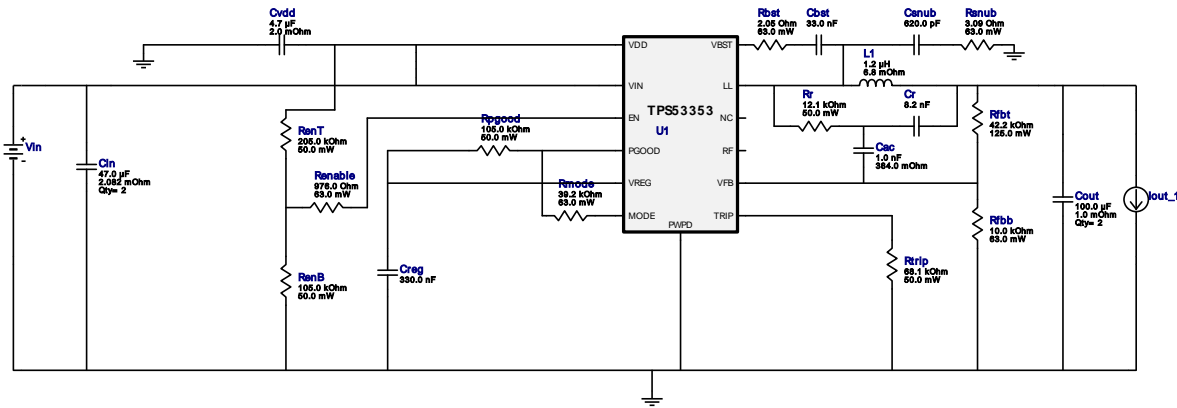


**WEBENCH® Design Report**

 Design : TPS53353DQPR  
 TPS53353DQPR 11.0V-13.0V to 3.30V @ 9.0A

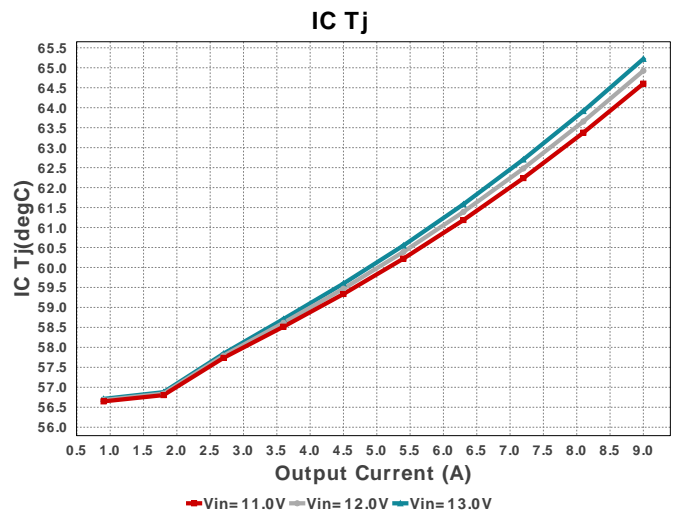
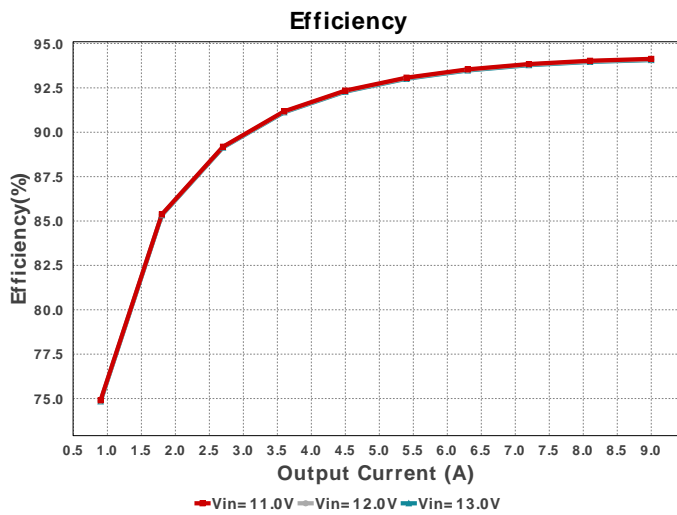
