# WEBENCH® Design Report

VinMin = 24.0V
VinMax = 32.0V
Vout = 3.0V
Iout = 0.35A

Device = LM3402MR/NOPB
Topology = Buck
Created = 6/9/15 6:15:07 PM
BOM Cost = $3.82
Footprint = 269.0 mm²
BOM Count = 10
Total Pd = 0.36W

Design : 4387412/4 LM3402MR/NOPB
LM3402MR/NOPB 24.0V-32.0V to 3.20V @ 0.35A

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**VinMax = 32.0V**

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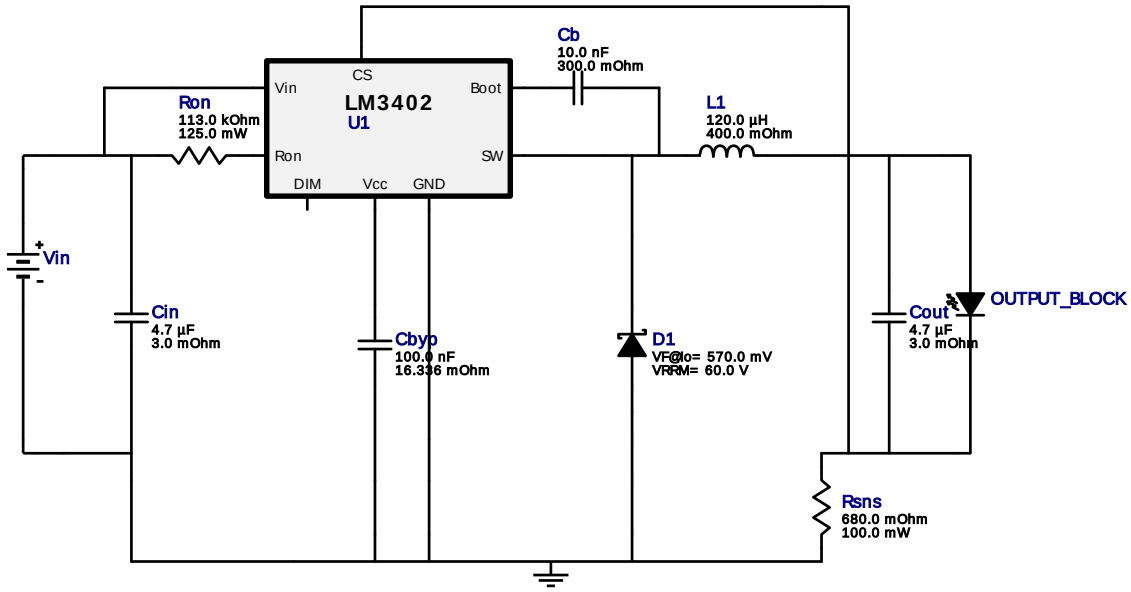
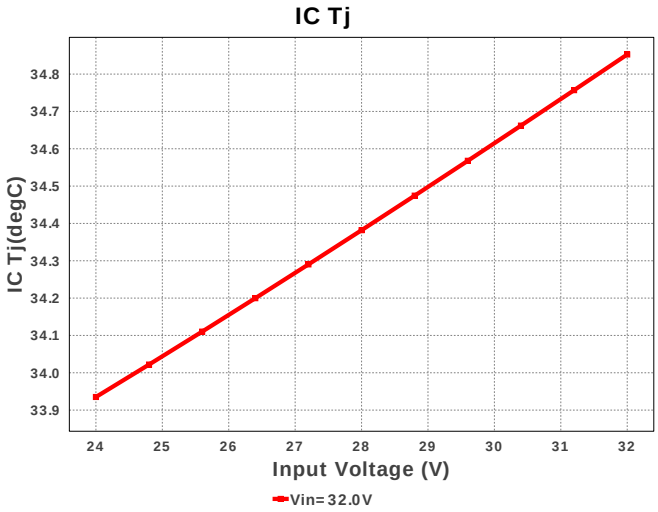
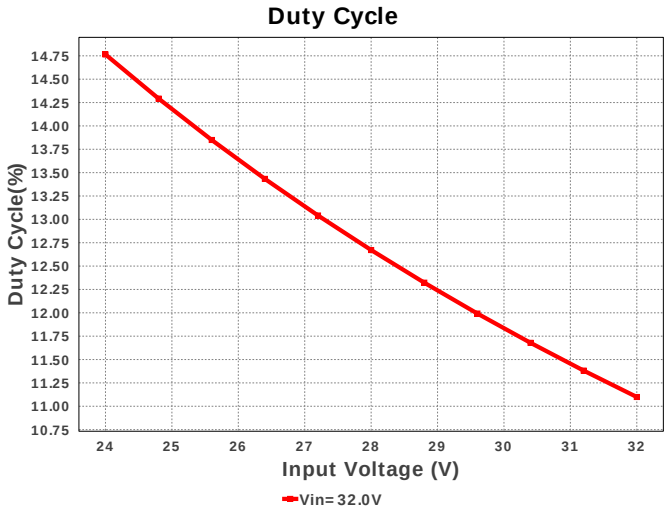


