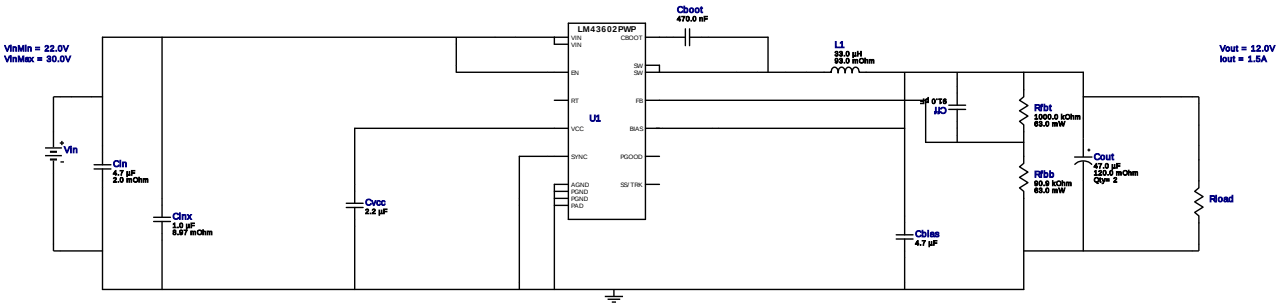
# WEBENCH® Design Report

VinMin = 22.0V
VinMax = 30.0V
Vout = 12.0V
Iout = 1.5A

Device = LM43602PWPR
Topology = Buck
Created = 2/18/15 3:58:25 AM
BOM Cost = $4.20
Footprint = 362.0 mm$^2$
BOM Count = 12
Total Pd = 0.94W

Design : 4270138/3 LM43602PWPR
LM43602PWPR 22.0V-30.0V to 12.00V @ 1.5A



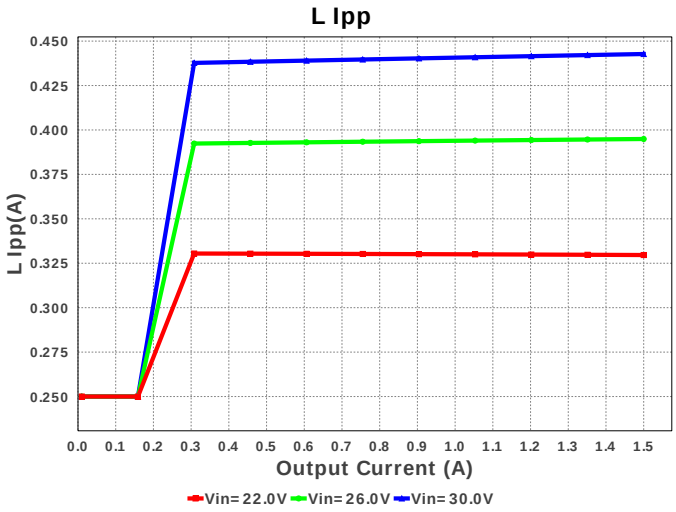

1. The input capacitor included in the BOM only contains a small filter capacitor that should be placed near the IC. Depending on where the power supply is laid out in the system additional bulk capacitance may need to be added to filter the line ripple.

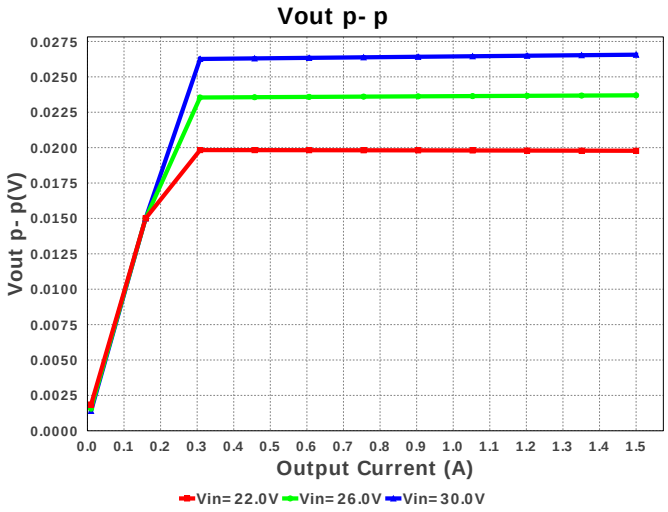
2. If there is no VinTyp specified, WEBENCH will use the VinMax value. To change the VinTyp value, click on the "Change Design Inputs" button under the Optimization Tuning knob. In some applications, while the design requires the input voltage to be a wide range, for a majority of the time, it is operating 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.