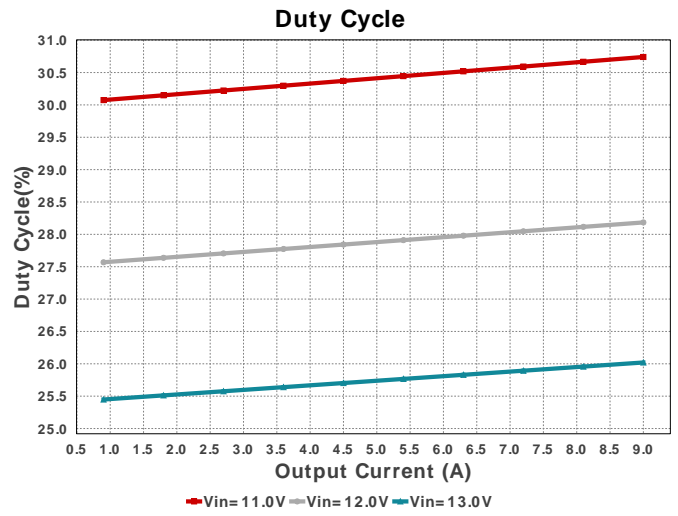
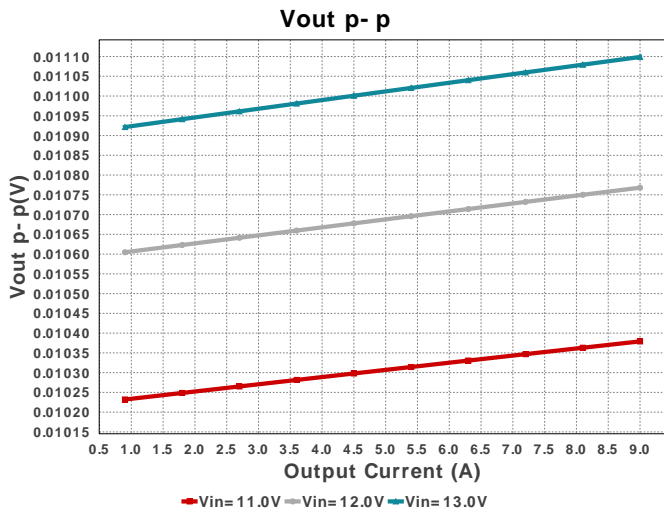
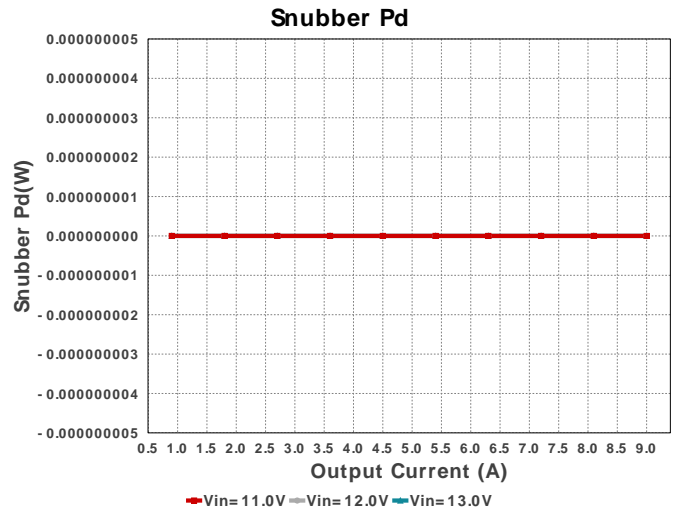
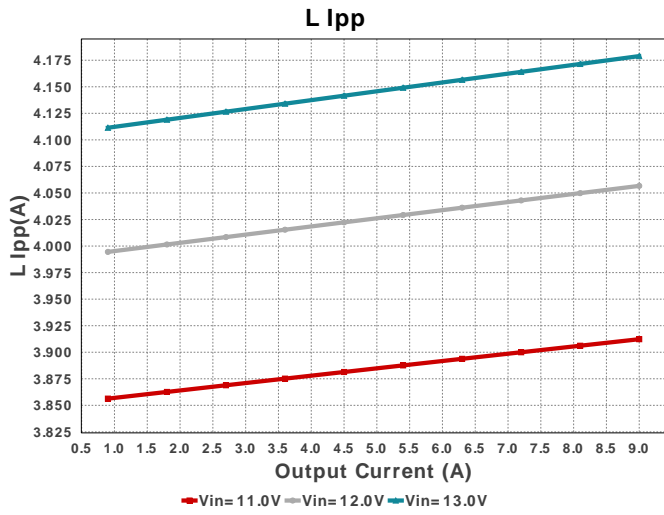
 Vout = 3.3V  
 Iout = 9.0A

