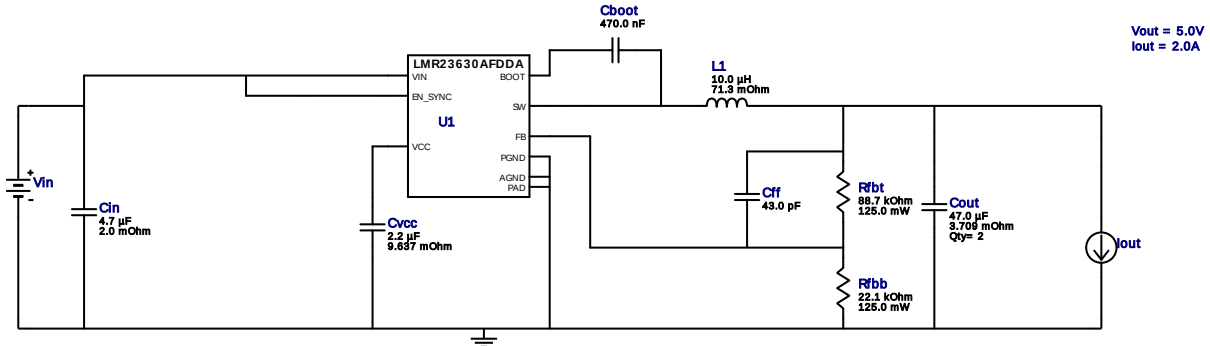


## WEBENCH® Design Report

Design : 4077713/50 LMR23630AFDDAR  
LMR23630AFDDAR 12.0V-36.0V to 5.00V @ 2.0A


1. The input capacitor included in the BOM only contains a small filter capacitor that should be placed near the IC. Depending on where the power supply is laid out in the system additional bulk capacitance may need to be added to filter the line ripple.
2. If there is no VinTyp specified, WEBENCH will use the VinMax value. To change the VinTyp value, click on the "Change Design Inputs" button under the Optimization Tuning knob. In some applications, while the design requires the input voltage to be a wide range, for a majority of the time, it is operating at a much lower voltage than the maximum input voltage. Sizing the inductor based on the maximum input voltage may yield an inductance much larger than typically needed, causing a larger footprint for the overall design. At the same time, components such as the input capacitor must be rated based on the maximum input voltage. WEBENCH now supports the use of this additional input voltage specification.

