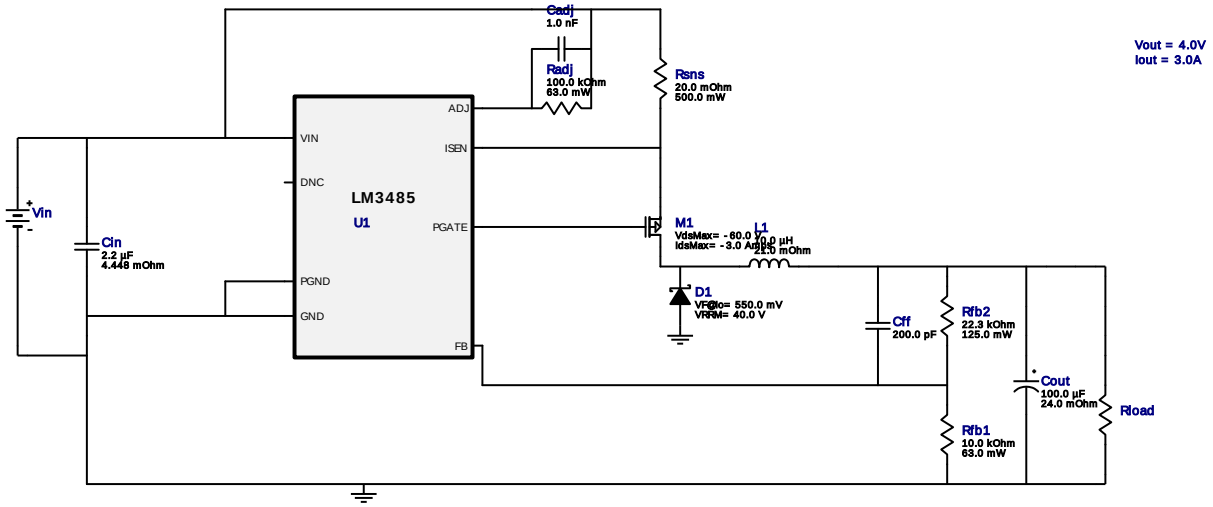
# WEBENCH® Design Report

VinMin = 19.0V
VinMax = 22.0V
Vout = 4.0V
Iout = 3.0A

Device = LM3485MM/NOPB
Topology = Buck
Created = 9/22/16 2:01:46 AM
BOM Cost = $1.80
BOM Count = 12
Total Pd = 1.83W

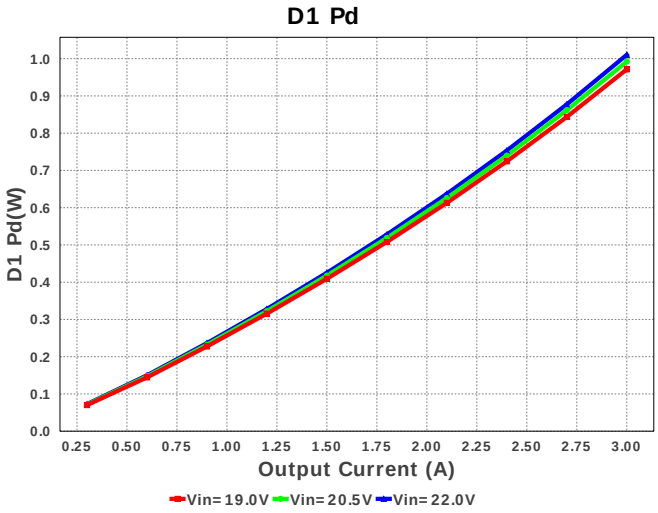
Design : 4770666/21 LM3485MM/NOPB
LM3485MM/NOPB 19.0V-22.0V to 4.00V @ 3.0A