**My Comments**

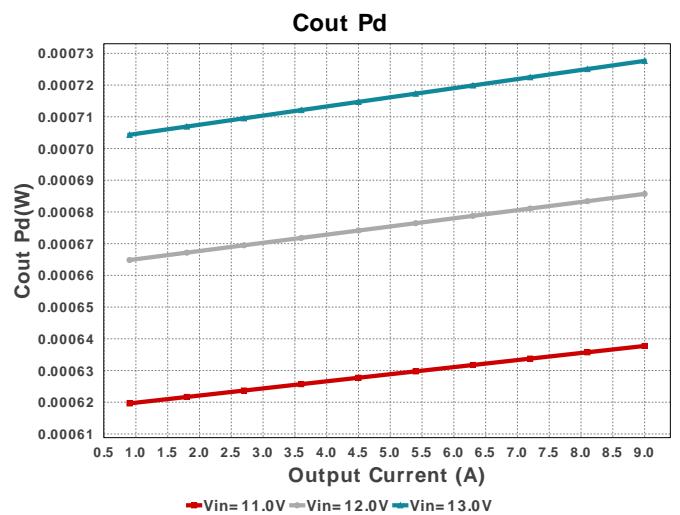
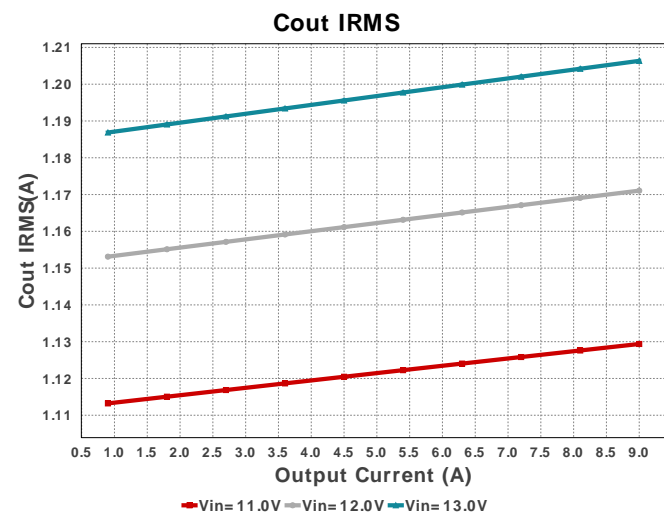
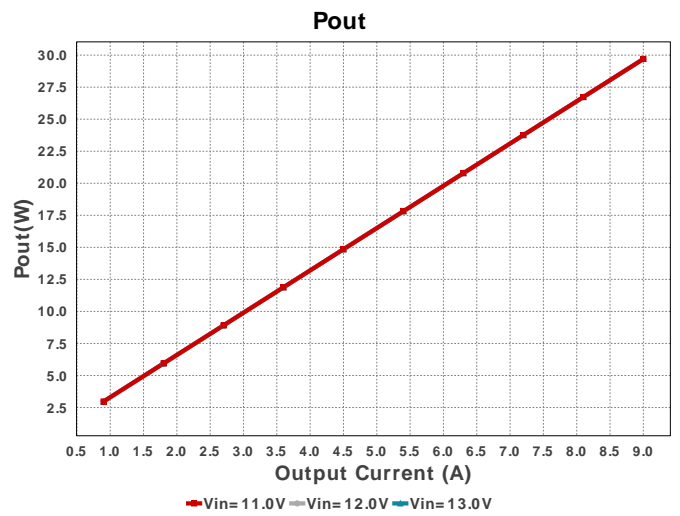
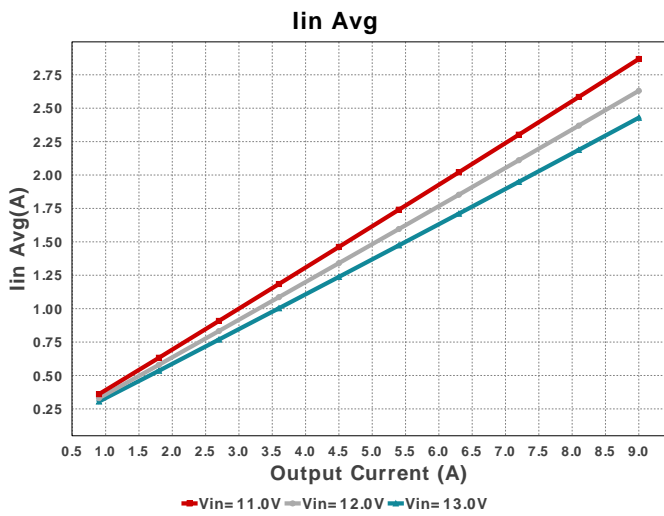
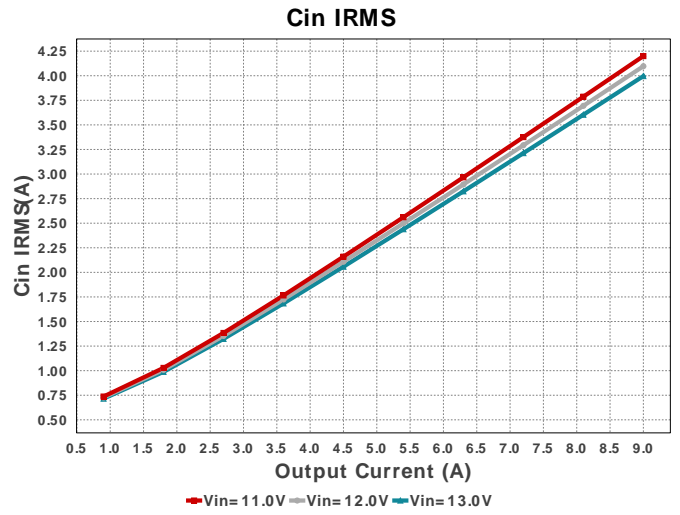
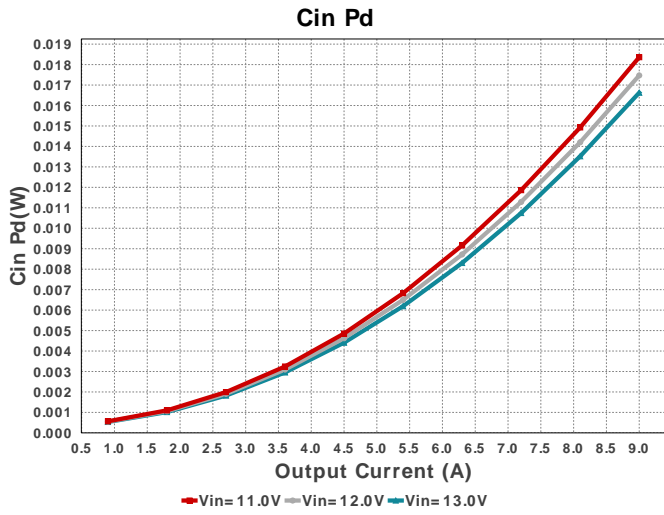
No comments