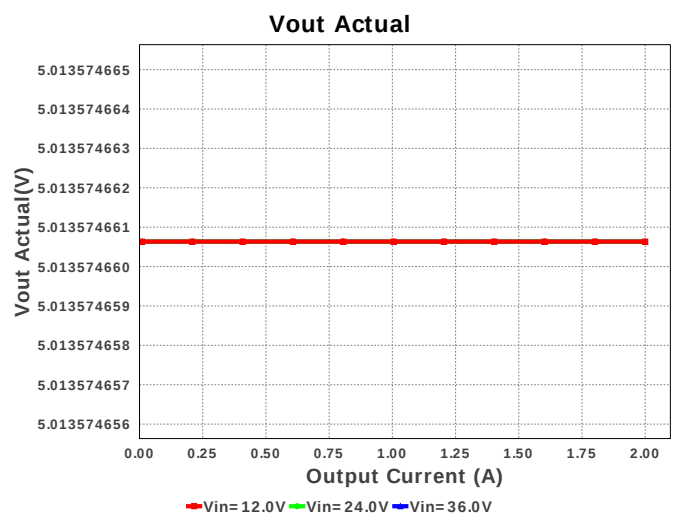
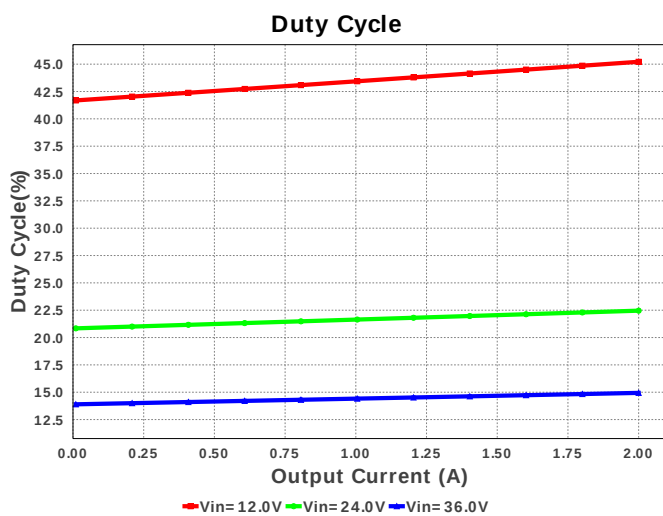
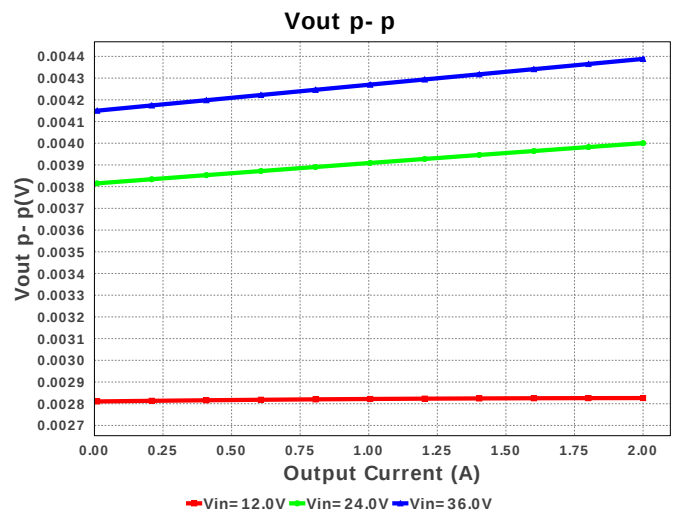
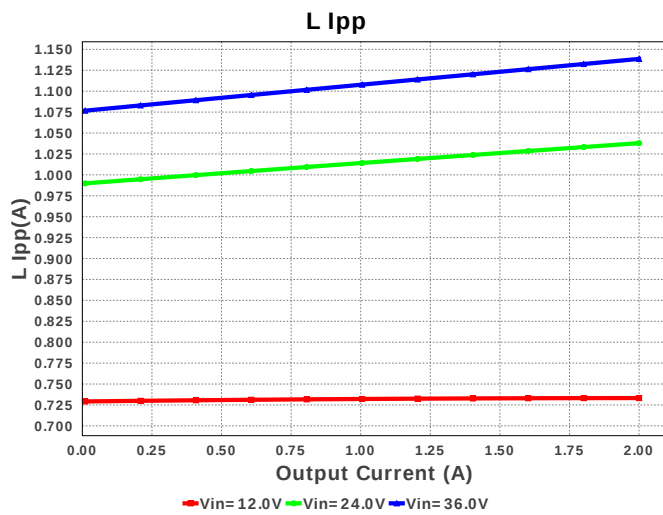
### My Comments

