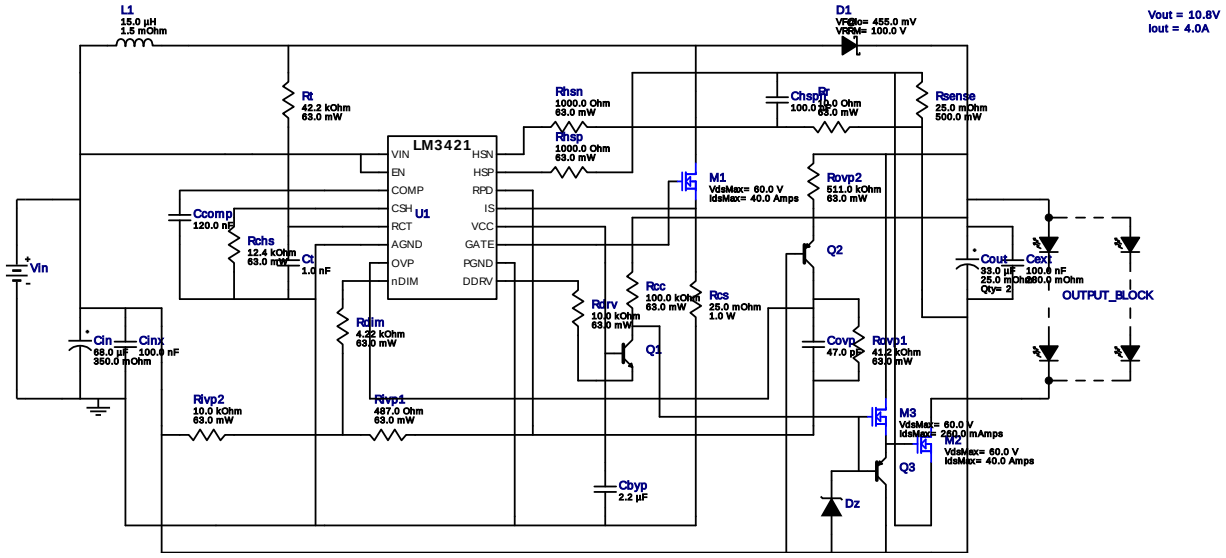
VinMin = 30.0V
VinMax = 36.0V
Vout = 10.8V
Iout = 4.0A

Device = LM3421MHX/NOPB
Topology = Buck_Boost
Created = 7/16/16 6:31:48 PM
BOM Cost = $0.00
BOM Count = 46
Total Pd = 3.98W

# WEBENCH® Design Report

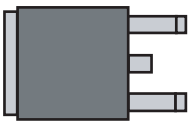
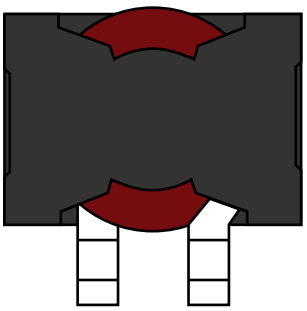
Design : 906020/2249 LM3421MHX/NOPB
LM3421MHX/NOPB 30.0V-36.0V to 10.77V @ 3.783860967741935A



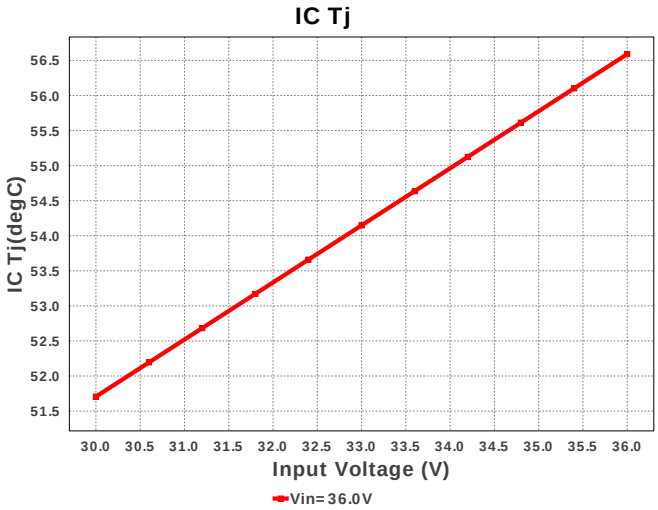

1. This regulator device is qualified for Automotive applications. All passives and other components selected in this design may not be qualified for Automotive applications. The user is required to verify that all components in the design meet the qualification and safety requirements for their specific application.View WEBENCH(R) Disclaimer.