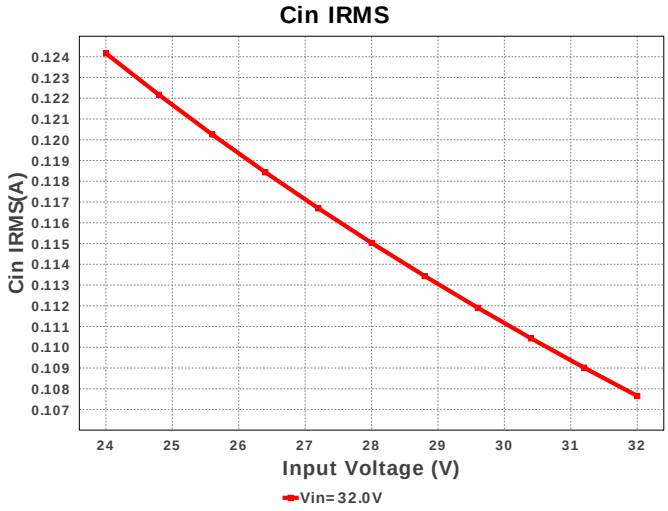

## Electrical BOM

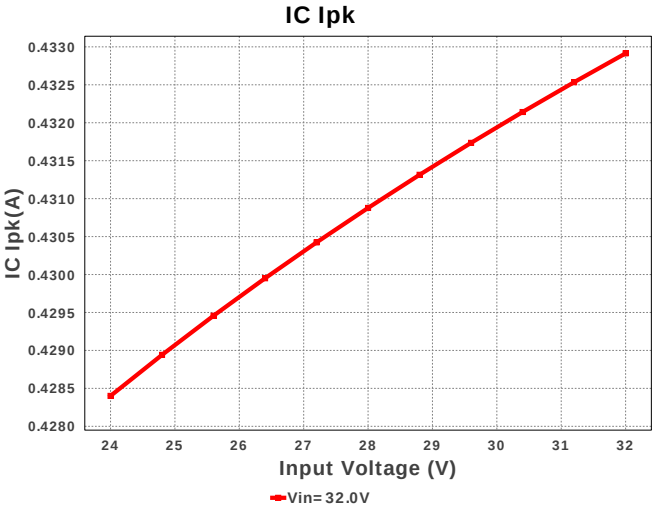
| # | Name | Manufacturer | Part Number | Properties | Qty | Price | Footprint |
|---|---|---|---|---|---|---|---|
| 1. | Cb | MuRata | GRM188R71E103KA01D<br>Series= X7R | Cap= 10.0 nF<br>ESR= 300.0 mOhm<br>VDC= 25.0 V<br>IRMS= 0.0 A | 1 | $0.01 | 0603 5 mm² |
| 2. | Cbyp | TDK | C1608X7R1E104K<br>Series= X7R | Cap= 100.0 nF<br>ESR= 16.336 mOhm<br>VDC= 25.0 V<br>IRMS= 0.0 A | 1 | $0.01 | 0603 5 mm² |
| 3. | 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 mm² |
| 4. | Cout | 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 mm² |
| 5. | D1 | NXP Semiconductor | PMEG6010CEH,115 | VF@Io= 570.0 mV<br>VRRM= 60.0 V | 1 | $0.11 | SOD-123F 12 mm² |
| 6. | D_LED | Cree | XPGWHT-L1-0000-00H51 | LED | 1 | $2.29 | xlampxpg 20 mm² |
| 7. | L1 | Bourns | SDR1006-121KL | L= 120.0 µH<br>DCR= 400.0 mOhm | 1 | $0.27 | SDR1006 139 mm² |