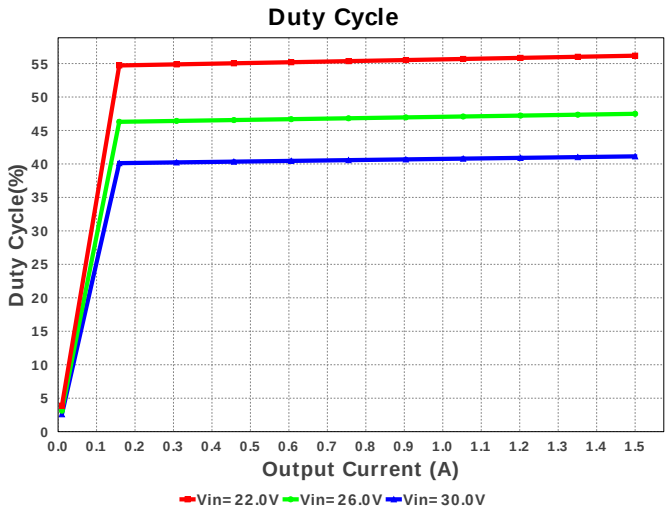
## Electrical BOM

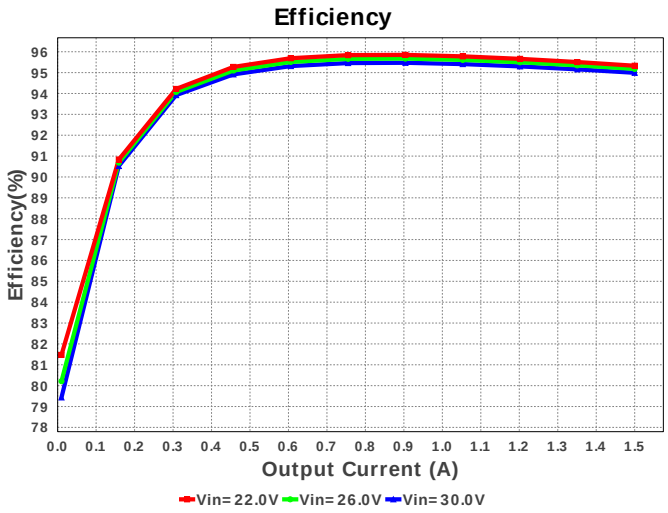
| # | Name | Manufacturer | Part Number | Properties | Qty | Price | Footprint |
|---|---|---|---|---|---|---|---|
| 1. | Cbias | MuRata | GRM21BC81E475KA12L<br>Series= 379 | Cap= 4.7 uF<br>VDC= 25.0 V<br>IRMS= 0.0 A | 1 | $0.04 | 0805 7 mm$^2$ |
| 2. | Cboot | MuRata | GRM21BR71H474KA88L<br>Series= X7R | Cap= 470.0 nF<br>VDC= 50.0 V<br>IRMS= 0.0 A | 1 | $0.05 | 0805 7 mm$^2$ |
| 3. | Cff | MuRata | GRM0335C1E910JA01D<br>Series= C0G | Cap= 91.0 pF<br>VDC= 25.0 V<br>IRMS= 0.0 A | 1 | $0.01 | 0201 2 mm$^2$ |
| 4. | 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 | $0.31 | 1210 15 mm$^2$ |
| 5. | Cinx | TDK | C3216X5R1H105K<br>Series= 285 | Cap= 1.0 uF<br>ESR= 8.97 mOhm<br>VDC= 50.0 V<br>IRMS= 0.0 A | 1 | $0.04 | 1206 11 mm$^2$ |
| 6. | Cout | Kemet | T495D476M025ATE120<br>Series= T495 | Cap= 47.0 uF<br>ESR= 120.0 mOhm<br>VDC= 25.0 V<br>IRMS= 1.006 A | 2 | $0.73 | 7343-31 59 mm$^2$ |
| 7. | Cvcc | Kemet | C0603C225K9PACTU<br>Series= X5R | Cap= 2.2 uF<br>VDC= 6.3 V<br>IRMS= 0.0 A | 1 | $0.02 | 0603 5 mm$^2$ |
| 8. | L1 | Coilcraft | MSS1038-333MLB | L= 33.0 µH<br>DCR= 93.0 mOhm | 1 | $0.50 | MSS1038 151 mm$^2$ |
| 9. | Rfbb | Vishay-Dale | CRCW040290K9FKED<br>Series= CRCW..e3 | Res= 90.9 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | 0402 3 mm$^2$ |