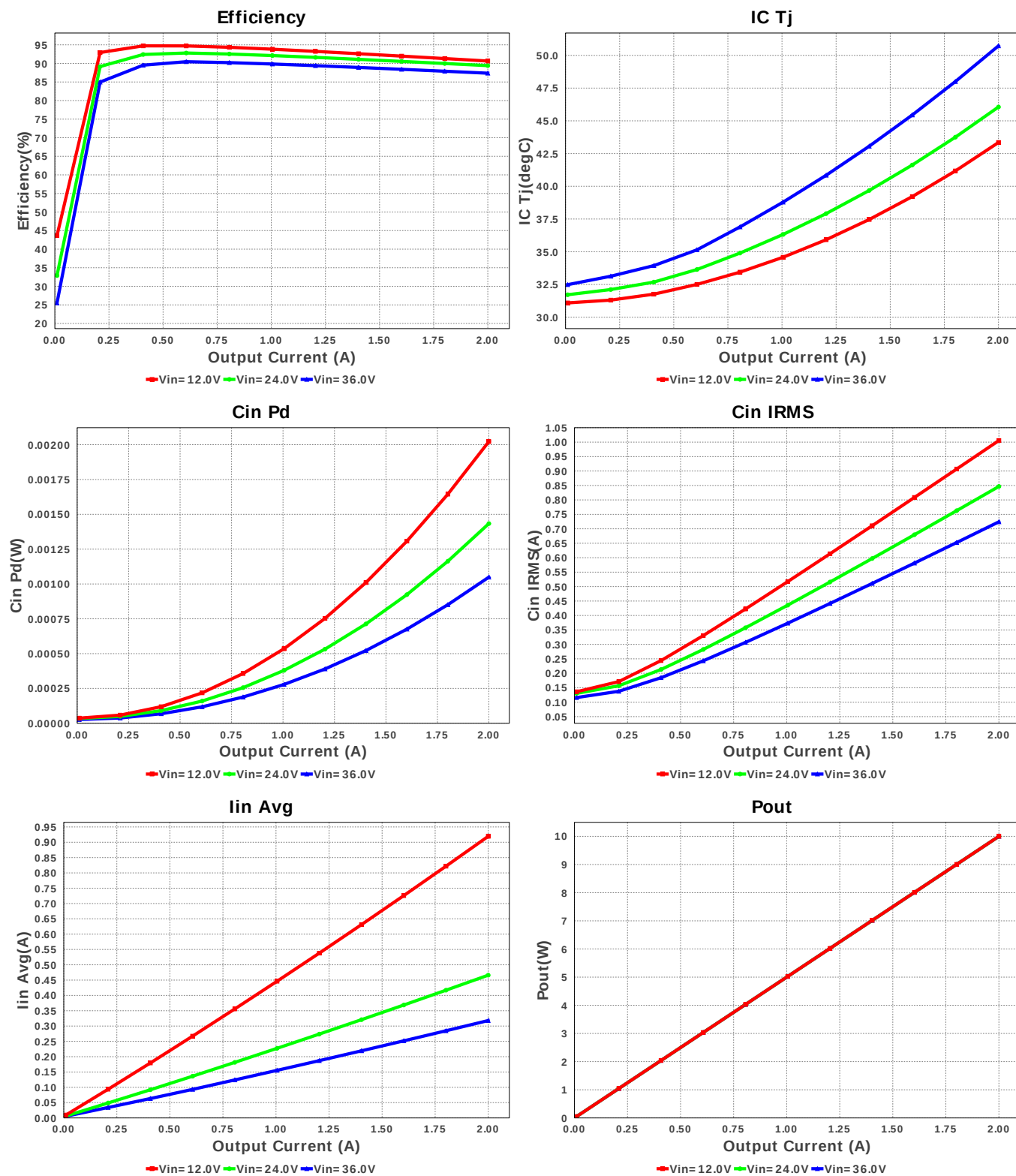
No comments

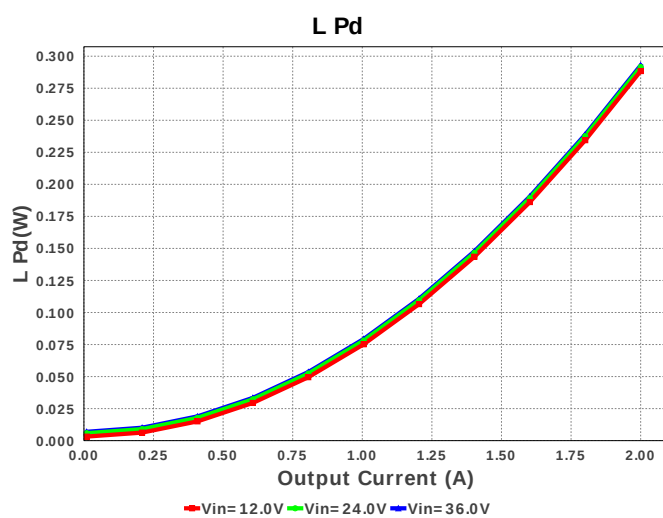
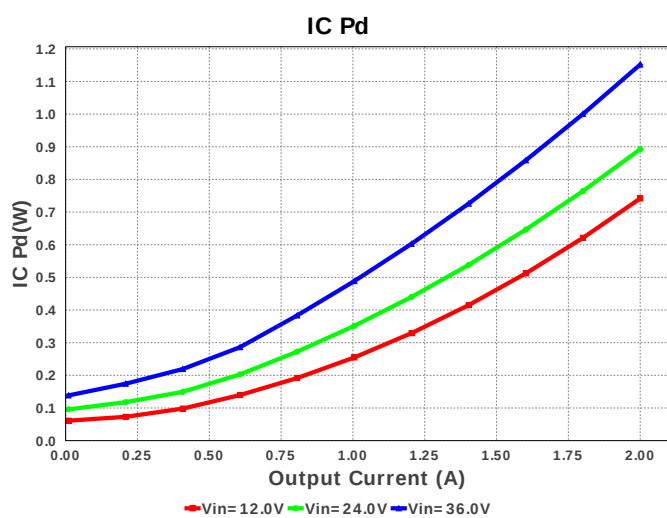
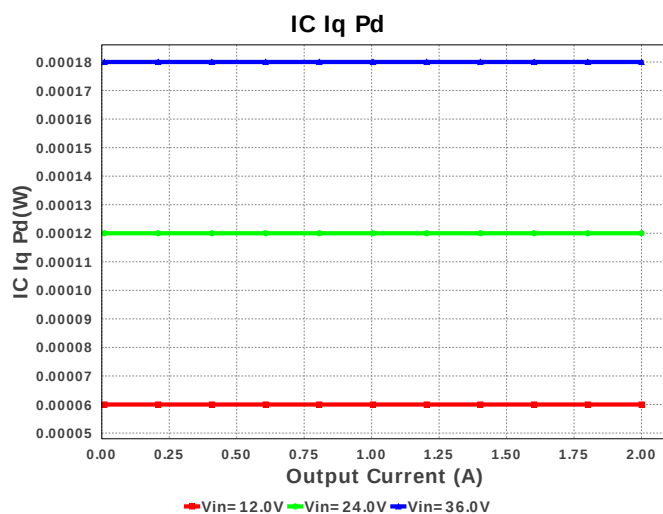