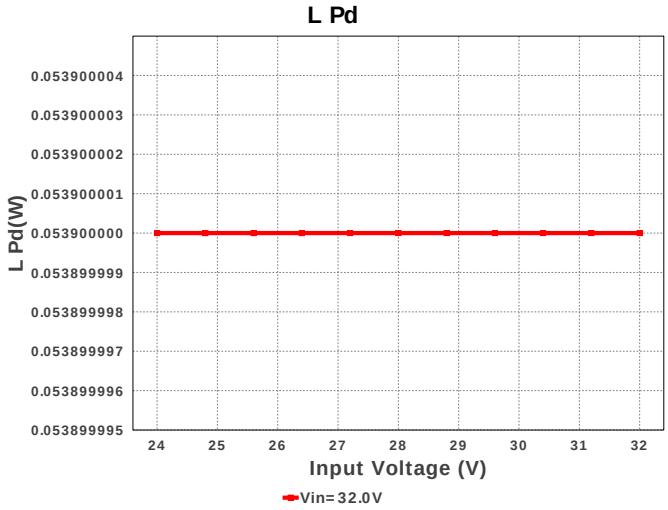
| # | Name | Manufacturer | Part Number | Properties | Qty | Price | Footprint |
|---|---|---|---|---|---|---|---|
| 8. | Ron | Panasonic | ERJ-6ENF1133V<br>Series= 225 | Res= 113.0 kOhm<br>Power= 125.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | 0805 7 mm$^2$ |
| 9. | Rsns | Panasonic | ERJ-3RQFR68V<br>Series= 227 | Res= 680.0 mOhm<br>Power= 100.0 mW<br>Tolerance= 1.0% | 1 | $0.02 | 0603 5 mm$^2$ |
| 10. | U1 | Texas Instruments | LM3402MR/NOPB | Switcher | 1 | $0.96 | MRA08B 56 mm$^2$ |