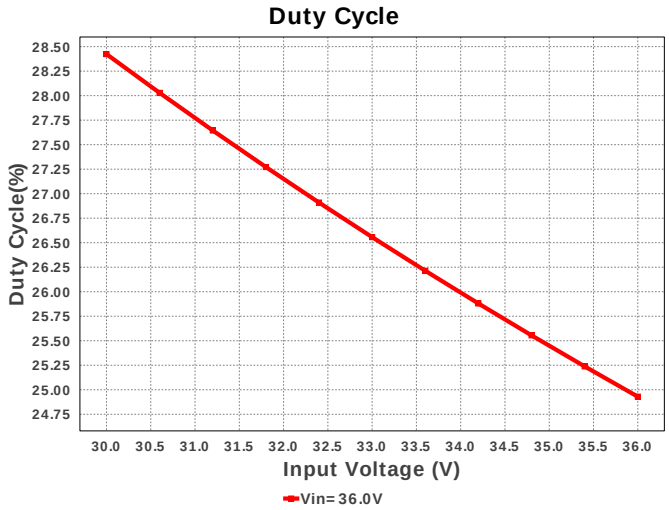
## Electrical BOM

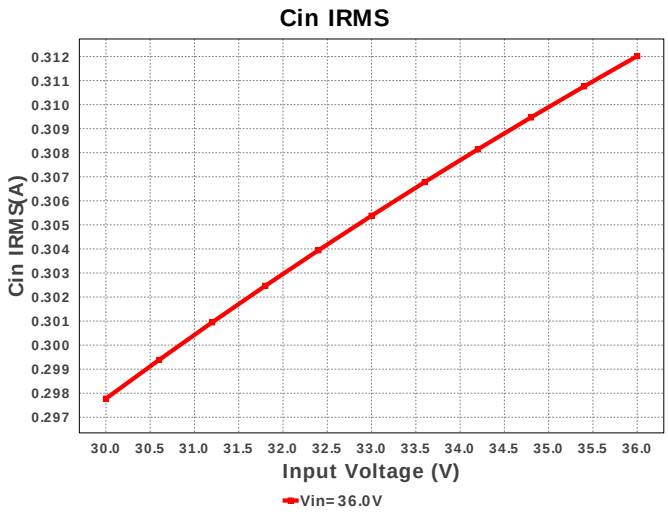
| # | Name | Manufacturer | Part Number | Properties | Qty | Price | Footprint |
|---|---|---|---|---|---|---|---|
| 1. | Cbyp | Taiyo Yuden | EMK212B7225KG-T<br>Series= X7R | Cap= 2.2 uF<br>VDC= 16.0 V<br>IRMS= 0.0 A | 1 | $0.03 | 0805 7 mm² |
| 2. | Ccomp | MuRata | GRM155C80J124KE01D<br>Series= X6S | Cap= 120.0 nF<br>VDC= 6.3 V<br>IRMS= 0.0 A | 1 | $0.02 | 0402 3 mm² |
| 3. | Cext | AVX | 08053C104KAT2A<br>Series= X7R | Cap= 100.0 nF<br>ESR= 280.0 mOhm<br>VDC= 25.0 V<br>IRMS= 0.0 A | 1 | $0.01 | 0805 7 mm² |
| 4. | Chspn | MuRata | GRM21BR71E104KA01L<br>Series= X7R | Cap= 100.0 nF<br>VDC= 25.0 V<br>IRMS= 0.0 A | 1 | $0.01 | 0805 7 mm² |
| 5. | Cin | Panasonic | EEE-FK1J680UP<br>Series= FK | Cap= 68.0 uF<br>ESR= 350.0 mOhm<br>VDC= 63.0 V<br>IRMS= 400.0 mA | 1 | $0.21 | SM_RADIAL_G 172 mm² |
| 6. | Cinx | MuRata | GRM188R72A104KA35D<br>Series= X7R | Cap= 100.0 nF<br>VDC= 100.0 V<br>IRMS= 0.0 A | 1 | $0.03 | 0603 5 mm² |
| 7. | Cout | Panasonic | 63SXV33M<br>Series= ? | Cap= 33.0 uF<br>ESR= 25.0 mOhm<br>VDC= 63.0 V<br>IRMS= 2.95 A | 2 | $1.25 | CAPSMT_62_E12 106 mm² |
| 8. | Covp | Kemet | C0805C470K5GACTU<br>Series= C0G/NP0 | Cap= 47.0 pF<br>VDC= 50.0 V<br>IRMS= 0.0 A | 1 | $0.01 | 0805 7 mm² |

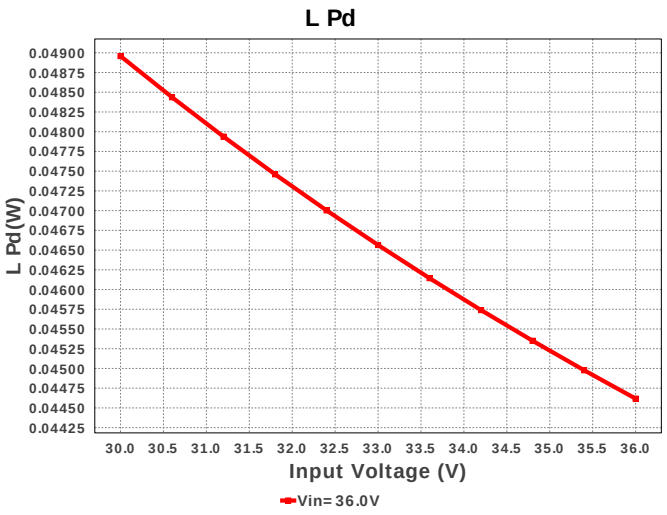
| # | Name | Manufacturer | Part Number | Properties | Qty | Price | Footprint |
|---|---|---|---|---|---|---|---|
| 9. | Ct | Samsung Electro-Mechanics | CL21C102JBCNFNC<br>Series= C0G/NP0 | Cap= 1.0 nF<br>VDC= 50.0 V<br>IRMS= 0.0 A | 1 | $0.01 | <br>0805 7 mm² |
| 10. | D1 | STMicroelectronics | STPS20M100SG-TR | VF@Io= 455.0 mV<br>VRRM= 100.0 V | 1 | $1.33 |  <br>DDPAK 210 mm² |
| 11. | D_LED | LEDEngin | LZ1-10NW05 | LED | 12 | NA |  <br>ledengin_1 29 mm² |
| 12. | Dz | ON Semiconductor | BZX84C10LT1G | Zener | 1 | $0.02 |  <br>SOT-23 14 mm² |
| 13. | L1 | Coilcraft | SER2915L-153KL | L= 15.0 µH<br>DCR= 1.5 mOhm | 1 | $1.88 |  <br>SER2915L 652 mm² |
| 14. | M1 | Infineon Technologies | BSZ100N06LS3 G | VdsMax= 60.0 V<br>IdsMax= 40.0 Amps | 1 | $0.39 |  <br>PG-TSDSON-8 19 mm² |
| 15. | M2 | Infineon Technologies | BSZ100N06LS3 G | VdsMax= 60.0 V<br>IdsMax= 40.0 Amps | 1 | $0.39 |  <br>PG-TSDSON-8 19 mm² |
| 16. | M3 | ON Semiconductor | 2N7002ET1G | VdsMax= 60.0 V<br>IdsMax= 260.0 mAmps | 1 | $0.02 |  <br>SOT-23 14 mm² |
| 17. | Q1 | Diodes Inc. | MMBT3904-7-F | Bipolar Transistor | 1 | $0.02 |  <br>SOT-23 14 mm² |
| 18. | Q2 | Diodes Inc. | MMBT3906-7-F | Bipolar Transistor | 1 | $0.02 |  <br>SOT-23 14 mm² |
| 19. | Q3 | Diodes Inc. | MMBT3906-7-F | Bipolar Transistor | 1 | $0.02 |  <br>SOT-23 14 mm² |
| 20. | Rcc | Vishay-Dale | CRCW0402100KFKED<br>Series= CRCW..e3 | Res= 100.0 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | <br>0402 3 mm² |
| 21. | Rchs | Vishay-Dale | CRCW040212K4FKED<br>Series= CRCW..e3 | Res= 12.4 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | <br>0402 3 mm² |
| 22. | Rcs | Stackpole Electronics Inc | CSRN2010FK25L0<br>Series= ? | Res= 25.0 mOhm<br>Power= 1.0 W<br>Tolerance= 1.0% | 1 | $0.15 |  <br>2010 32 mm² |
| 23. | Rdim | Vishay-Dale | CRCW04024K22FKED<br>Series= CRCW..e3 | Res= 4.22 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | <br>0402 3 mm² |
| 24. | Rdrv | 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 mm² |
| 25. | Rhsn | Vishay-Dale | CRCW04021K00FKED<br>Series= CRCW..e3 | Res= 1000.0 Ohm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | <br>0402 3 mm² |