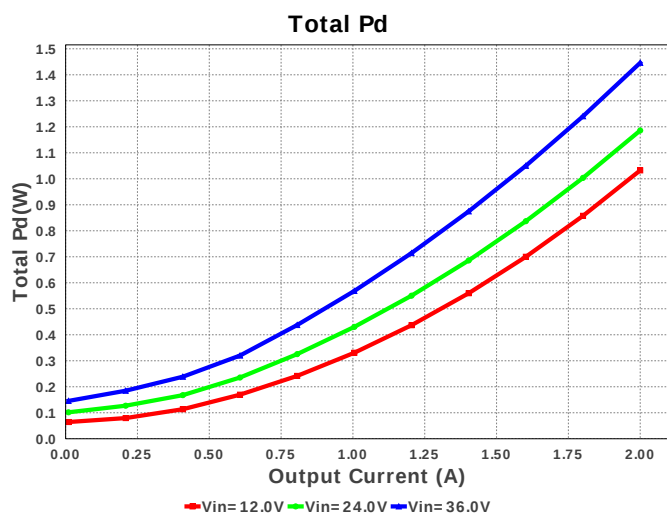
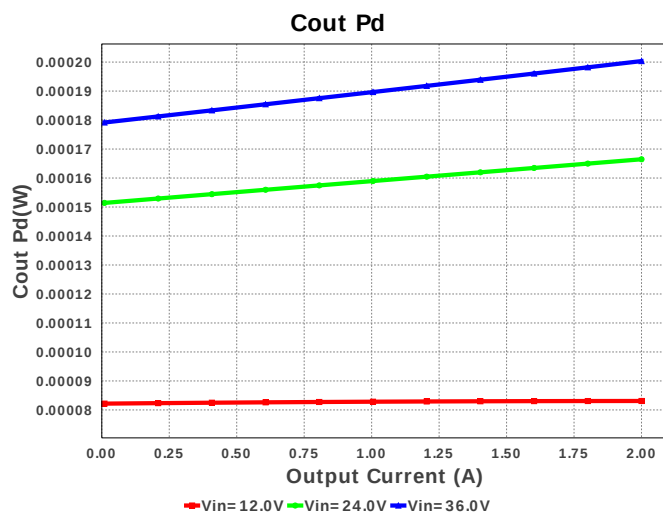
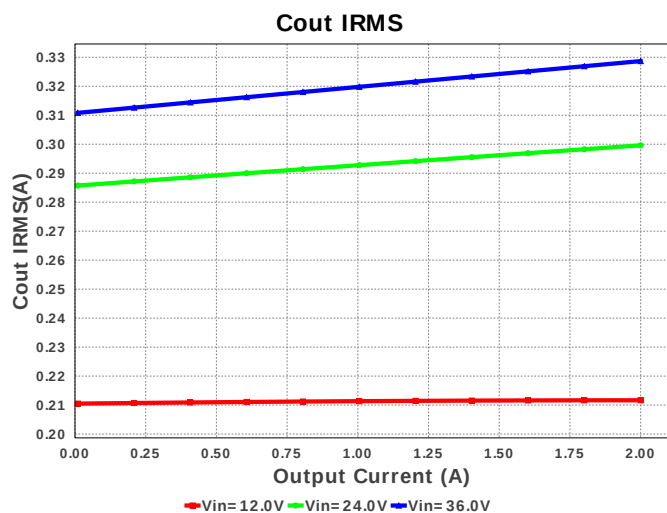
### Electrical BOM