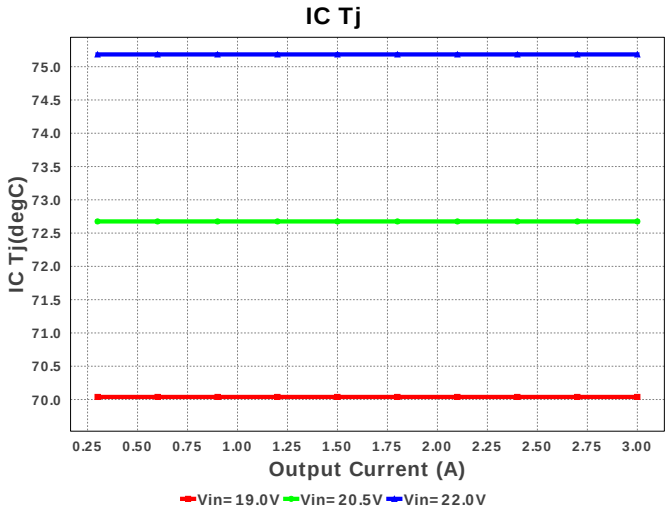


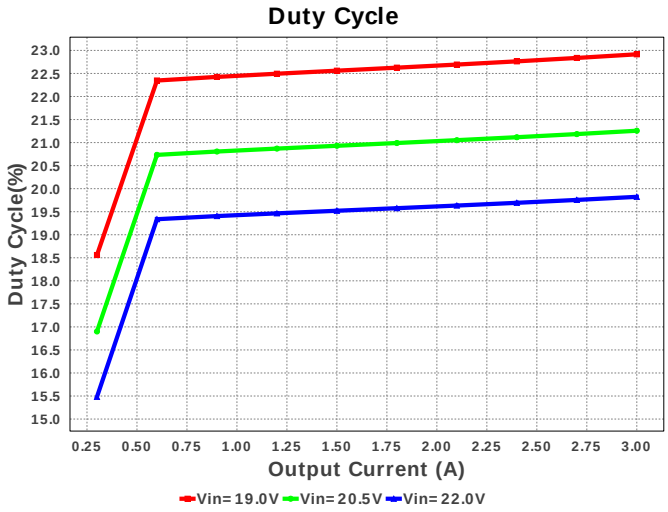

## Electrical BOM

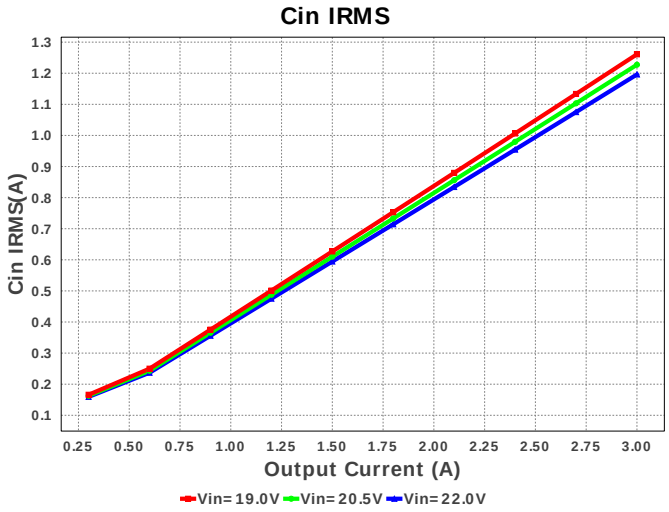
| # | Name | Manufacturer | Part Number | Properties | Qty | Price | Footprint |
|---|---|---|---|---|---|---|---|
| 1. | Cadj | Samsung Electro-Mechanics | CL21C102JBCNFNC<br>Series= C0G/NP0 | Cap= 1.0 nF<br>VDC= 50.0 V<br>IRMS= 0.0 A | 1 | $0.01 | 0805 7 mm² |
| 2. | Cff | Samsung Electro-Mechanics | CL21C201JBANNNC<br>Series= C0G/NP0 | Cap= 200.0 pF<br>VDC= 50.0 V<br>IRMS= 0.0 A | 1 | $0.01 | 0805 7 mm² |
| 3. | Cin | MuRata | GRM31CR71H225KA88L<br>Series= X7R | Cap= 2.2 uF<br>ESR= 4.448 mOhm<br>VDC= 50.0 V<br>IRMS= 2.2252 A | 1 | $0.05 | 1206_190 11 mm² |
| 4. | Cout | Panasonic | 16SVPC100M<br>Series= SVPC | Cap= 100.0 uF<br>ESR= 24.0 mOhm<br>VDC= 16.0 V<br>IRMS= 2.49 A | 1 | $0.29 | SM_RADIAL_6.3AMM 80 mm² |
| 5. | D1 | Diodes Inc. | B540C-13-F | VF@Io= 550.0 mV<br>VRRM= 40.0 V | 1 | $0.17 | SMC 83 mm² |
| 6. | L1 | Bourns | SDR1307-100ML | L= 10.0 µH<br>DCR= 21.0 mOhm | 1 | $0.35 | SDR1307 227 mm² |
| 7. | M1 | Fairchild Semiconductor | FDC5614P | VdsMax= -60.0 V<br>IdsMax= -3.0 Amps | 1 | $0.23 | SOT-23-6 15 mm² |
| 8. | Radj | Vishay-Dale | CRCW0402100KFKED<br>Series= CRCW..e3 | Res= 100.0 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | 0402 3 mm² |