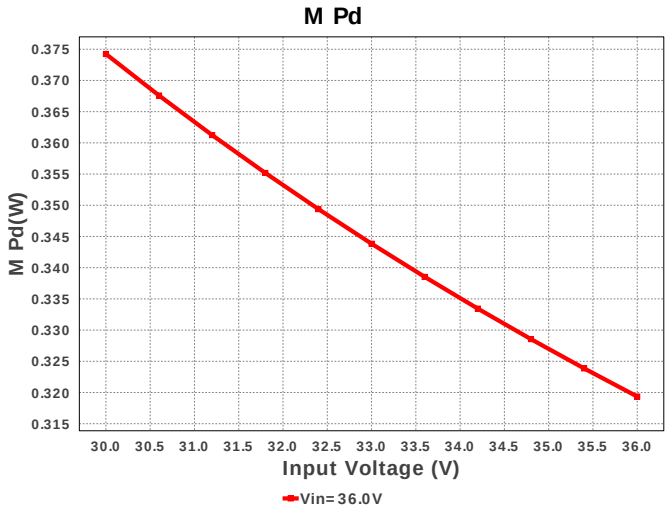
| # | Name | Manufacturer | Part Number | Properties | Qty | Price | Footprint |
|---|---|---|---|---|---|---|---|
| 26. | Rhsp | Vishay-Dale | CRCW04021K00FKED<br>Series= CRCW..e3 | Res= 1000.0 Ohm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | 0402 3 mm² |
| 27. | Rivp1 | Vishay-Dale | CRCW0402487RFKED<br>Series= CRCW..e3 | Res= 487.0 Ohm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | 0402 3 mm² |
| 28. | Rivp2 | 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 mm² |
| 29. | Rovp1 | Vishay-Dale | CRCW040241K2FKED<br>Series= CRCW..e3 | Res= 41.2 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | 0402 3 mm² |
| 30. | Rovp2 | Vishay-Dale | CRCW0402511KFKED<br>Series= CRCW..e3 | Res= 511.0 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | 0402 3 mm² |
| 31. | Rr | Vishay-Dale | CRCW040210R0FKED<br>Series= CRCW..e3 | Res= 10.0 Ohm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | 0402 3 mm² |
| 32. | Rsense | Stackpole Electronics Inc | CSR1206FK25L0<br>Series= ? | Res= 25.0 mOhm<br>Power= 500.0 mW<br>Tolerance= 1.0% | 1 | $0.10 | 1206 11 mm² |
| 33. | Rt | Vishay-Dale | CRCW040242K2FKED<br>Series= CRCW..e3 | Res= 42.2 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | 0402 3 mm² |
| 34. | U1 | Texas Instruments | LM3421MHX/NOPB | Switcher | 1 | $1.15 | MXA16A 59 mm² |