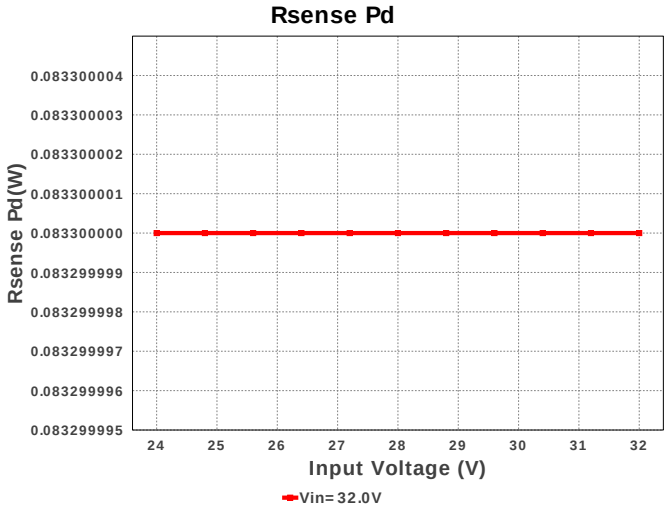


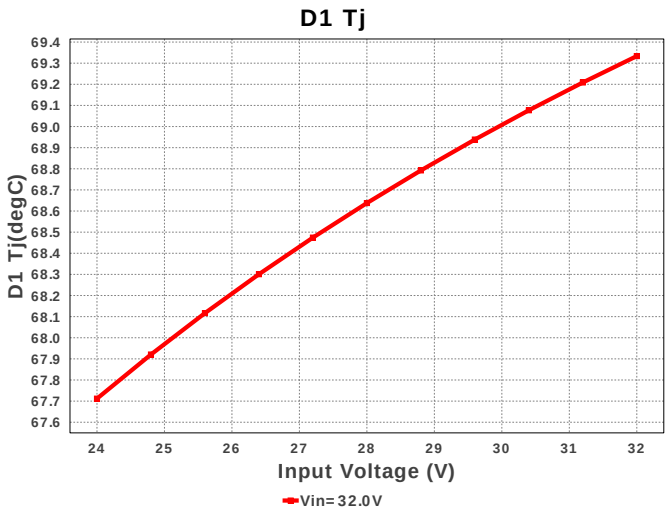



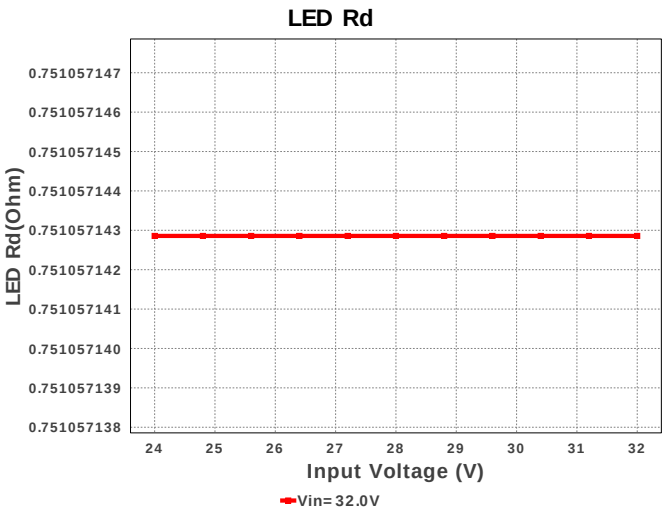



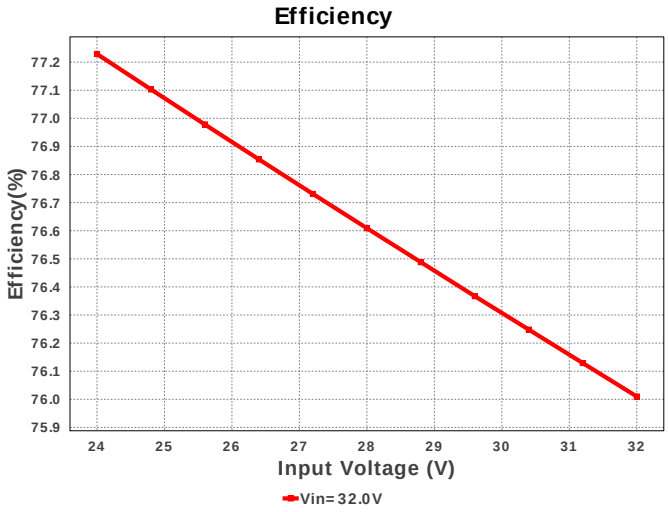



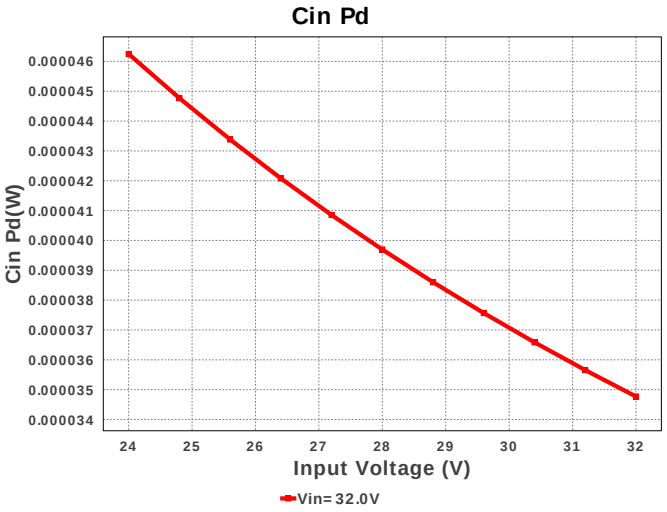



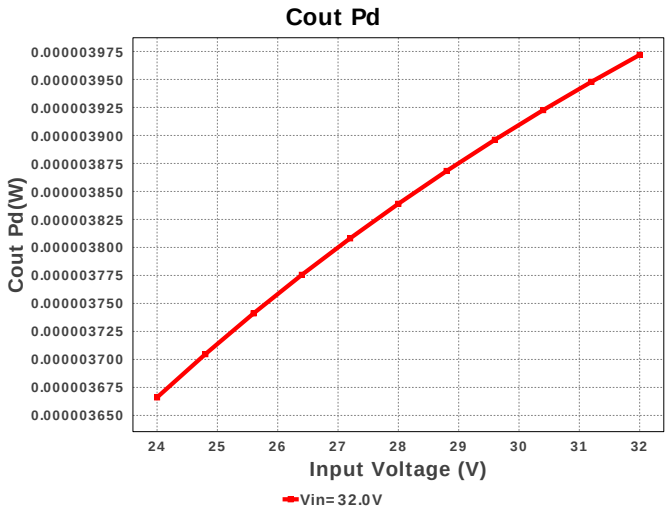



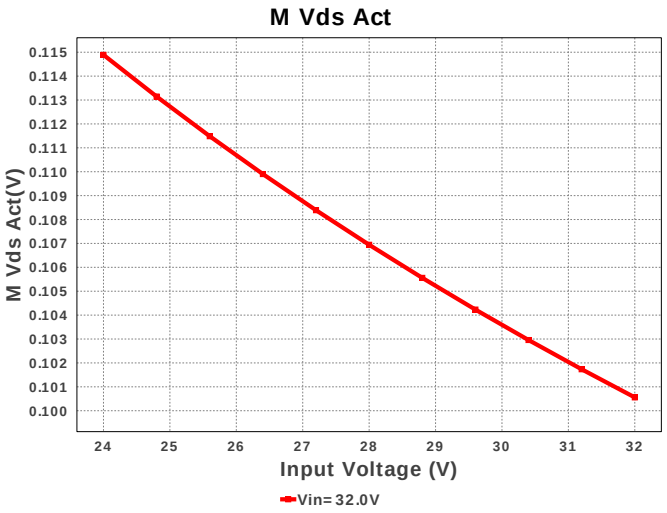


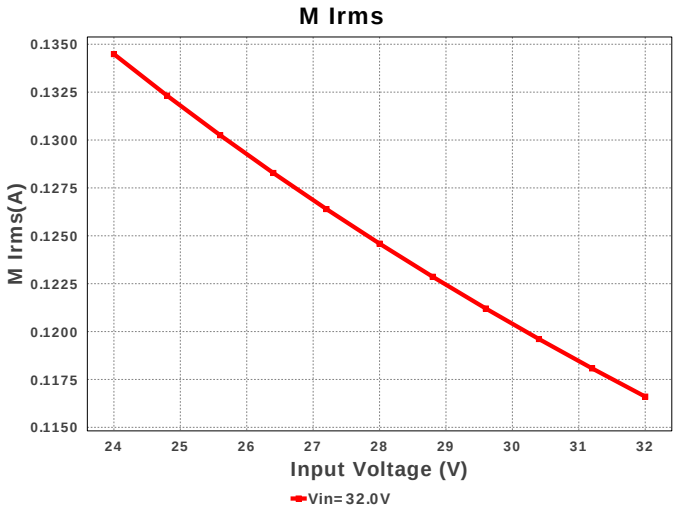



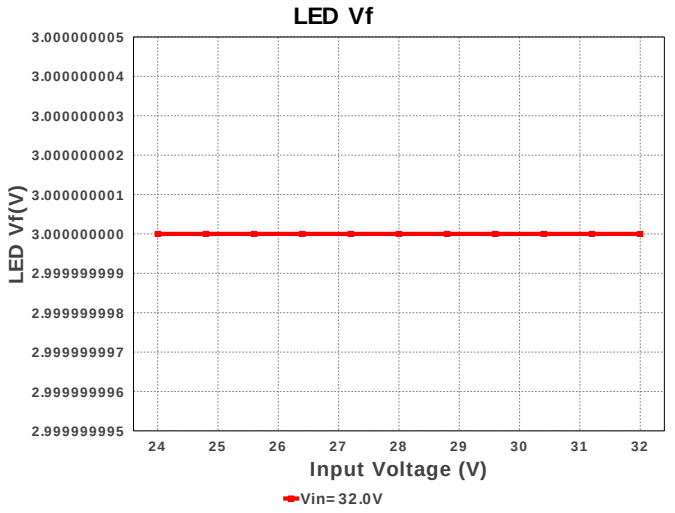



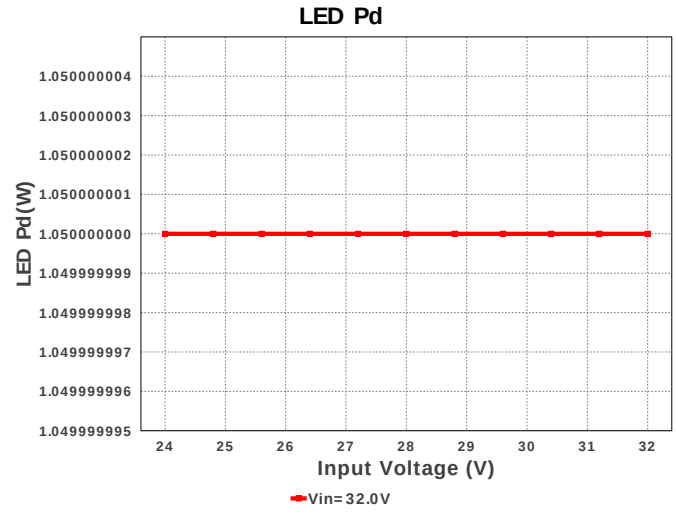



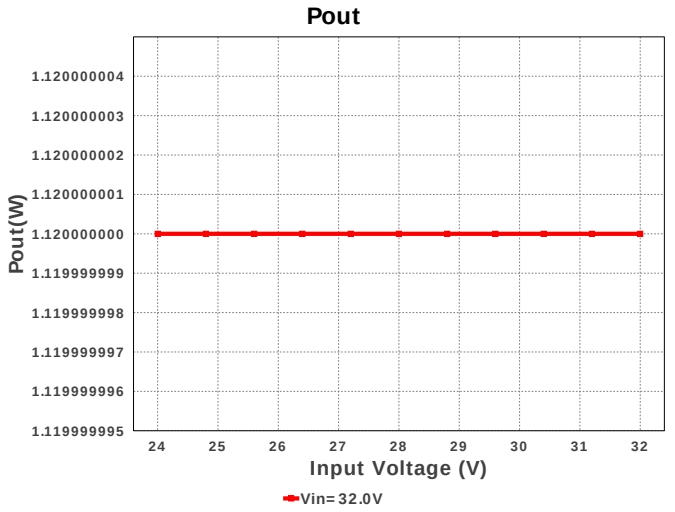



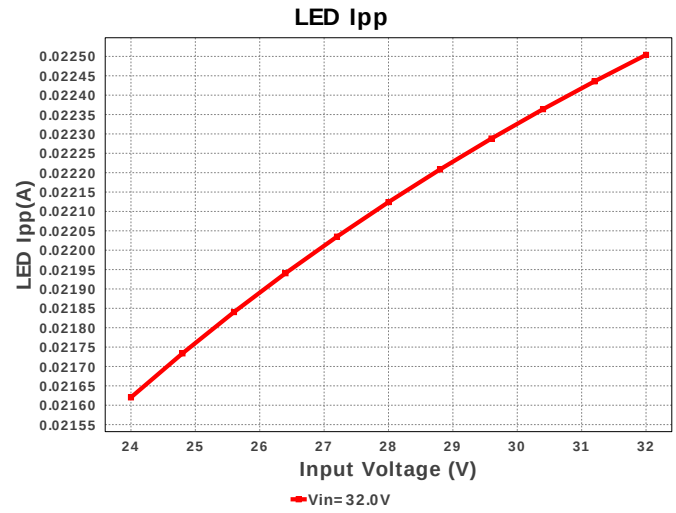



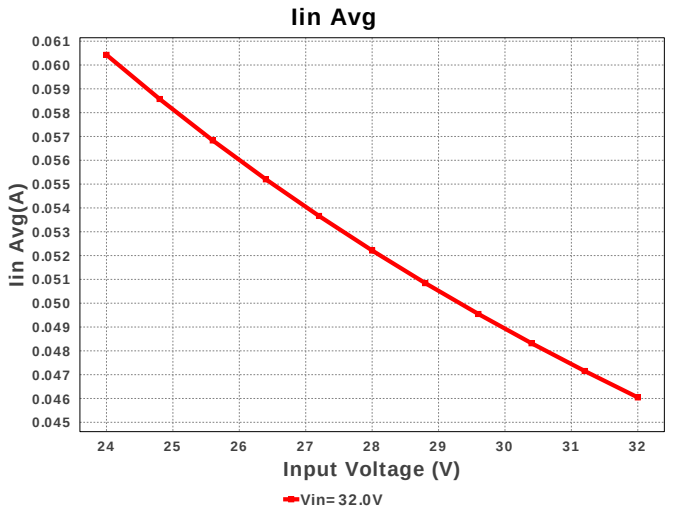


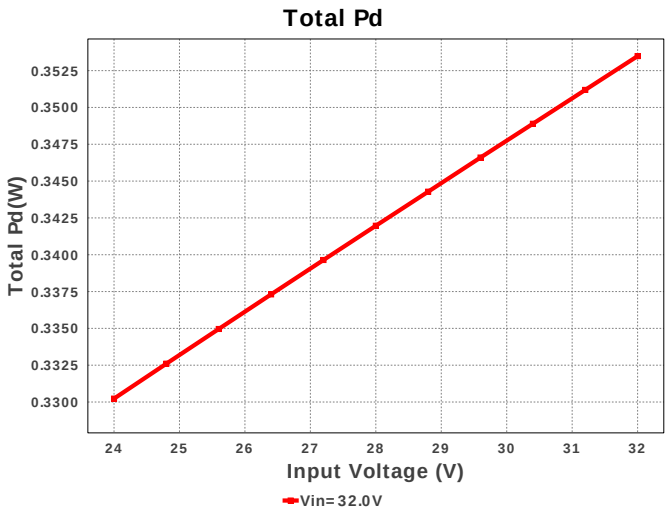



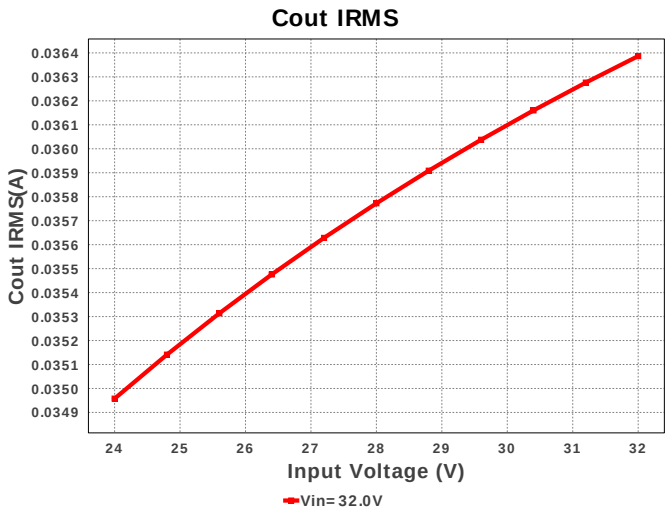



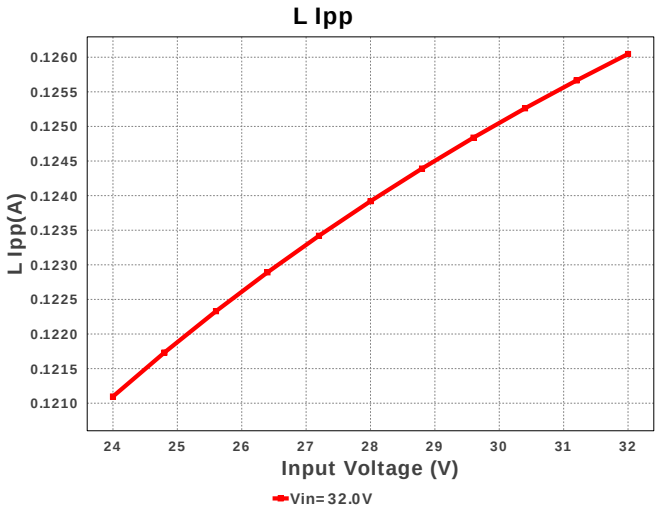



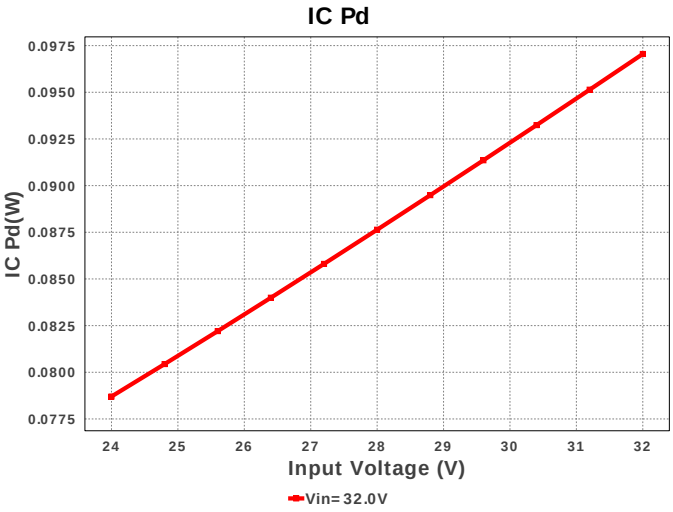



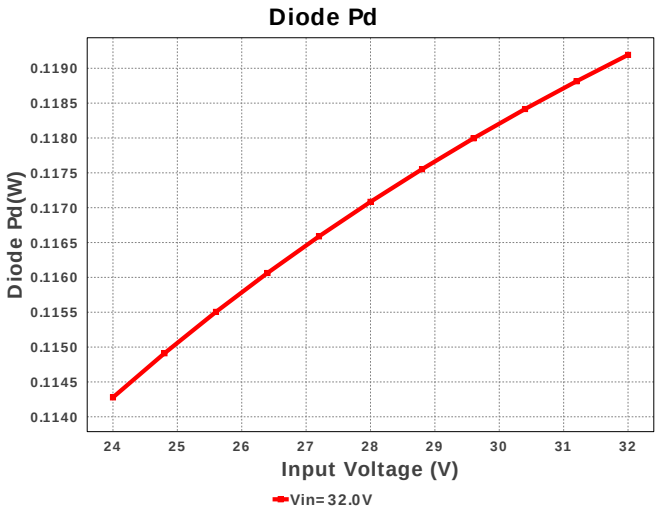



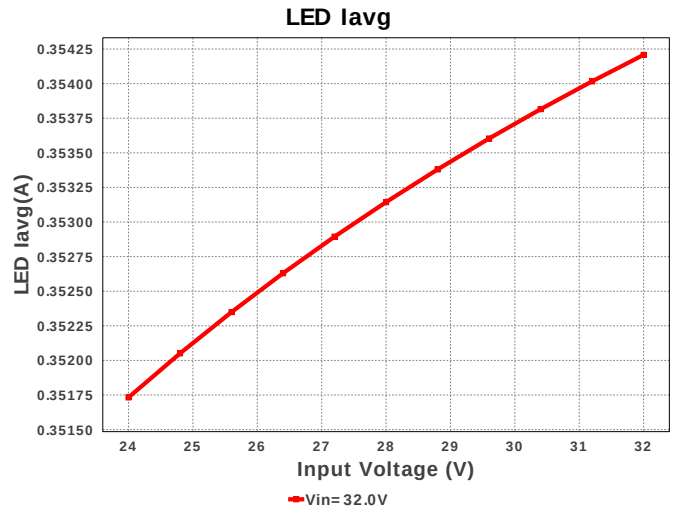