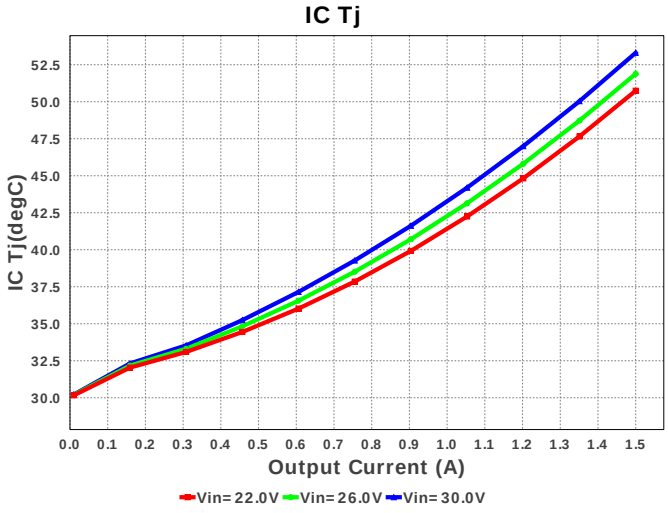
| # | Name | Manufacturer | Part Number | Properties | Qty | Price | Footprint |
|---|---|---|---|---|---|---|---|
| 10. | Rfbt | Vishay-Dale | CRCW04021M00FKED<br>Series= CRCW..e3 | Res= 1000.0 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | 0402 3 mm$^2$ |
| 11. | U1 | Texas Instruments | LM43602PWPR | Switcher | 1 | $1.75 | PWP0016F 42 mm$^2$ |