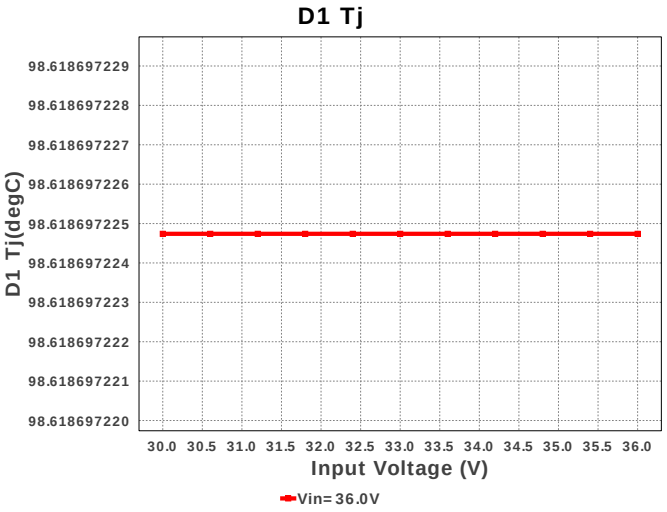


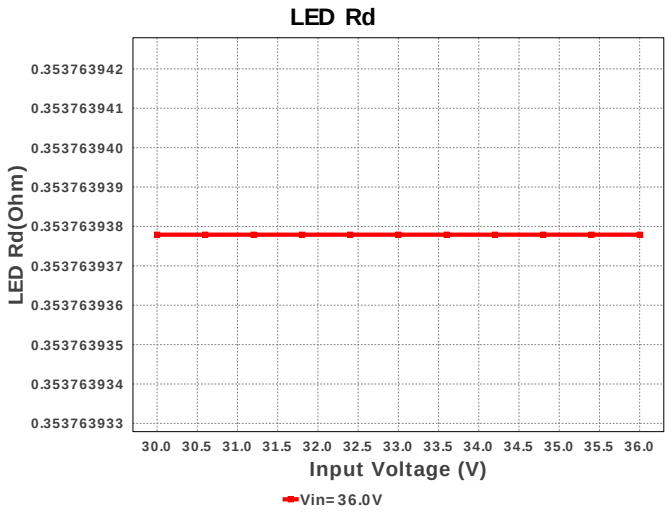



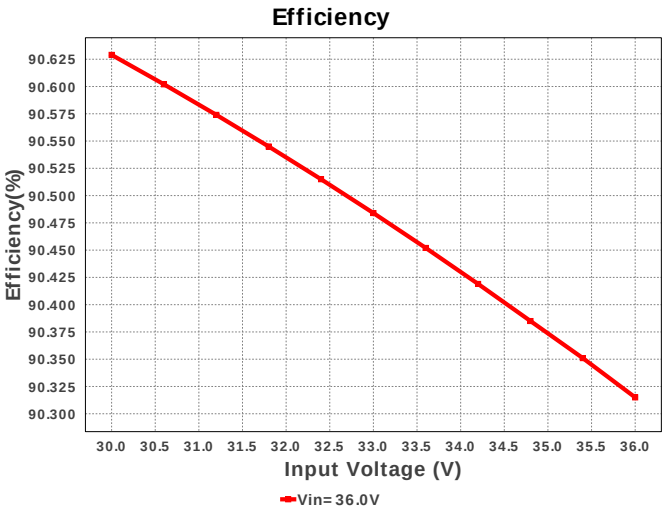


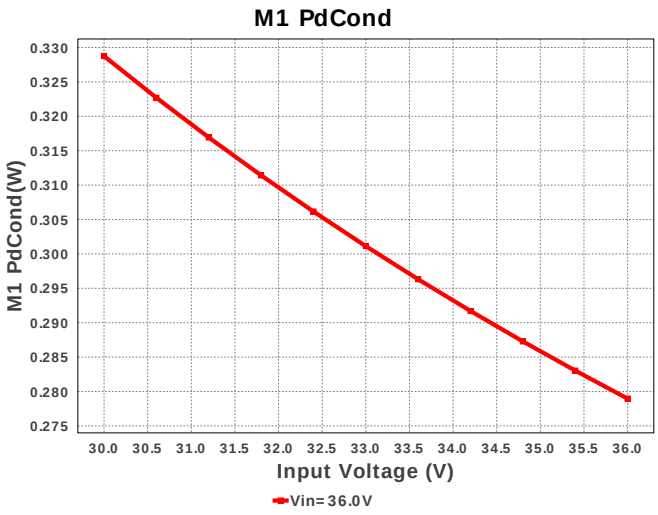



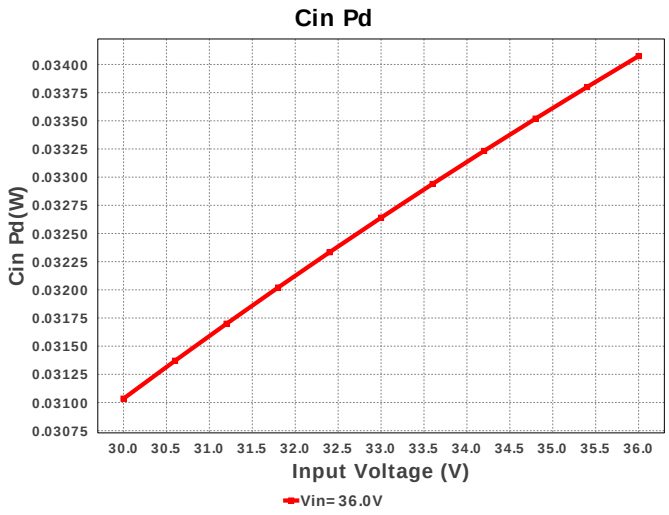



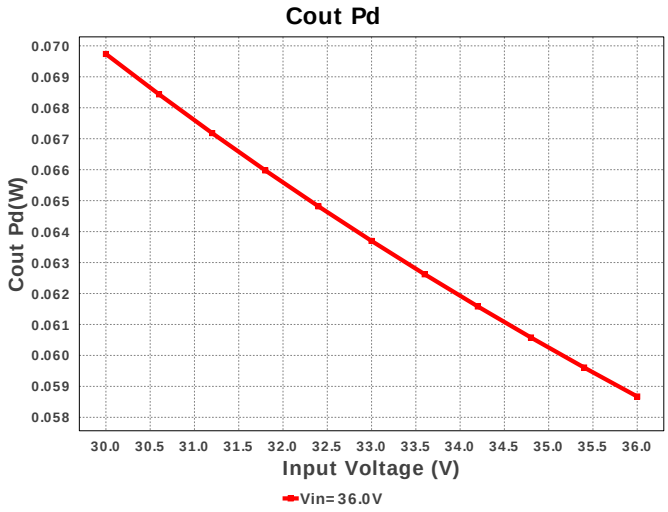



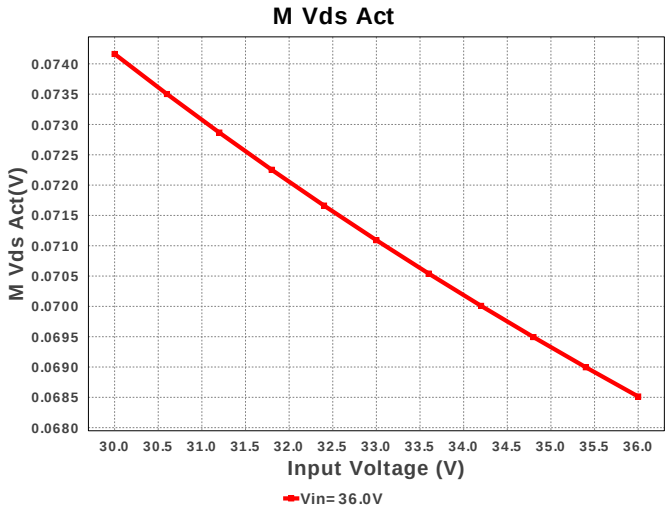



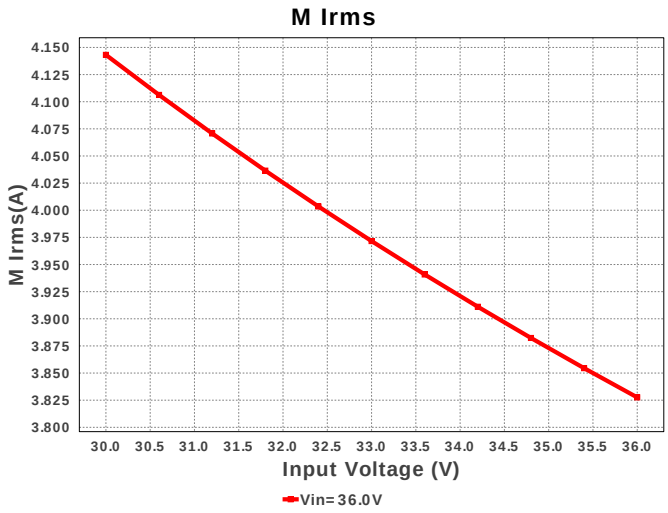



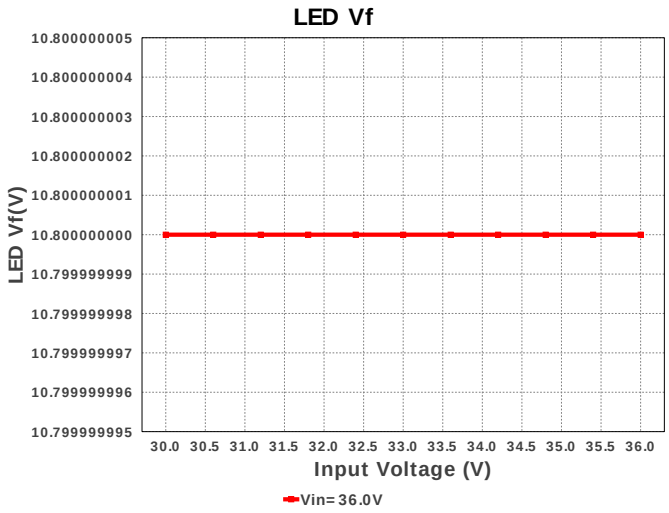


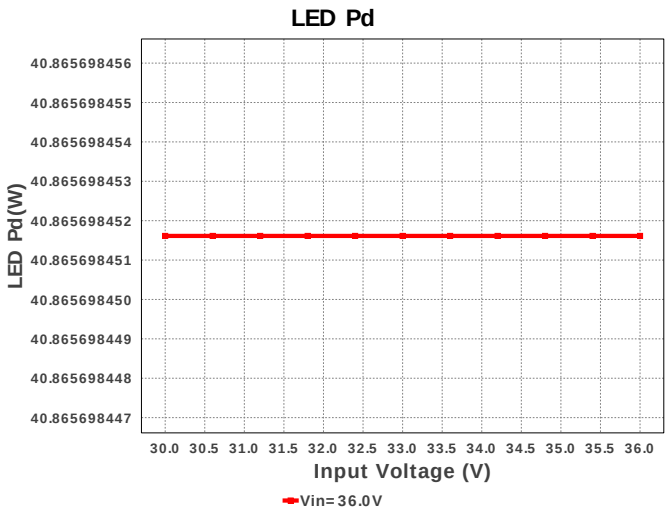



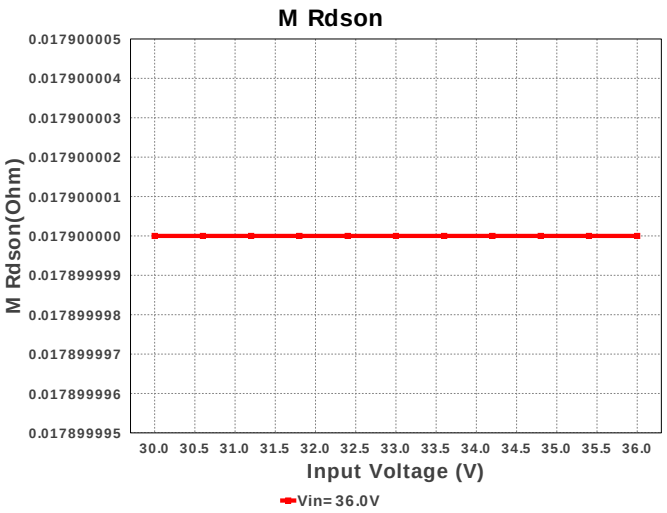



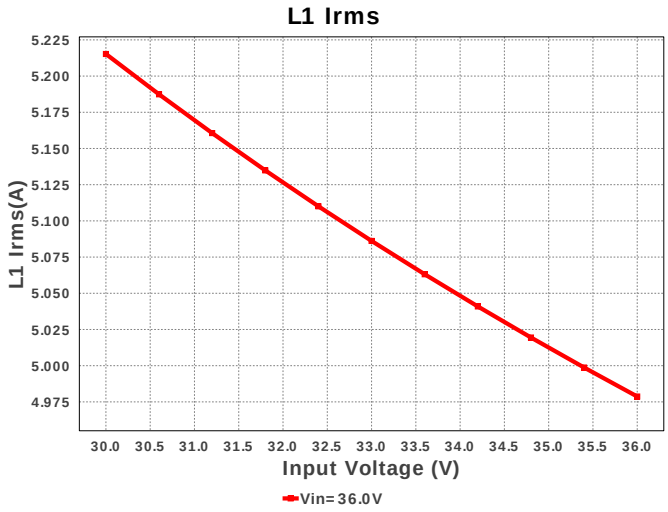



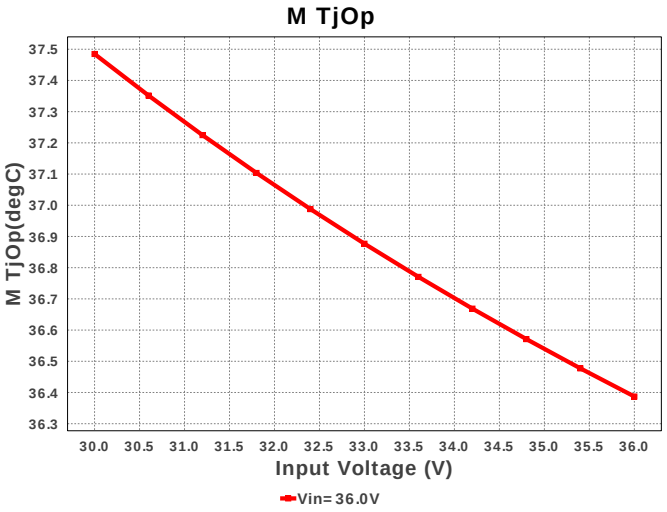



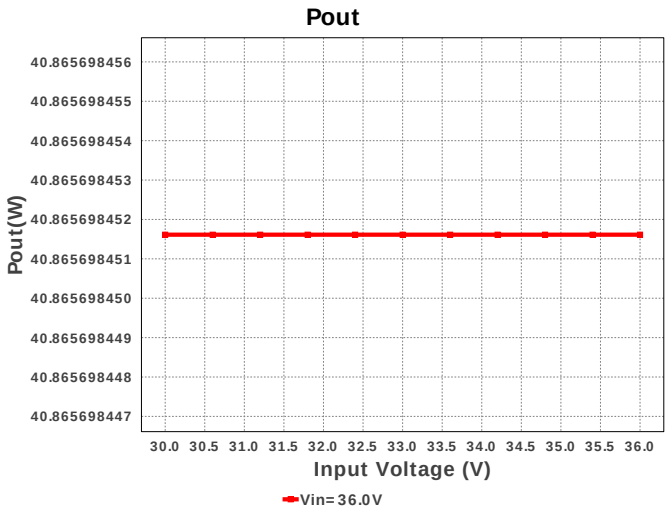



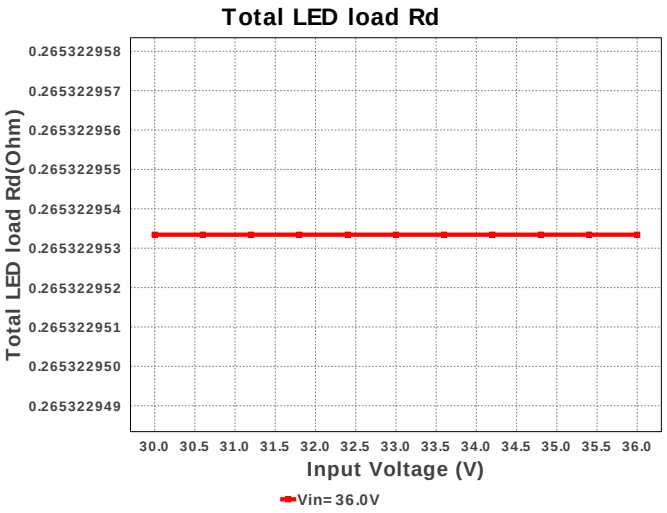


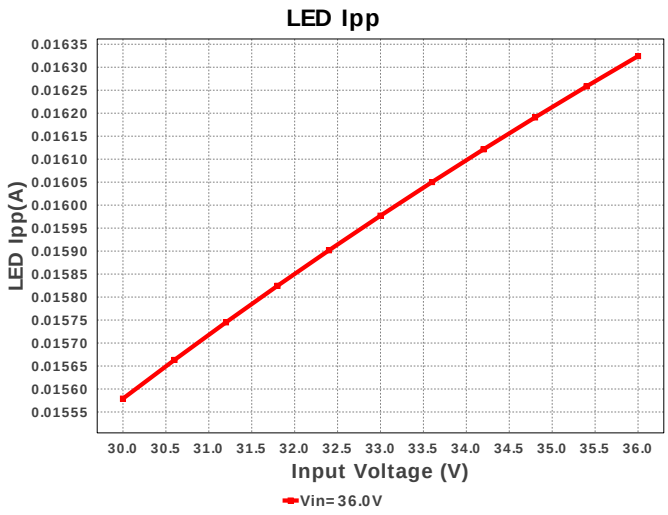



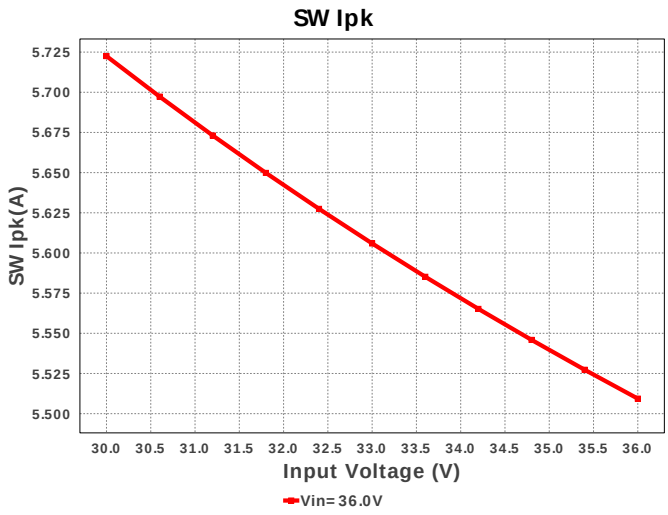



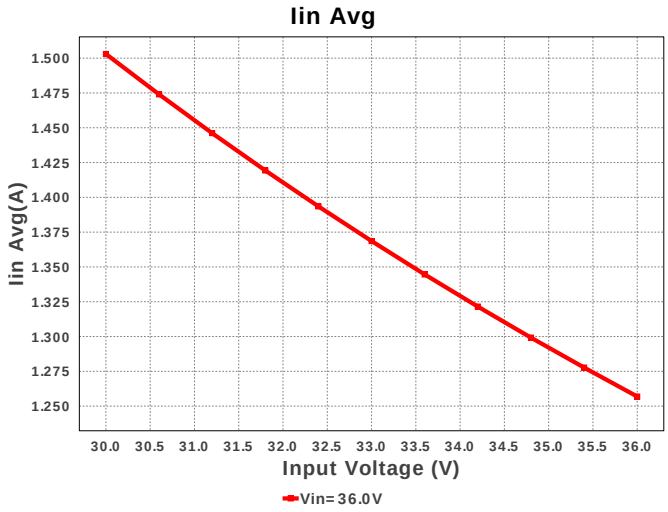



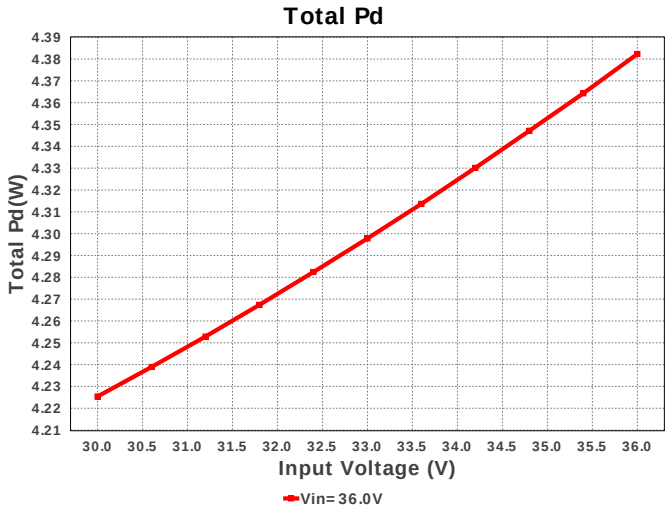



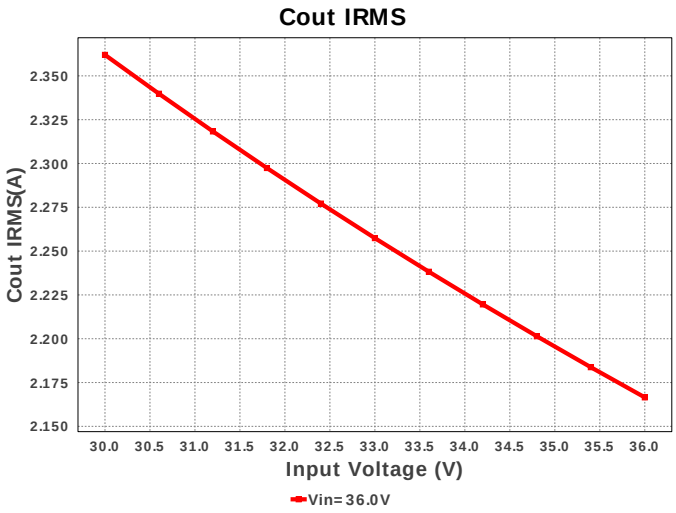



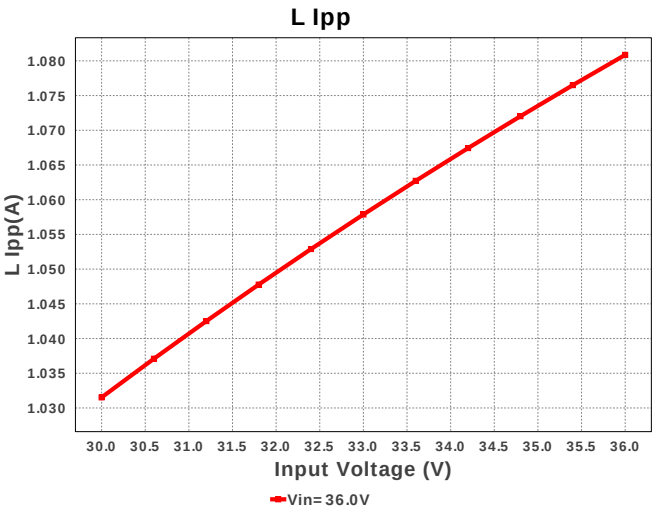


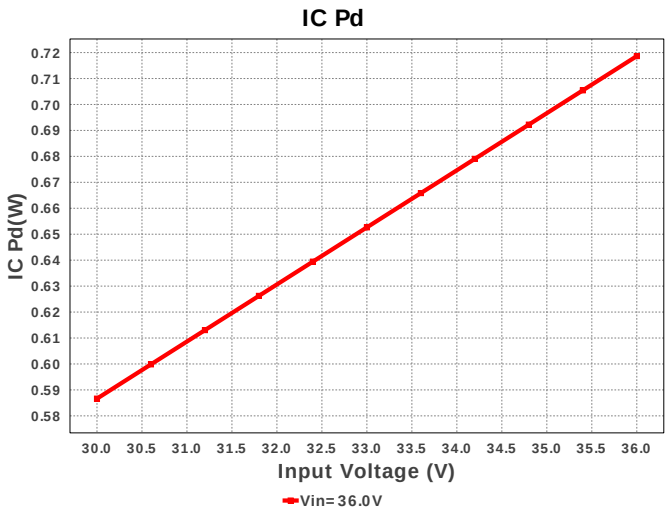



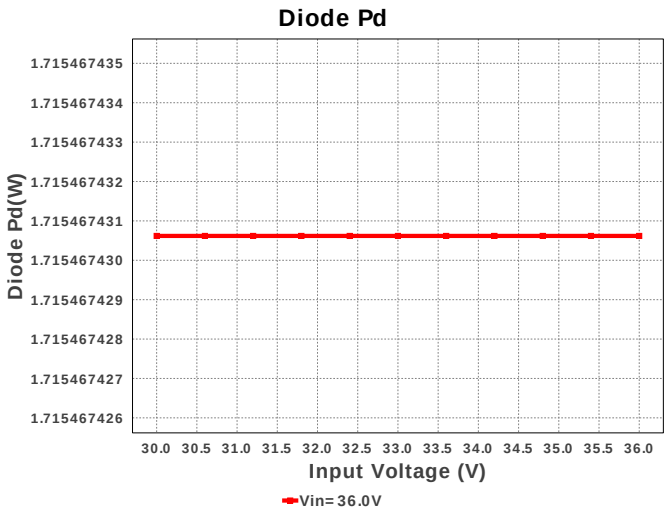