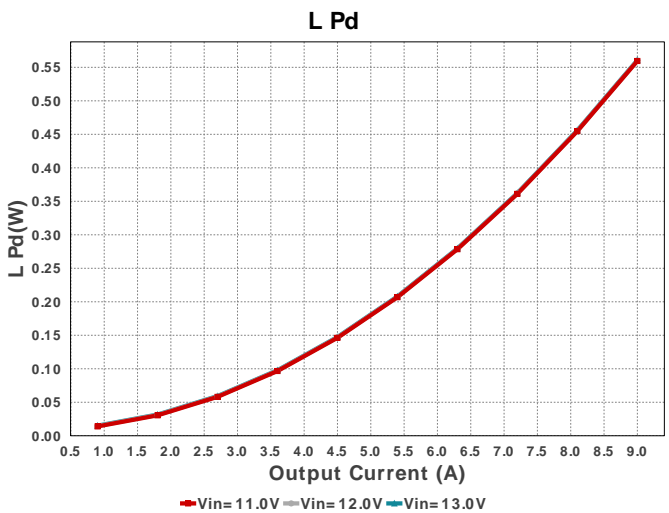
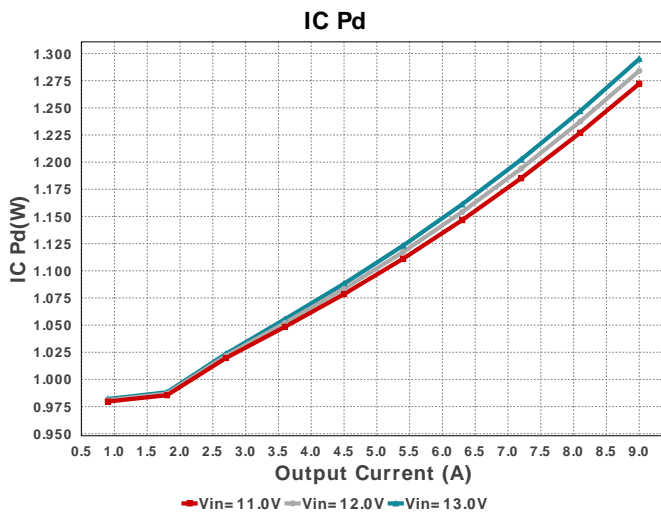
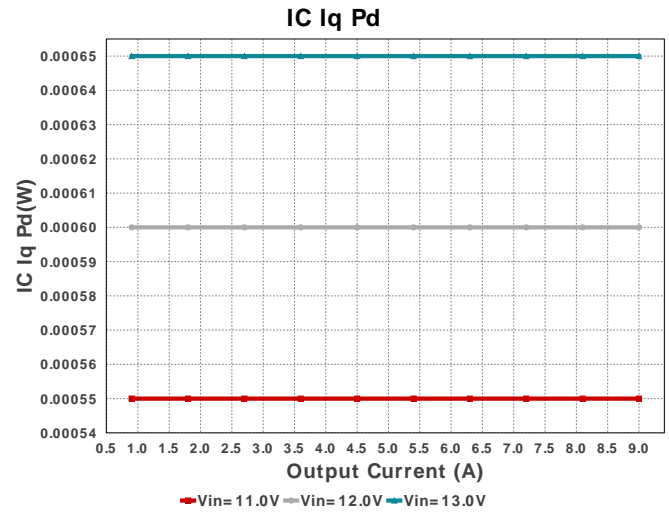
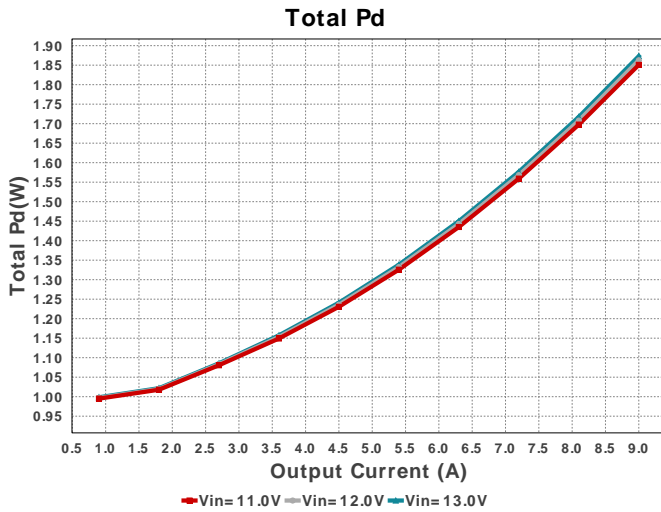
**Electrical BOM**