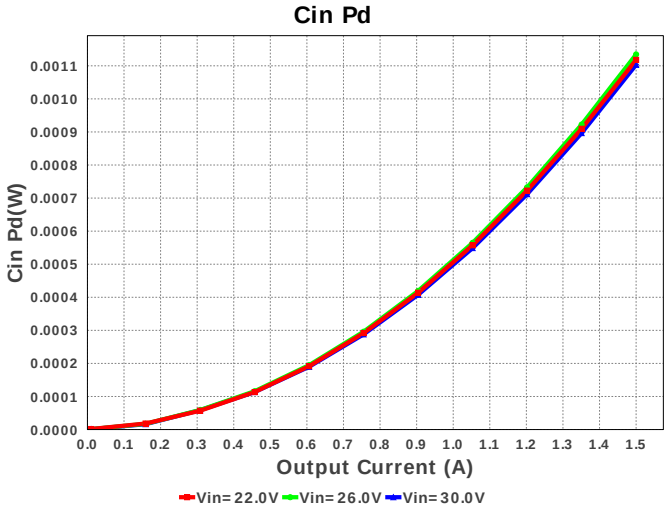


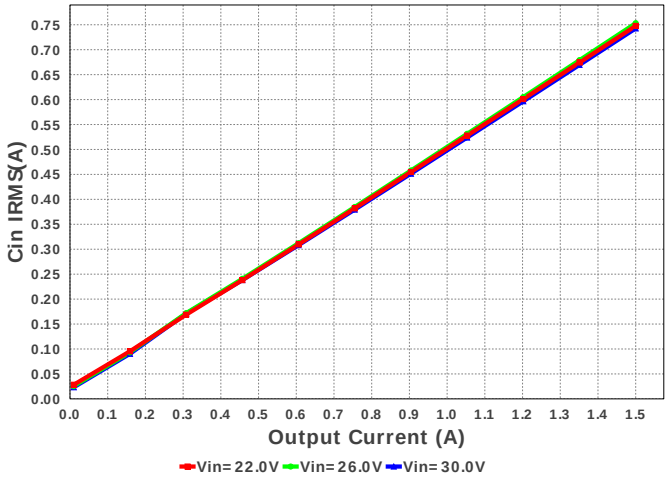



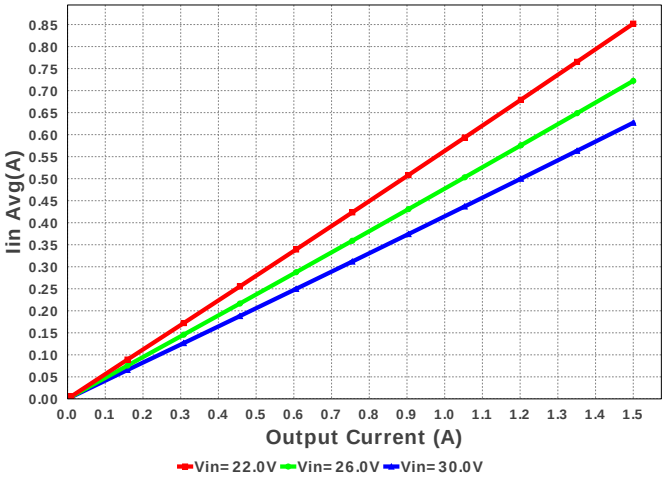



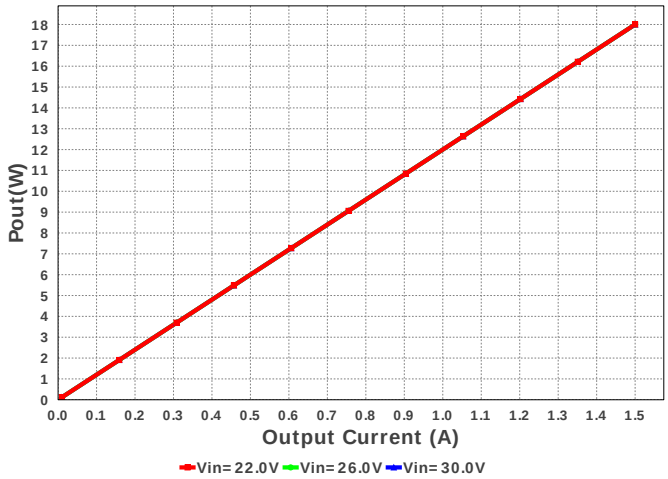
## Cin IRMS



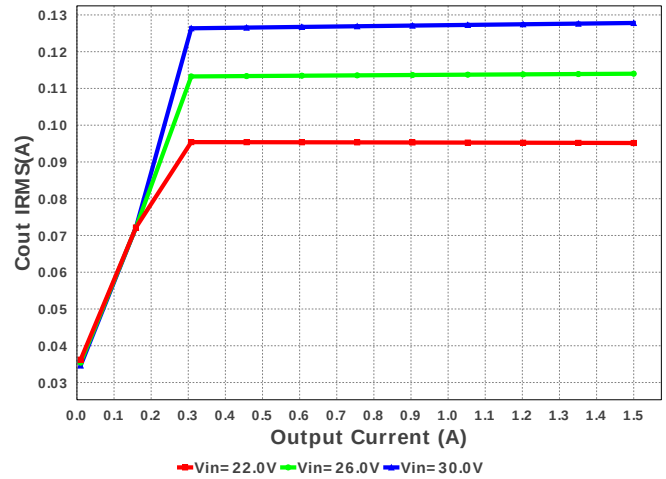

## Iin Avg



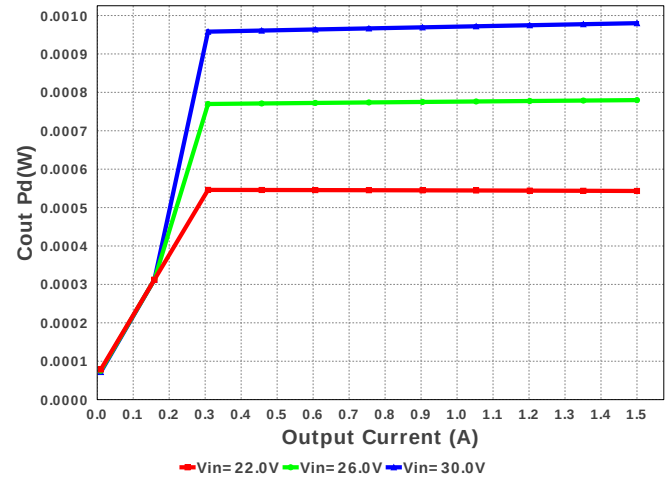

## Pout



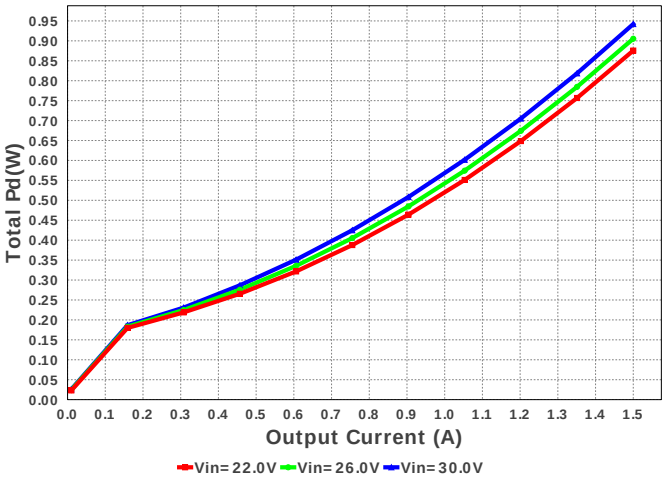

## Cout IRMS

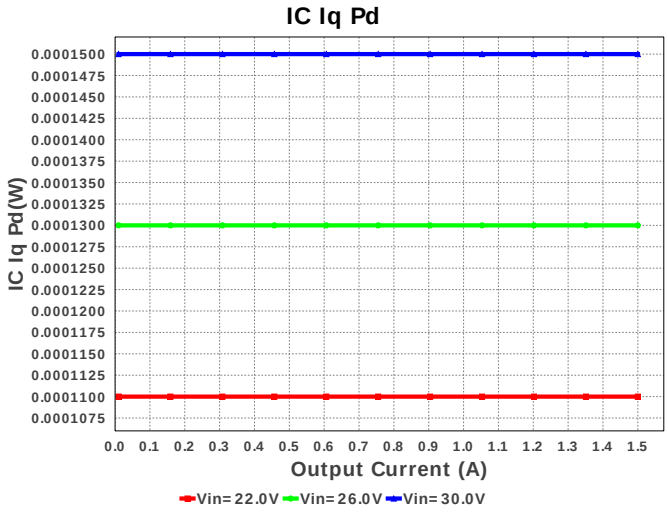


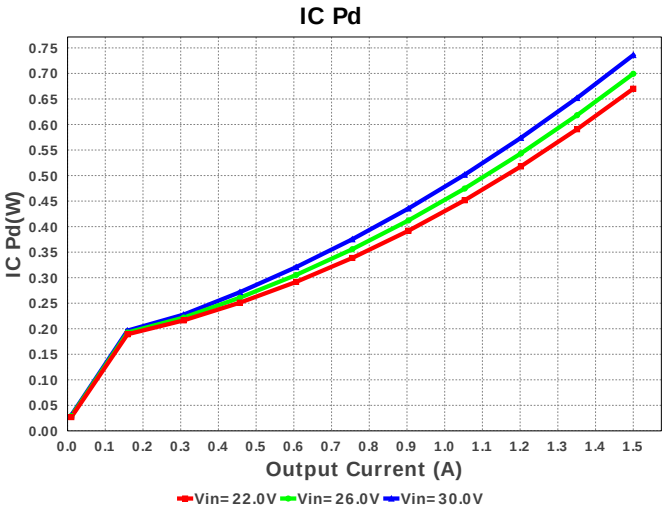

## Cout Pd

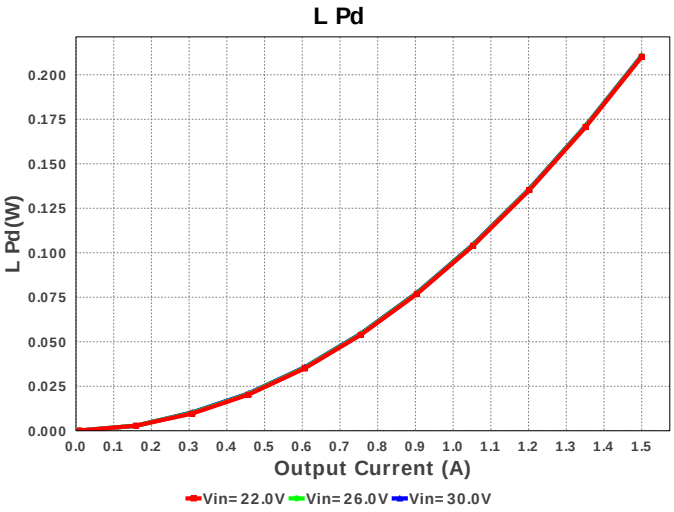


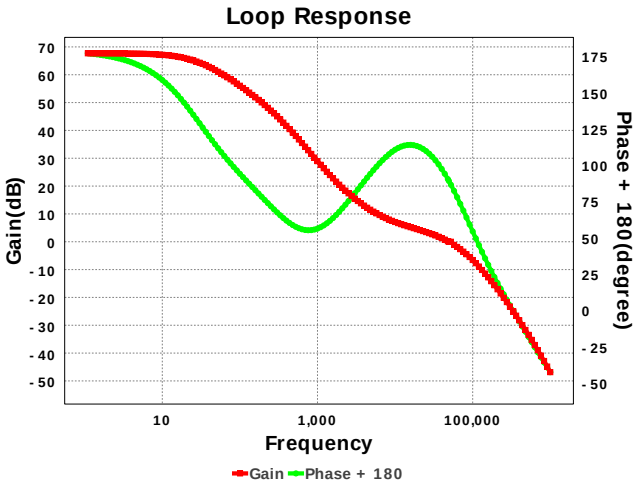

## Total Pd

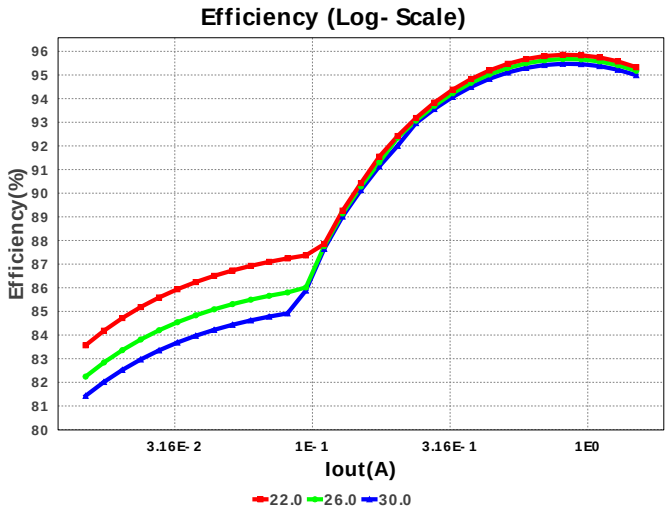





## Operating Values

| # | Name | Value | Category | Description |
|---|---|---|---|---|
| 1. | BOM Count | 12 | | Total Design BOM count |
| 2. | Total BOM | $4.2 | | Total BOM Cost |