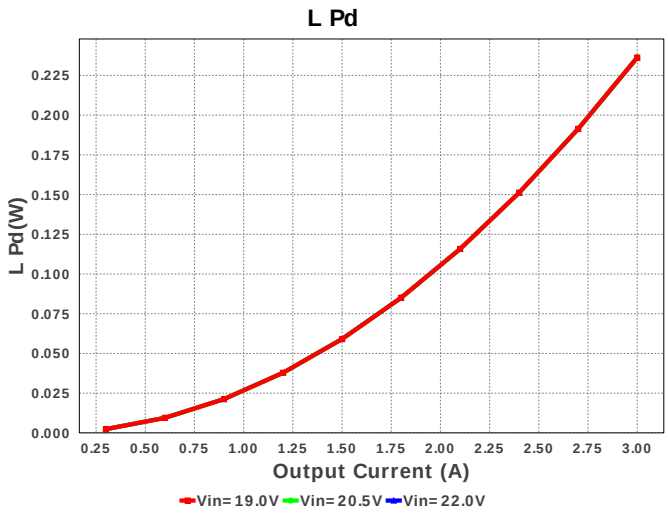
| # | Name | Manufacturer | Part Number | Properties | Qty | Price | Footprint |
|---|---|---|---|---|---|---|---|
| 9. | Rfb1 | Vishay-Dale | CRCW040210K0FKED<br>Series= CRCW..e3 | Res= 10.0 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | 0402 3 mm$^2$ |
| 10. | Rfb2 | Yageo America | RT0805BRD0722K3L<br>Series= RT0805 | Res= 22.3 kOhm<br>Power= 125.0 mW<br>Tolerance= 0.1% | 1 | $0.05 | 0805 7 mm$^2$ |
| 11. | Rsns | Stackpole Electronics Inc | CSR1206FK20L0<br>Series= ? | Res= 20.0 mOhm<br>Power= 500.0 mW<br>Tolerance= 1.0% | 1 | $0.10 | 1206 11 mm$^2$ |
| 12. | U1 | Texas Instruments | LM3485MM/NOPB | Switcher | 1 | $0.52 | MUA08A 24 mm$^2$ |