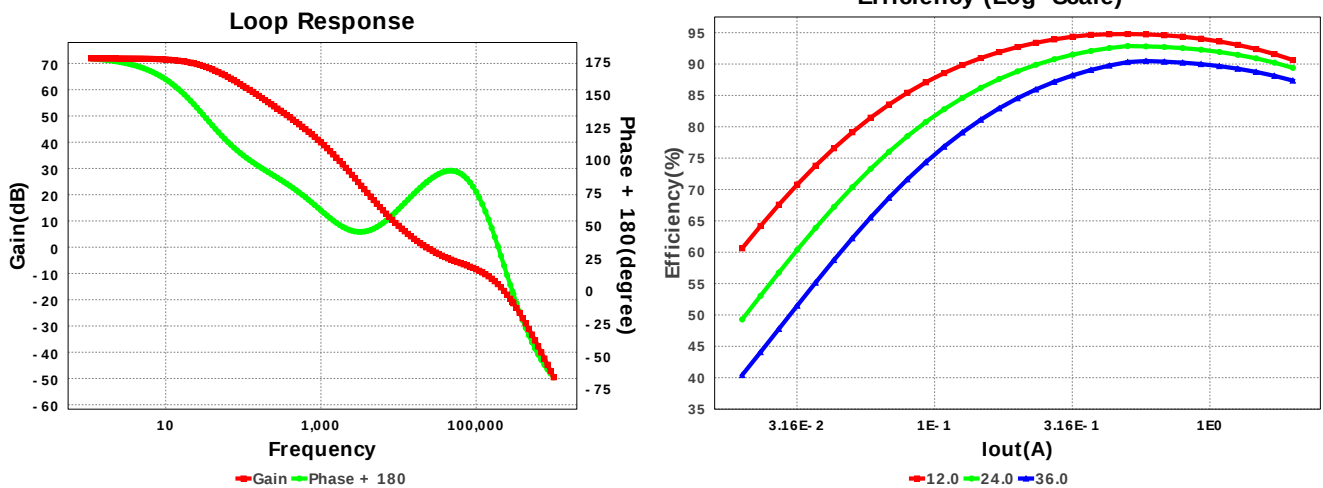
| #  | Name  | Manufacturer              | Part Number                        | Properties                                                       | Qty | Price  | Footprint                                                                                                               |
|----|-------|---------------------------|------------------------------------|------------------------------------------------------------------|-----|--------|-------------------------------------------------------------------------------------------------------------------------|
| 1. | Cboot | MuRata                    | GRM21BR72A474KA73L<br>Series= X7R  | Cap= 470.0 nF<br>VDC= 100.0 V<br>IRMS= 0.0 A                     | 1   | \$0.13 | <br>0805 7 mm <sup>2</sup>         |
| 2. | Cff   | Samsung Electro-Mechanics | CL21C430JBANNNC<br>Series= C0G/NP0 | Cap= 43.0 pF<br>VDC= 50.0 V<br>IRMS= 0.0 A                       | 1   | \$0.01 | <br>0805 7 mm <sup>2</sup>         |
| 3. | 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      | 1   | \$0.19 | <br>1210 15 mm <sup>2</sup>        |
| 4. | Cout  | MuRata                    | GRM31CR61A476KE15L<br>Series= X5R  | Cap= 47.0 uF<br>ESR= 3.709 mOhm<br>VDC= 10.0 V<br>IRMS= 4.2862 A | 2   | \$0.15 | <br>1206_190 11 mm <sup>2</sup>    |
| 5. | Cvcc  | MuRata                    | GRM188R60J225KE19D<br>Series= X5R  | Cap= 2.2 uF<br>ESR= 9.637 mOhm<br>VDC= 6.3 V<br>IRMS= 1.32271 A  | 1   | \$0.02 | <br>0603 5 mm <sup>2</sup>         |
| 6. | L1    | Vishay-Dale               | IHLP2525EZER100M01                 | L= 10.0 uH<br>DCR= 71.3 mOhm                                     | 1   | \$1.40 | <br>IHLP-2525EZ 81 mm <sup>2</sup> |
| 7. | Rfbb  | Panasonic                 | ERJ-6ENF2212V<br>Series= ERJ-6E    | Res= 22.1 kOhm<br>Power= 125.0 mW<br>Tolerance= 1.0%             | 1   | \$0.01 | <br>0805 7 mm <sup>2</sup>         |
| 8. | Rfht  | Panasonic                 | ERJ-6ENF8872V<br>Series= ERJ-6E    | Res= 88.7 kOhm<br>Power= 125.0 mW<br>Tolerance= 1.0%             | 1   | \$0.01 | <br>0805 7 mm <sup>2</sup>         |