| 3. | Cin IRMS | 742.652 mA | Current | Input capacitor RMS ripple current |
| 4. | Cout IRMS | 127.807 mA | Current | Output capacitor RMS ripple current |
| 5. | Iin Avg | 627.07 mA | Current | Average input current |
| 6. | L Ipp | 442.736 mA | Current | Peak-to-peak inductor ripple current |
| 7. | FootPrint | 362.0 $mm^2$ | General | Total Foot Print Area of BOM components |
| 8. | Frequency | 500.0 kHz | General | Switching frequency |
| 9. | Pout | 18.0 W | General | Total output power |
| 10. | Vout OP | 12.0 V | Op_Point | Operational Output Voltage |
| 11. | Cross Freq | 49.319 kHz | Op_point | Bode plot crossover frequency |

| # | Name | Value | Category | Description |
|---|---|---|---|---|
| 12. | Duty Cycle | 41.134 % | Op_point | Duty cycle |
| 13. | Efficiency | 94.992 % | Op_point | Steady state efficiency |
| 14. | IC Tj | 53.307 degC | Op_point | IC junction temperature |
| 15. | ICThetaJA | 38.9 degC/W | Op_point | IC junction-to-ambient thermal resistance |
| 16. | IOUT_OP | 1.5 A | Op_point | Iout operating point |
| 17. | Phase Marg | 89.75 deg | Op_point | Bode Plot Phase Margin |
| 18. | VIN_OP | 30.0 V | Op_point | Vin operating point |
| 19. | Vout p-p | 26.564 mV | Op_point | Peak-to-peak output ripple voltage |
| 20. | Cin Pd | 1.103 mW | Power | Input capacitor power dissipation |
| 21. | Cout Pd | 980.074 µW | Power | Output capacitor power dissipation |
| 22. | IC Iq Pd | 150.0 µW | Power | IC Iq Pd |
| 23. | IC Pd | 735.948 mW | Power | IC power dissipation |
| 24. | L Pd | 210.769 mW | Power | Inductor power dissipation |
| 25. | Total Pd | 942.11 mW | Power | Total Power Dissipation |

## Design Inputs

| # | Name | Value | Description |
|---|---|---|---|
| 1. | Iout | 1.5 | Maximum Output Current |
| 2. | Iout1 | 1.5 | Output Current #1 |
| 3. | VinMax | 30.0 | Maximum input voltage |
| 4. | VinMin | 22.0 | Minimum input voltage |
| 5. | Vout | 12.0 | Output Voltage |
| 6. | Vout1 | 12.0 | Output Voltage #1 |
| 7. | base_pn | LM43602 | Base Product Number |
| 8. | source | DC | Input Source Type |
| 9. | Ta | 30.0 | Ambient temperature |

## Design Assistance

1. **LM43602** Product Folder : http://www.ti.com/product/lm43602 : contains the data sheet and other resources.