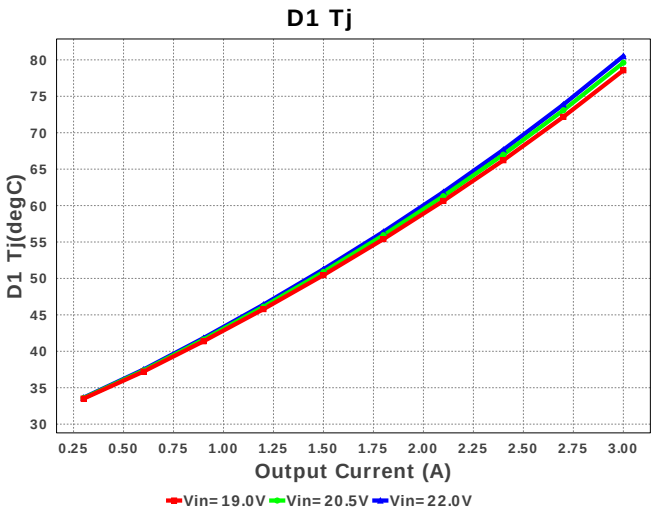


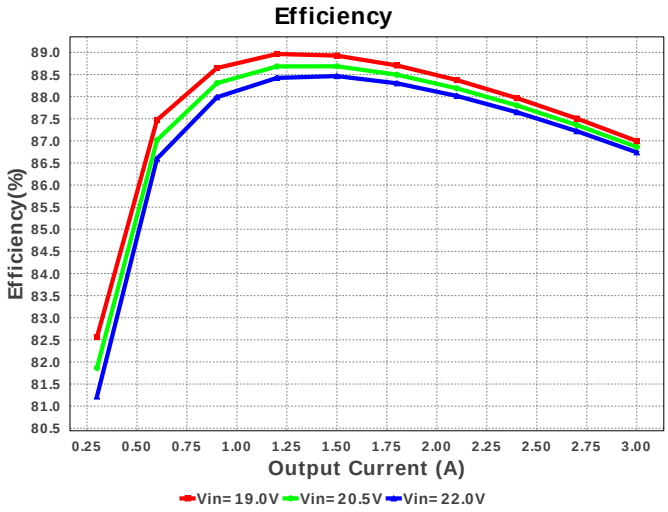



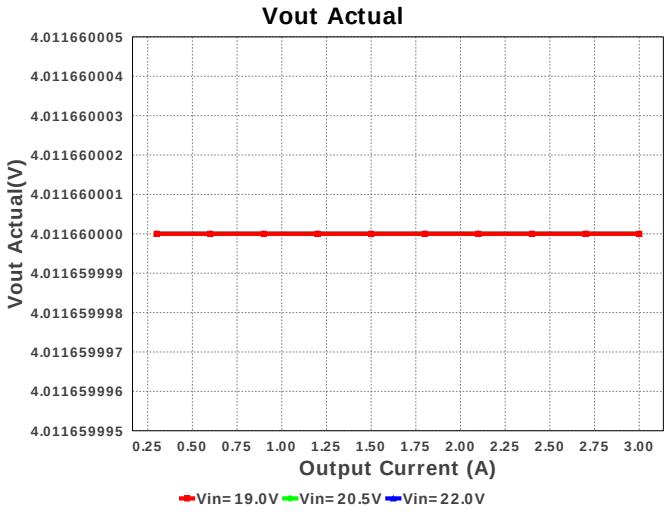



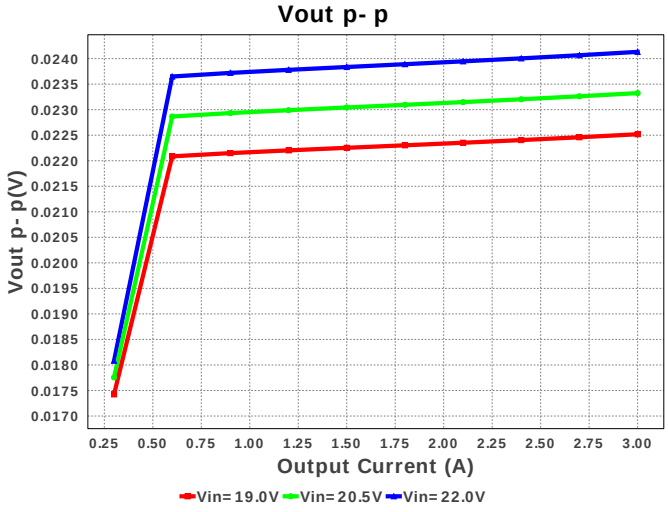



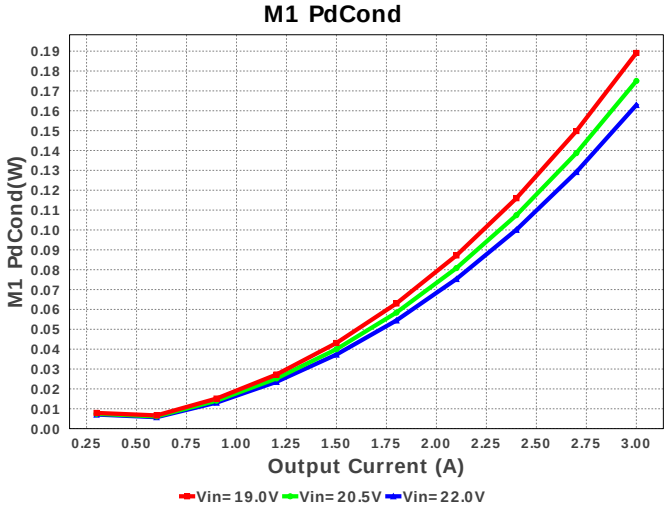


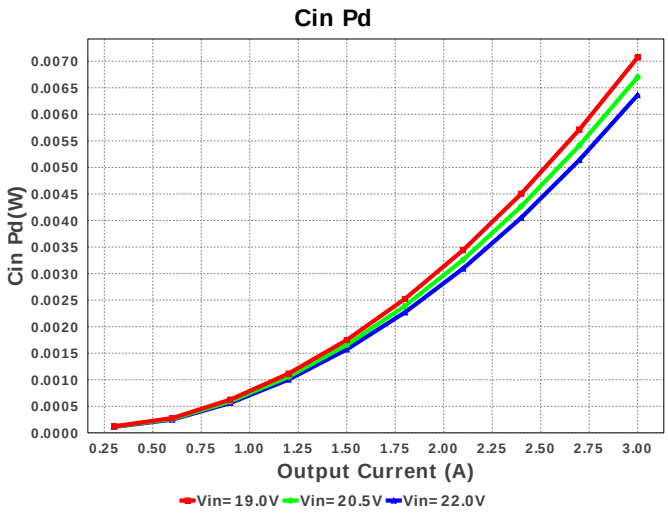



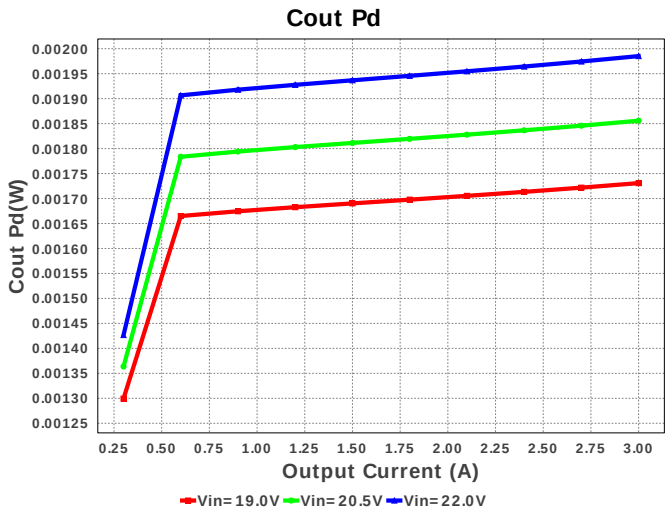



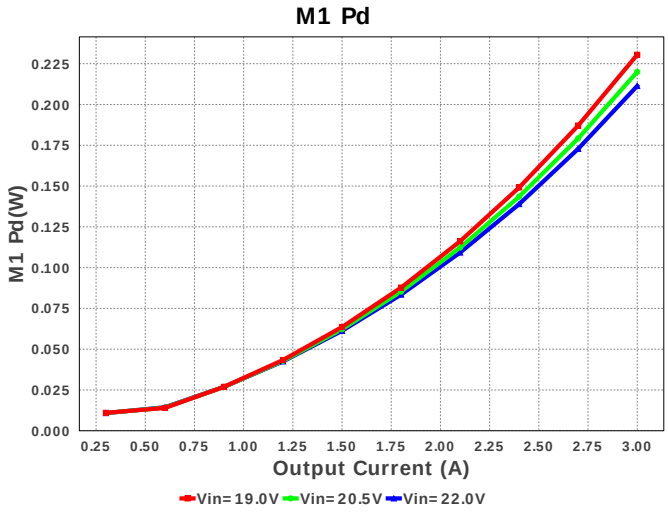



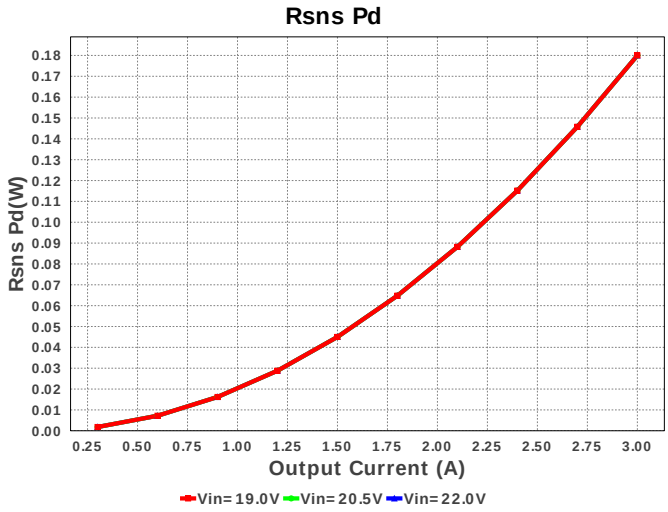



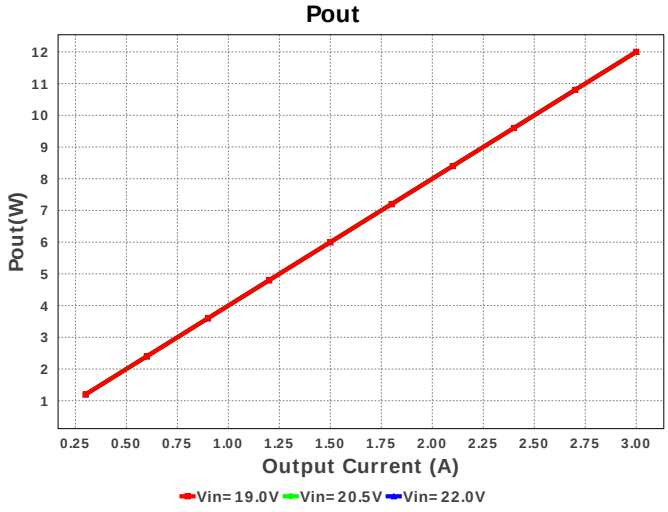



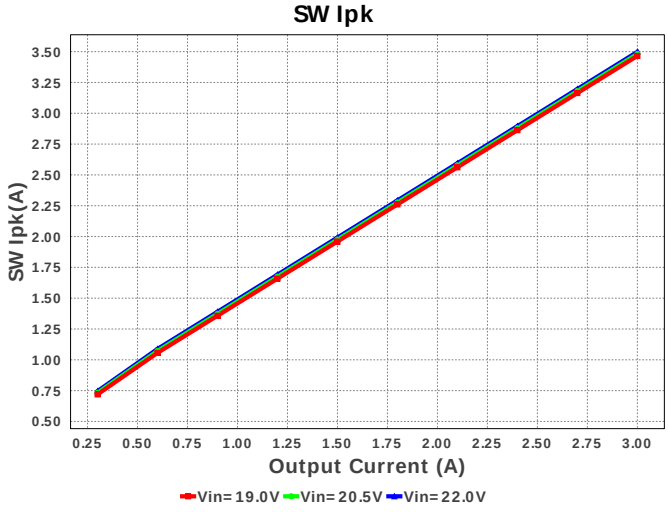


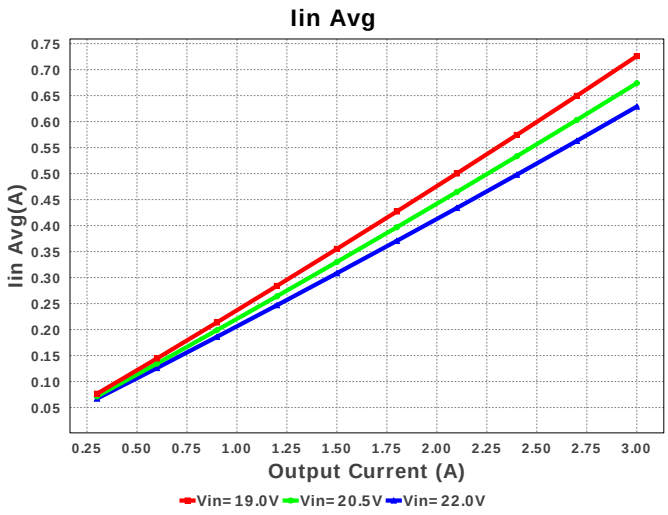



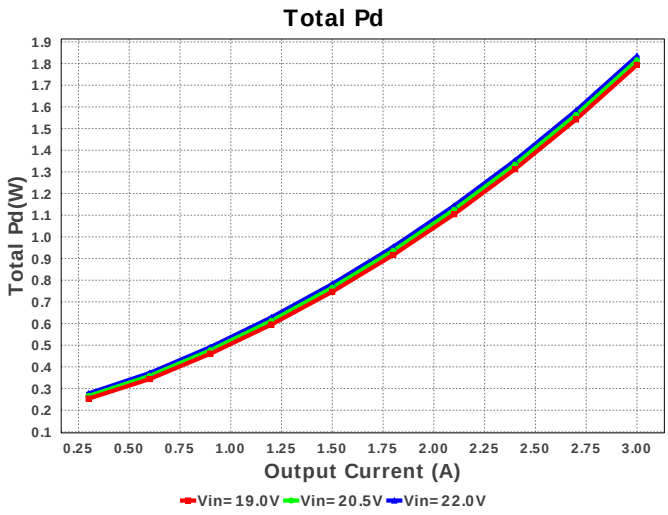



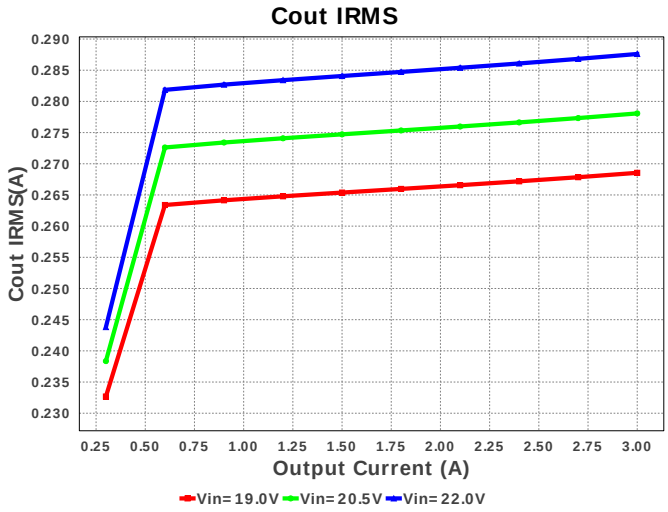



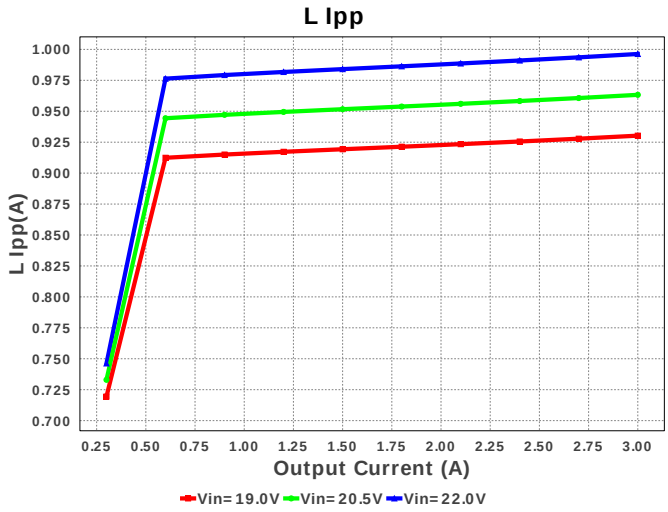



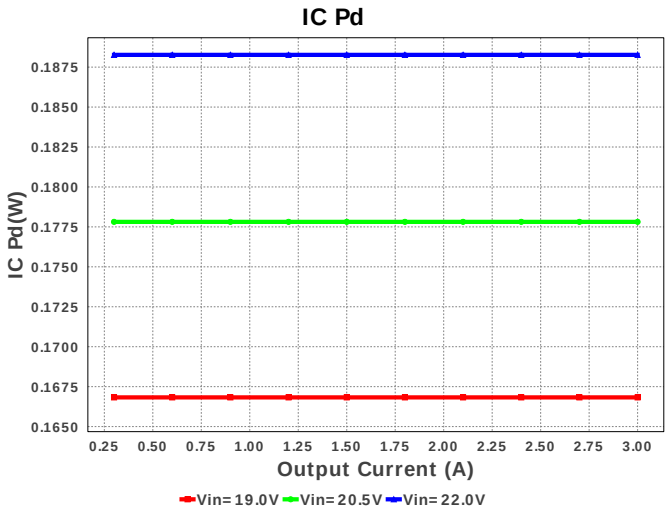



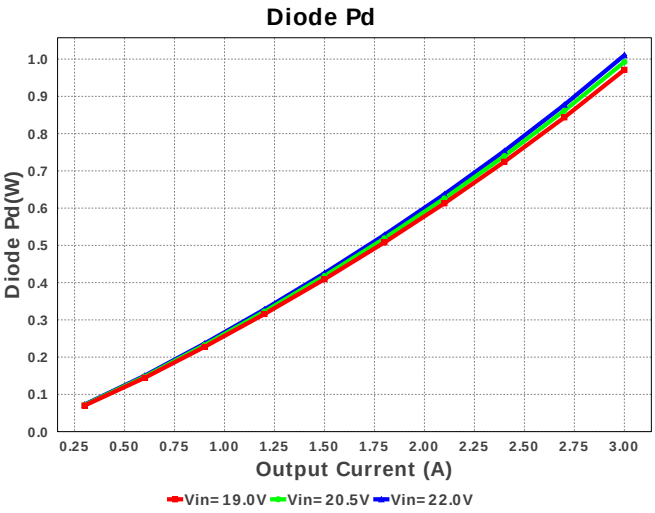


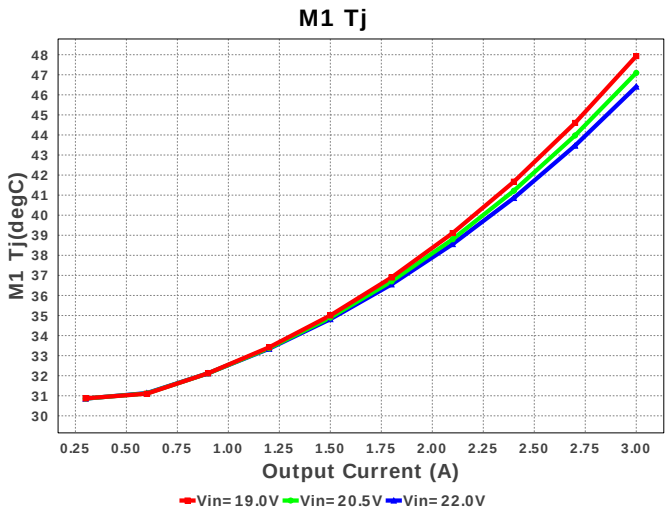



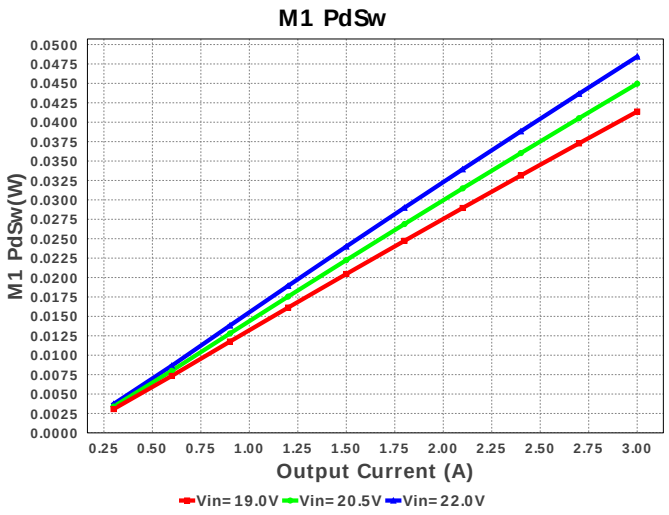