| #  | Name | Manufacturer      | Part Number    | Properties | Qty | Price  | Footprint                                                                                                            |
|----|------|-------------------|----------------|------------|-----|--------|----------------------------------------------------------------------------------------------------------------------|
| 9. | U1   | Texas Instruments | LMR23630AFDDAR | Switcher   | 1   | \$1.40 | <br>DDA0008E_N 57 mm <sup>2</sup> |









## Operating Values

| #   | Name                | Value                 | Category | Description                                                                                |
|-----|---------------------|-----------------------|----------|--------------------------------------------------------------------------------------------|
| 1.  | Cin IRMS            | 724.175 mA            | Current  | Input capacitor RMS ripple current                                                         |
| 2.  | Cout IRMS           | 328.677 mA            | Current  | Output capacitor RMS ripple current                                                        |
| 3.  | Iin Avg             | 317.94 mA             | Current  | Average input current                                                                      |
| 4.  | L Ipp               | 1.139 A               | Current  | Peak-to-peak inductor ripple current                                                       |
| 5.  | BOM Count           | 10                    | General  | Total Design BOM count                                                                     |
| 6.  | FootPrint           | 206.0 mm <sup>2</sup> | General  | Total Foot Print Area of BOM components                                                    |
| 7.  | Frequency           | 400.0 kHz             | General  | Switching frequency                                                                        |
| 8.  | Pout                | 10.0 W                | General  | Total output power                                                                         |
| 9.  | Total BOM           | \$3.47                | General  | Total BOM Cost                                                                             |
| 10. | ICThetaJA Effective | 18.0 degC/W           | Op_Point | Effective IC Junction-to-Ambient Thermal Resistance                                        |
| 11. | Low Freq Gain       | 71.902 dB             | Op_Point | Gain at 10Hz                                                                               |
| 12. | Vout Actual         | 5.014 V               | Op_Point | Vout Actual calculated based on selected voltage divider resistors                         |
| 13. | Vout OP             | 5.0 V                 | Op_Point | Operational Output Voltage                                                                 |
| 14. | Cross Freq          | 22.926 kHz            | Op_point | Bode plot crossover frequency                                                              |
| 15. | Duty Cycle          | 14.939 %              | Op_point | Duty cycle                                                                                 |
| 16. | Efficiency          | 87.366 %              | Op_point | Steady state efficiency                                                                    |
| 17. | Gain Marg           | -20.815 dB            | Op_point | Bode Plot Gain Margin                                                                      |
| 18. | IC Tj               | 50.726 degC           | Op_point | IC junction temperature                                                                    |
| 19. | IOUT_OP             | 2.0 A                 | Op_point | Iout operating point                                                                       |
| 20. | Phase Marg          | 83.325 deg            | Op_point | Bode Plot Phase Margin                                                                     |
| 21. | VIN_OP              | 36.0 V                | Op_point | Vin operating point                                                                        |
| 22. | Vout p-p            | 4.388 mV              | Op_point | Peak-to-peak output ripple voltage                                                         |
| 23. | Cin Pd              | 1.049 mW              | Power    | Input capacitor power dissipation                                                          |
| 24. | Cout Pd             | 200.339 μW            | Power    | Output capacitor power dissipation                                                         |
| 25. | IC Iq Pd            | 180.0 μW              | Power    | IC Iq Pd                                                                                   |
| 26. | IC Pd               | 1.152 W               | Power    | IC power dissipation                                                                       |
| 27. | L Pd                | 292.902 mW            | Power    | Inductor power dissipation                                                                 |
| 28. | Total Pd            | 1.446 W               | Power    | Total Power Dissipation                                                                    |
| 29. | Vout Tolerance      | 3.65 %                |          | 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  | 36.0       | Maximum input voltage  |
| 3. | VinMin  | 12.0       | Minimum input voltage  |
| 4. | Vout    | 5.0        | Output Voltage         |
| 5. | base_pn | LMR23630AF | Base Product Number    |
| 6. | source  | DC         | Input Source Type      |
| 7. | Ta      | 30.0       | Ambient temperature    |

## Design Assistance

1. **LMR23630AF** Product Folder : <http://www.ti.com/product/LMR23630> : contains the data sheet and other resources.

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