| #  | Name  | Manufacturer              | Part Number                             | Properties   | Qty | Price  | Footprint               |
|----|-------|---------------------------|---|--|-----|--------|-------------------------|
| 1. | Cac   | Kemet                     | C0805C102K5RACTU<br>Series= X7R         | Cap= 1.0 nF<br>ESR= 384.0 mOhm<br>VDC= 50.0 V<br>IRMS= 214.0 mA  | 1   | \$0.01 | 0805 7 mm <sup>2</sup>  |
| 2. | Cbst  | TDK                       | CGA4J2C0G1H333J125AA<br>Series= C0G/NP0 | Cap= 33.0 nF<br>VDC= 50.0 V<br>IRMS= 0.0 A                       | 1   | \$0.10 | 0805 7 mm <sup>2</sup>  |
| 3. | Cin   | TDK                       | C3216X5R1E476M160AC<br>Series= X5R      | Cap= 47.0 uF<br>ESR= 2.082 mOhm<br>VDC= 25.0 V<br>IRMS= 5.0279 A | 2   | \$0.44 | 1206 11 mm <sup>2</sup> |
| 4. | Cin   | TDK                       | C3216X5R1E476M160AC<br>Series= X5R      | Cap= 47.0 uF<br>ESR= 2.082 mOhm<br>VDC= 25.0 V<br>IRMS= 5.0279 A | 2   | \$0.44 | 1206 11 mm <sup>2</sup> |
| 5. | Cout  | Taiyo Yuden               | JMK316BJ107ML-T<br>Series= X5R          | Cap= 100.0 uF<br>ESR= 1.0 mOhm<br>VDC= 6.3 V<br>IRMS= 0.0 A      | 2   | \$0.33 | 1206 11 mm <sup>2</sup> |
| 6. | Cr    | Samsung Electro-Mechanics | CL21C822JBFNNNE<br>Series= C0G/NP0      | Cap= 8.2 nF<br>VDC= 50.0 V<br>IRMS= 0.0 A                        | 1   | \$0.02 | 0805 7 mm <sup>2</sup>  |
| 7. | Creg  | Panasonic                 | EPCU1C334MA5<br>Series= EPCU(A)         | Cap= 330.0 nF<br>VDC= 16.0 V<br>IRMS= 0.0 A                      | 1   | \$0.16 | 1206 11 mm <sup>2</sup> |
| 8. | Csnub | Samsung Electro-Mechanics | CL21C621JBCNNNC<br>Series= C0G/NP0      | Cap= 620.0 pF<br>VDC= 50.0 V<br>IRMS= 0.0 A                      | 1   | \$0.01 | 0805 7 mm <sup>2</sup>  |
| 9. | Cvdd  | MuRata                    | GRM21BR61E475MA12L<br>Series= X5R       | Cap= 4.7 uF<br>ESR= 2.0 mOhm<br>VDC= 25.0 V<br>IRMS= 7.29 A      | 1   | \$0.03 | 0805 7 mm <sup>2</sup>  |