## Operating Values

| # | Name | Value | Category | Description |
|---|---|---|---|---|
| 1. | Cin IRMS | 1.196 A | Current | Input capacitor RMS ripple current |
| 2. | Cout IRMS | 281.19 mA | Current | Output capacitor RMS ripple current |
| 3. | Iin Avg | 628.86 mA | Current | Average input current |
| 4. | L Ipp | 974.07 mA | Current | Peak-to-peak inductor ripple current |
| 5. | SW Ipk | 3.487 A | Current | Peak switch current |
| 6. | BOM Count | 12 | General | Total Design BOM count |
| 7. | FootPrint | 476.0 $mm^2$ | General | Total Foot Print Area of BOM components |
| 8. | Frequency | 382.03 kHz | General | Switching frequency |
| 9. | IC Tolerance | 0.0 V | General | IC Feedback Tolerance |
| 10. | Mode | CCM | General | Conduction Mode |
| 11. | Pout | 12.0 W | General | Total output power |
| 12. | Total BOM | $1.8 | General | Total BOM Cost |
| 13. | D1 Tj | 80.516 degC | Op_Point | D1 junction temperature |
| 14. | Vout Actual | 4.012 V | Op_Point | Vout Actual calculated based on selected voltage divider resistors |
| 15. | Vout OP | 4.0 V | Op_Point | Operational Output Voltage |
| 16. | Duty Cycle | 19.823 % | Op_point | Duty cycle |
| 17. | Efficiency | 86.737 % | Op_point | Steady state efficiency |
| 18. | IC Tj | 67.653 degC | Op_point | IC junction temperature |
| 19. | ICThetaJA | 200.0 degC/W | Op_point | IC junction-to-ambient thermal resistance |
| 20. | IOUT_OP | 3.0 A | Op_point | Iout operating point |
| 21. | M1 Tj | 46.411 degC | Op_point | M1 MOSFET junction temperature |
| 22. | VIN_OP | 22.0 V | Op_point | Vin operating point |
| 23. | Vout p-p | 23.594 mV | Op_point | Peak-to-peak output ripple voltage |
