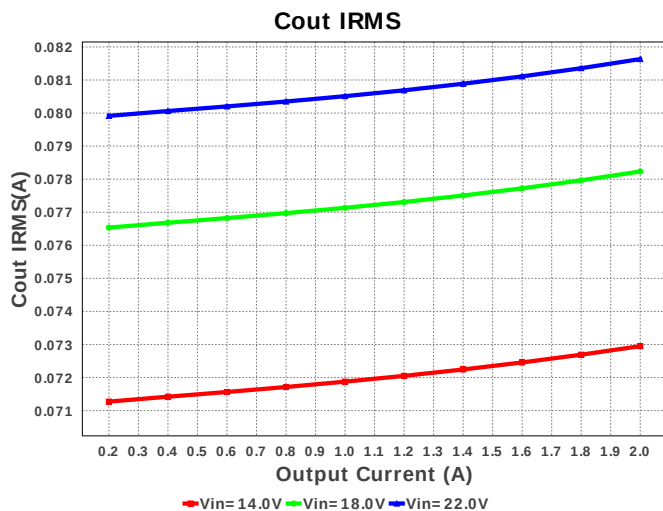
| #  | Name  | Manufacturer | Part Number                          | Properties                                                      | Qty | Price  | Footprint                                                                                                               |
|----|-------|--------------|--------------------------------------|-----------------------------------------------------------------|-----|--------|-------------------------------------------------------------------------------------------------------------------------|
| 1. | Cboot | Kemet        | C0805C103K5RACTU<br>Series= X7R      | Cap= 10.0 nF<br>ESR= 1.739 Ohm<br>VDC= 50.0 V<br>IRMS= 411.0 mA | 1   | \$0.01 |  0805 7 mm <sup>2</sup>            |
| 2. | Cin   | MuRata       | GRM31CR71H475KA12L<br>Series= X7R    | Cap= 4.7 uF<br>ESR= 3.0 mOhm<br>VDC= 50.0 V<br>IRMS= 4.98 A     | 1   | \$0.07 |  1206 11 mm <sup>2</sup>           |
| 3. | Cout  | Panasonic    | 4SVP330M<br>Series= SVP              | Cap= 330.0 uF<br>ESR= 35.0 mOhm<br>VDC= 4.0 V<br>IRMS= 2.56 A   | 1   | \$0.49 |  SM_RADIAL_8MM 113 mm <sup>2</sup> |
| 4. | 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>            |
| 5. | L1    | Bourns       | SDR1105-220ML                        | L= 22.0 µH<br>DCR= 80.0 mOhm                                    | 1   | \$0.29 |  SDR1105 157 mm <sup>2</sup>       |
| 6. | Rfbb  | Vishay-Dale  | CRCW04025K90FKED<br>Series= CRCW..e3 | Res= 5.9 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0%              | 1   | \$0.01 |  0402 3 mm <sup>2</sup>            |
| 7. | Rfbbt | Vishay-Dale  | CRCW040210K0FKED<br>Series= CRCW..e3 | Res= 10.0 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                                                                                                      |
|----|------|-------------------|-------------|------------|-----|--------|----------------------------------------------------------------------------------------------------------------|
| 8. | U1   | Texas Instruments | TPS5420DR   | Switcher   | 1   | \$1.70 | <br>M08A 55 mm <sup>2</sup> |









## Operating Values

| #   | Name         | Value                 | Category | Description                             |
|-----|--------------|-----------------------|----------|-----------------------------------------|
| 1.  | Cin IRMS     | 702.002 mA            | Current  | Input capacitor RMS ripple current      |
| 2.  | Cout IRMS    | 81.632 mA             | Current  | Output capacitor RMS ripple current     |
| 3.  | IC Ipk       | 2.141 A               | Current  | Peak switch current in IC               |
| 4.  | Iin Avg      | 359.07 mA             | Current  | Average input current                   |
| 5.  | L Ipp        | 282.78 mA             | Current  | Peak-to-peak inductor ripple current    |
| 6.  | M Irms       | 815.702 mA            | Current  | MOSFET RMS current                      |
| 7.  | BOM Count    | 8                     | General  | Total Design BOM count                  |
| 8.  | FootPrint    | 387.0 mm <sup>2</sup> | General  | Total Foot Print Area of BOM components |
| 9.  | Frequency    | 500.0 kHz             | General  | Switching frequency                     |
| 10. | IC Tolerance | 18.315 mV             | General  | IC Feedback Tolerance                   |
| 11. | M Vds Act    | 102.72 mV             | General  | Voltage drop across the MosFET          |

| #   | Name           | Value       | Category | Description                                                                                |
|-----|----------------|-------------|----------|--------------------------------------------------------------------------------------------|
| 12. | Mode           | CCM         | General  | Conduction Mode                                                                            |
| 13. | Pout           | 6.6 W       | General  | Total output power                                                                         |
| 14. | Total BOM      | \$2.69      | General  | Total BOM Cost                                                                             |
| 15. | D1 Tj          | 98.489 degC | Op_Point | D1 junction temperature                                                                    |
| 16. | Vout Actual    | 3.29 V      | Op_Point | Vout Actual calculated based on selected voltage divider resistors                         |
| 17. | Vout OP        | 3.3 V       | Op_Point | Operational Output Voltage                                                                 |
| 18. | Cross Freq     | 13.758 kHz  | Op_point | Bode plot crossover frequency                                                              |
| 19. | Duty Cycle     | 16.634 %    | Op_point | Duty cycle                                                                                 |
| 20. | Efficiency     | 83.55 %     | Op_point | Steady state efficiency                                                                    |
| 21. | IC Tj          | 49.567 degC | Op_point | IC junction temperature                                                                    |
| 22. | ICThetaJA      | 75.0 degC/W | Op_point | IC junction-to-ambient thermal resistance                                                  |
| 23. | IOUT_OP        | 2.0 A       | Op_point | Iout operating point                                                                       |
| 24. | Phase Marg     | 67.021 deg  | Op_point | Bode Plot Phase Margin                                                                     |
| 25. | VIN_OP         | 22.0 V      | Op_point | Vin operating point                                                                        |
| 26. | Vout p-p       | 9.897 mV    | Op_point | Peak-to-peak output ripple voltage                                                         |
| 27. | Cin Pd         | 1.478 mW    | Power    | Input capacitor power dissipation                                                          |
| 28. | Cout Pd        | 233.233 µW  | Power    | Output capacitor power dissipation                                                         |
| 29. | Diode Pd       | 684.893 mW  | Power    | Diode power dissipation                                                                    |
| 30. | IC Pd          | 260.889 mW  | Power    | IC power dissipation                                                                       |
| 31. | L Pd           | 352.0 mW    | Power    | Inductor power dissipation                                                                 |
| 32. | Total Pd       | 1.299 W     | Power    | Total Power Dissipation                                                                    |
| 33. | Vout Tolerance | 2.79 %      |          | 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  | 22.0    | Maximum input voltage              |
| 3. | VinMin  | 14.0    | Minimum input voltage              |
| 4. | Vout    | 3.3     | Output Voltage                     |
| 5. | base_pn | TPS5420 | Texas Instruments Base Part Number |
| 6. | source  | DC      | Input Source Type                  |
| 7. | ta      | 30.0    | Ambient temperature                |

## Design Assistance

1. Feature Highlights: 2A, 500kHz Fixed Switching Frequency, Internal Compensation
2. TPS5420 Product Folder : <http://www.ti.com/product/TPS5420> : contains the data sheet and other resources.

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