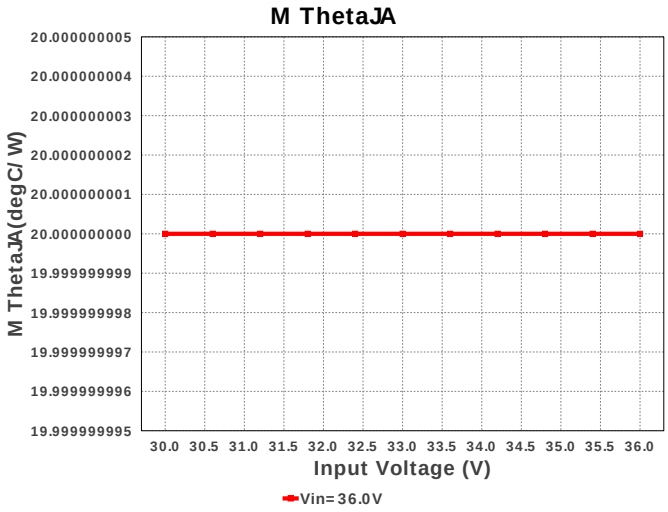



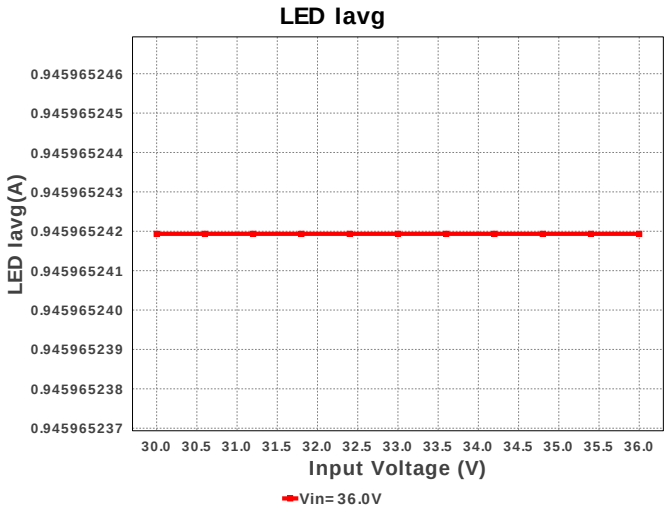



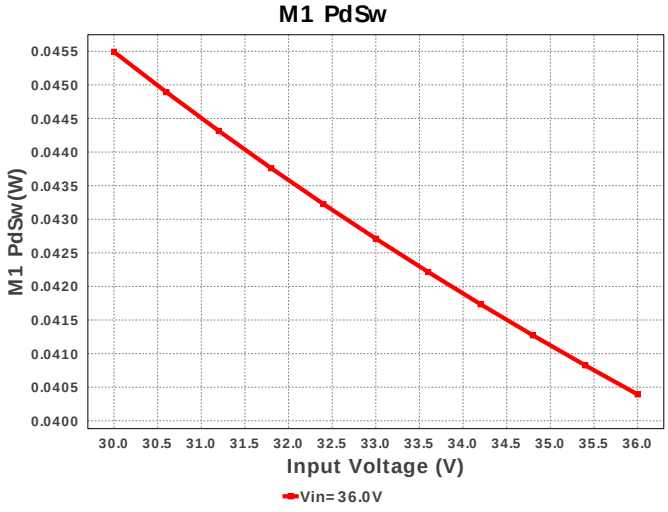






## Operating Values

| # | Name | Value | Category | Description |
|---|---|---|---|---|
| 1. | Cin IRMS | 297.328 mA | Current | Input capacitor RMS ripple current |
| 2. | Cout IRMS | 2.355 A | Current | Output capacitor RMS ripple current |
| 3. | Iin Avg | 1.491 A | Current | Average input current |
| 4. | L Ipp | 1.03 A | Current | Peak-to-peak inductor ripple current |
| 5. | L1 Irms | 5.209 A | Current | Inductor ripple current |
| 6. | LED Iavg | 945.965 mA | Current | LED Average Current |
| 7. | LED Ipp | 15.556 mA | Current | LED Ripple Current |
| 8. | M Irms | 4.129 A | Current | MOSFET RMS ripple current |
| 9. | SW Ipk | 5.716 A | Current | Peak switch current |
| 10. | BOM Count | 46 | General | Total Design BOM count |
| 11. | FootPrint | 1.883 k $mm^2$ | General | Total Foot Print Area of BOM components |