| 24. | Cin Pd | 6.362 mW | Power | Input capacitor power dissipation |
| 25. | Cout Pd | 1.898 mW | Power | Output capacitor power dissipation |
| 26. | D1 Pd | 1.01 W | Power | Output Diode Power Dissipation |
| 27. | Diode Pd | 1.01 W | Power | Diode power dissipation |
| 28. | IC Pd | 188.267 mW | Power | IC power dissipation |
| 29. | L Pd | 236.25 mW | Power | Inductor power dissipation |
| 30. | M1 Pd | 211.88 mW | Power | M1 MOSFET total power dissipation |
| 31. | M1 PdCond | 163.433 mW | Power | M1 MOSFET conduction losses |
| 32. | M1 PdSw | 48.448 mW | Power | M1 MOSFET switching losses |
| 33. | Rsns Pd | 180.0 mW | Power | LED Current Rsns Power Dissipation |
| 34. | Total Pd | 1.835 W | Power | Total Power Dissipation |
| 35. | Vout Tolerance | 767.11 m% | | Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable |

## Design Inputs

| # | Name | Value | Description |
|---|---|---|---|
| 1. | Iout | 3.0 | Maximum Output Current |
| 2. | VinMax | 22.0 | Maximum input voltage |
| 3. | VinMin | 19.0 | Minimum input voltage |
| 4. | Vout | 4.0 | Output Voltage |
| 5. | base_pn | LM3485 | Base Product Number |
| 6. | source | DC | Input Source Type |
| 7. | Ta | 30.0 | Ambient temperature |

## Design Assistance

1. Outline The LM3485 is a hysteretic PFET controller. The hysteretic control architecture provides for a stable design without the use of a control loop. The switching frequency depends on the inductance value, output capacitor ESR, and the input voltage. Therefore depending on the chosen BOM, the frequency at different input voltages would vary.

2. **LM3485** Product Folder : http://www.ti.com/product/LM3485 : contains the data sheet and other resources.