| #   | Name    | Manufacturer      | Part Number                          | Properties   | Qty | Price  | Footprint  |
|-----|---------|-------------------|--------------------------------------|--|-----|--------|--|
| 10. | L1      | Coilcraft         | XAL6030-122MEB                       | L= 1.2 $\mu$ H<br>DCR= 6.8 mOhm                      | 1   | \$0.65 | <br>XAL6030 72 mm <sup>2</sup>    |
| 11. | Rbst    | Vishay-Dale       | CRCW04022R05FKED<br>Series= CRCW..e3 | Res= 2.05 Ohm<br>Power= 63.0 mW<br>Tolerance= 1.0%   | 1   | \$0.01 | <br>0402 3 mm <sup>2</sup>        |
| 12. | RenB    | Yageo             | RC0201FR-07105KL<br>Series= ?        | Res= 105.0 kOhm<br>Power= 50.0 mW<br>Tolerance= 1.0% | 1   | \$0.01 | <br>0201 2 mm <sup>2</sup>        |
| 13. | RenT    | Yageo             | RC0201FR-07205KL<br>Series= ?        | Res= 205.0 kOhm<br>Power= 50.0 mW<br>Tolerance= 1.0% | 1   | \$0.01 | <br>0201 2 mm <sup>2</sup>        |
| 14. | Renable | Vishay-Dale       | CRCW0402976RFKED<br>Series= CRCW..e3 | Res= 976.0 Ohm<br>Power= 63.0 mW<br>Tolerance= 1.0%  | 1   | \$0.01 | <br>0402 3 mm <sup>2</sup>        |
| 15. | Rfbb    | Vishay-Dale       | CRCW040210K0FKED<br>Series= CRCW..e3 | Res= 10.0 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0%  | 1   | \$0.01 | <br>0402 3 mm <sup>2</sup>        |
| 16. | Rfbt    | Vishay-Dale       | CRCW080542K2FKEA<br>Series= CRCW..e3 | Res= 42.2 kOhm<br>Power= 125.0 mW<br>Tolerance= 1.0% | 1   | \$0.01 | <br>0805 7 mm <sup>2</sup>        |
| 17. | Rmode   | Vishay-Dale       | CRCW040239K2FKED<br>Series= CRCW..e3 | Res= 39.2 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0%  | 1   | \$0.01 | <br>0402 3 mm <sup>2</sup>        |
| 18. | Rpgood  | Yageo             | RC0201FR-07105KL<br>Series= ?        | Res= 105.0 kOhm<br>Power= 50.0 mW<br>Tolerance= 1.0% | 1   | \$0.01 | <br>0201 2 mm <sup>2</sup>        |
| 19. | Rr      | Yageo             | RC0201FR-0712K1L<br>Series= ?        | Res= 12.1 kOhm<br>Power= 50.0 mW<br>Tolerance= 1.0%  | 1   | \$0.01 | <br>0201 2 mm <sup>2</sup>      |
| 20. | Rsnub   | Vishay-Dale       | CRCW04023R09FKED<br>Series= CRCW..e3 | Res= 3.09 Ohm<br>Power= 63.0 mW<br>Tolerance= 1.0%   | 1   | \$0.01 | <br>0402 3 mm <sup>2</sup>      |
| 21. | Rtrip   | Yageo             | RC0201FR-0768K1L<br>Series= ?        | Res= 68.1 kOhm<br>Power= 50.0 mW<br>Tolerance= 1.0%  | 1   | \$0.01 | <br>0201 2 mm <sup>2</sup>      |
| 22. | U1      | Texas Instruments | TPS53353DQPR                         | Switcher   | 1   | \$3.05 | <br>DQP0022A 56 mm <sup>2</sup> |