## Operating Values

| # | Name | Value | Category | Description |
|---|---|---|---|---|
| 1. | Cin IRMS | 107.799 mA | Current | Input capacitor RMS ripple current |
| 2. | Cout IRMS | 36.501 mA | Current | Output capacitor RMS ripple current |
| 3. | IC Ipk | 433.398 mA | Current | Peak switch current in IC |
| 4. | Iin Avg | 46.169 mA | Current | Average input current |
| 5. | L Ipp | 126.44 mA | Current | Peak-to-peak inductor ripple current |
| 6. | LED Iavg | 354.407 mA | Current | LED Average Current |
| 7. | LED Ipp | 22.575 mA | Current | LED Ripple Current |
| 8. | M Irms | 116.787 mA | Current | MOSFET RMS current |
| 9. | BOM Count | 10 | General | Total Design BOM count |
| 10. | FootPrint | 269.0 $mm^2$ | General | Total Foot Print Area of BOM components |
| 11. | Frequency | 211.333 kHz | General | Switching frequency |

| # | Name | Value | Category | Description |
|---|---|---|---|---|
| 12. | IC Tolerance | 6.0 mV | General | IC Feedback Tolerance |
| 13. | M Vds Act | 100.851 mV | General | Voltage drop across the MosFET |
| 14. | Pout | 1.12 W | General | Total output power |
| 15. | Total BOM | $3.82 | General | Total BOM Cost |
| 16. | D1 Tj | 70.62 degC | Op_Point | D1 junction temperature |
| 17. | Vout OP | 3.2 V | Op_Point | Operational Output Voltage |
| 18. | Duty Cycle | 11.134 % | Op_point | Duty cycle |
| 19. | Efficiency | 75.808 % | Op_point | Steady state efficiency |
| 20. | IC Tj | 34.854 degC | Op_point | IC junction temperature |
| 21. | ICThetaJA | 50.0 degC/W | Op_point | IC junction-to-ambient thermal resistance |
| 22. | IOUT_OP | 350.0 mA | Op_point | Iout operating point |