| # | Name | Value | Category | Description |
|---|---|---|---|---|
| 12. | Frequency | 528.91 kHz | General | Switching frequency |
| 13. | IC Tolerance | 25.0 mV | General | IC Feedback Tolerance |
| 14. | M Rdson | 6.8 mOhm | General | Drain-Source On-resistance |
| 15. | M Vds Act | 28.078 mV | General | M Vds |
| 16. | Pout | 40.747 W | General | Total output power |
| 17. | Total BOM | $0.0 | General | Total BOM Cost |
| 18. | D1 Tj | 98.866 degC | Op_Point | D1 junction temperature |
| 19. | Vout OP | 10.769 V | Op_Point | Operational Output Voltage |
| 20. | Duty Cycle | 28.261 % | Op_point | Duty cycle |
| 21. | Efficiency | 91.095 % | Op_point | Steady state efficiency |
| 22. | IC Tj | 53.185 degC | Op_point | IC junction temperature |
| 23. | ICThetaJA | 37.0 degC/W | Op_point | IC junction-to-ambient thermal resistance |
| 24. | IOUT_OP | 3.784 A | Op_point | Iout operating point |
| 25. | LED Rd | 353.764 mOhm | Op_point | LED DynamicResistance |
| 26. | LED Vf | 10.769 V | Op_point | Total LED Forward Calculated Voltage |
| 27. | M ThetaJA | 50.0 degC/W | Op_point | MOSFET junction-to-ambient thermal resistance |
| 28. | M TjOp | 40.364 degC | Op_point | MOSFET junction temperature |
| 29. | VIN_OP | 30.0 V | Op_point | Vin operating point |
| 30. | Cin Pd | 30.941 mW | Power | Input capacitor power dissipation |
| 31. | Cout Pd | 69.341 mW | Power | Output capacitor power dissipation |
| 32. | Diode Pd | 1.722 W | Power | Diode power dissipation |
| 33. | IC Pd | 626.628 mW | Power | IC power dissipation |
| 34. | L Pd | 48.846 mW | Power | Inductor power dissipation |
| 35. | LED Pd | 40.747 W | Power | LED Power Dissipation |
| 36. | M Pd | 207.282 mW | Power | MOSFET power dissipation |
| 37. | M1 PdCond | 123.063 mW | Power | M1 MOSFET conduction losses |
| 38. | M1 PdSw | 84.219 mW | Power | M1 MOSFET switching losses |
| 39. | Total Pd | 3.983 W | Power | Total Power Dissipation |
| 40. | Total LED load Rd | 265.323 mOhm | | Total LED Load DynamicResistance |
| 41. | Vout Tolerance | 232.156 m% | | Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable |

## Design Inputs

| # | Name | Value | Description |
|---|---|---|---|
| 1. | Iout | 4.0 | Maximum Output Current |
| 2. | VinMax | 36.0 | Maximum input voltage |
| 3. | VinMin | 30.0 | Minimum input voltage |
| 4. | Vout | 10.8 | Output Voltage |
| 5. | application | LED_DRIVER | LED Application |
| 6. | base_pn | LM3421 | Texas Instruments Base Part Number |
| 7. | isLEDArchitect | N | LED Architect Project |
| 8. | ledparallel | 4.0 | Number of LED in parallel |
| 9. | ledpartnumber | LZ1-10NW05 | LED Part number |
| 10. | ledseries | 3.0 | Number of LED in series |
| 11. | line_fsw | 60.0 | AC Line Frequency |
| 12. | source | DC | Input Source Type |
| 13. | ta | 30.0 | Ambient temperature |

## Design Assistance

1. LM3421 Product Folder : http://www.ti.com/product/LM3421 : contains the data sheet and other resources.