### Operating Values

| #   | Name           | Value                 | Category | Description  |
|-----|----------------|-----------------------|----------|--|
| 1.  | Cin IRMS       | 3.996 A               | Current  | Input capacitor RMS ripple current   |
| 2.  | Cout IRMS      | 1.206 A               | Current  | Output capacitor RMS ripple current  |
| 3.  | Iin Avg        | 2.429 A               | Current  | Average input current  |
| 4.  | L Ipp          | 4.179 A               | Current  | Peak-to-peak inductor ripple current   |
| 5.  | BOM Count      | 25                    | General  | Total Design BOM count   |
| 6.  | FootPrint      | 270.0 mm <sup>2</sup> | General  | Total Foot Print Area of BOM components  |
| 7.  | Frequency      | 500.0 kHz             | General  | Switching frequency  |
| 8.  | Mode           | CCM                   | General  | Conduction Mode  |
| 9.  | Pout           | 29.7 W                | General  | Total output power   |
| 10. | Total BOM      | \$6.56                | General  | Total BOM Cost   |
| 11. | Duty Cycle     | 26.02 %               | Op Point | Duty cycle   |
| 12. | Efficiency     | 93.912 %              | Op Point | Steady state efficiency  |
| 13. | IC Tj          | 65.223 degC           | Op Point | IC junction temperature  |
| 14. | ICThetaJA      | 27.2 degC/W           | Op Point | IC junction-to-ambient thermal resistance  |
| 15. | IOUT_OP        | 9.0 A                 | Op Point | Iout operating point   |
| 16. | VIN_OP         | 13.0 V                | Op Point | Vin operating point  |
| 17. | Vout Actual    | 3.132 V               | Op Point | Vout Actual calculated based on selected voltage divider resistors                         |
| 18. | Vout OP        | 3.3 V                 | Op Point | Operational Output Voltage   |
| 19. | Vout Tolerance | 2.65 %                | Op Point | Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable |
| 20. | Vout p-p       | 11.099 mV             | Op Point | Peak-to-peak output ripple voltage   |
| 21. | Cin Pd         | 16.626 mW             | Power    | Input capacitor power dissipation  |
| 22. | Cout Pd        | 727.632 μW            | Power    | Output capacitor power dissipation   |
| 23. | IC Iq Pd       | 650.0 μW              | Power    | IC Iq Pd   |
| 24. | IC Pd          | 1.295 W               | Power    | IC power dissipation   |
| 25. | L Pd           | 560.696 mW            | Power    | Inductor power dissipation   |
| 26. | Snubber Pd     | 52.39 mW              | Power    | Snubber Power Dissipation  |
| 27. | Total Pd       | 1.922 W               | Power    | Total Power Dissipation  |

### Design Inputs

| #  | Name    | Value    | Description            |
|----|---------|----------|------------------------|
| 1. | Iout    | 9.0      | Maximum Output Current |
| 2. | VinMax  | 13.0     | Maximum input voltage  |
| 3. | VinMin  | 11.0     | Minimum input voltage  |
| 4. | Vout    | 3.3      | Output Voltage         |
| 5. | base_pn | TPS53353 | Base Product Number    |
| 6. | source  | DC       | Input Source Type      |
| 7. | Ta      | 30.0     | Ambient temperature    |

## Design Assistance

1. **TPS53353** Product Folder : <http://www.ti.com/product/TPS53353> : contains the data sheet and other resources.

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