| 23. | LED Rd | 751.057 mOhm | Op_point | LED DynamicResistance |
| 24. | LED Vf | 3.0 V | Op_point | Total LED Forward Calculated Voltage |
| 25. | VIN_OP | 32.0 V | Op_point | Vin operating point |
| 26. | Cin Pd | 34.862 µW | Power | Input capacitor power dissipation |
| 27. | Cout Pd | 3.997 µW | Power | Output capacitor power dissipation |
| 28. | Diode Pd | 123.092 mW | Power | Diode power dissipation |
| 29. | IC Pd | 97.084 mW | Power | IC power dissipation |
| 30. | L Pd | 53.9 mW | Power | Inductor power dissipation |
| 31. | LED Pd | 1.05 W | Power | LED Power Dissipation |
| 32. | Rsense Pd | 83.3 mW | Power | LED Power Dissipation |
| 33. | Total Pd | 357.415 mW | Power | Total Power Dissipation |

## Design Inputs

| # | Name | Value | Description |
|---|---|---|---|
| 1. | Iout | 350.0 m | Maximum Output Current |
| 2. | Iout1 | 350.0 m | Output Current #1 |
| 3. | VinMax | 32.0 | Maximum input voltage |
| 4. | VinMin | 24.0 | Minimum input voltage |
| 5. | Vout | 3.0 | Output Voltage |
| 6. | Vout1 | 3.0 | Output Voltage #1 |
| 7. | application | LED_DRIVER | LED Application |
| 8. | base_pn | LM3402 | Texas Instruments Base Part Number |
| 9. | isLEDArchitect | N | LED Architect Project |
| 10. | ledparallel | 1.0 | Number of LED in parallel |
| 11. | ledpartnumber | XPGWHT-L1-0000-00H51 | LED Part number |
| 12. | ledseries | 1.0 | Number of LED in series |
| 13. | line_fsw | 60.0 | AC Line Frequency |
| 14. | source | DC | Input Source Type |
| 15. | ta | 30.0 | Ambient temperature |

## Design Assistance

1. LM3402 Product Folder : http://www.ti.com/product/LM3402 : contains the data sheet and other resources.