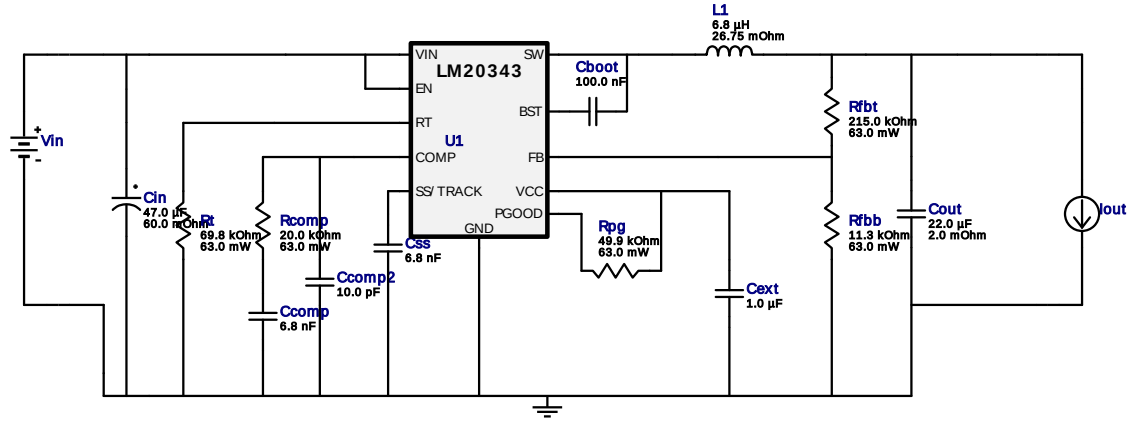
TEXAS INSTRUMENTS

# WEBENCH® Design Report

VinMin = 20.5V
VinMax = 20.5V
Vout = 16.0V
Iout = 2.5A

Device = LM20343MHX/NOPB
Topology = Buck
Created = 10/16/14 6:38:37 AM
BOM Cost = $3.71
Footprint = 266.0 mm²
BOM Count = 14
Total Pd = 1.75W

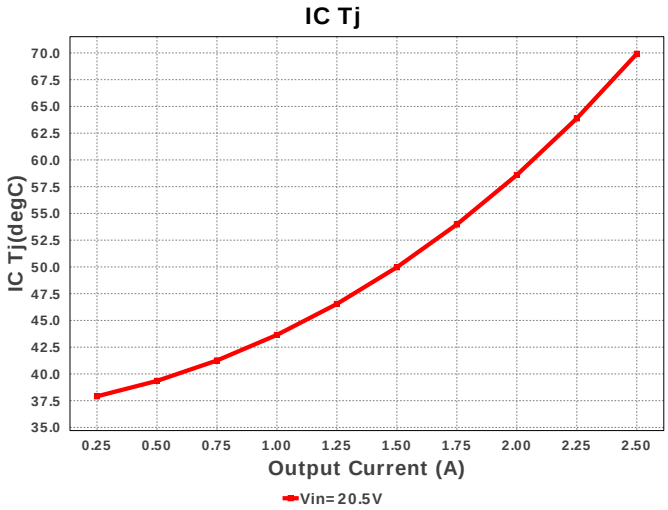
Design : 3456224/910 LM20343MHX/NOPB
LM20343MHX/NOPB 20.5V-20.5V to 16.00V @ 2.5A

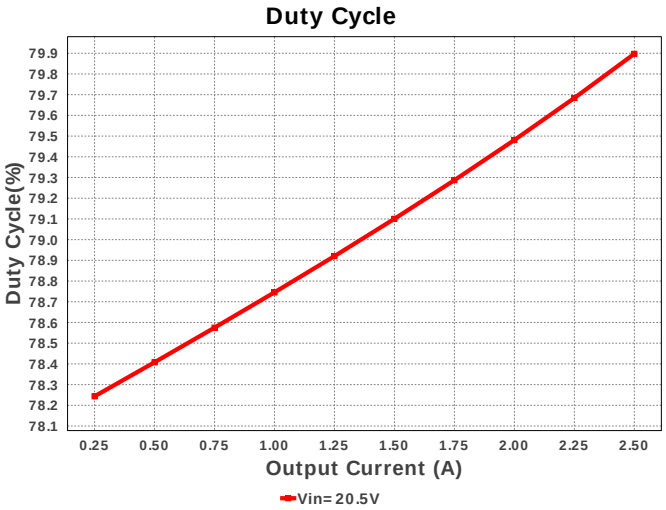


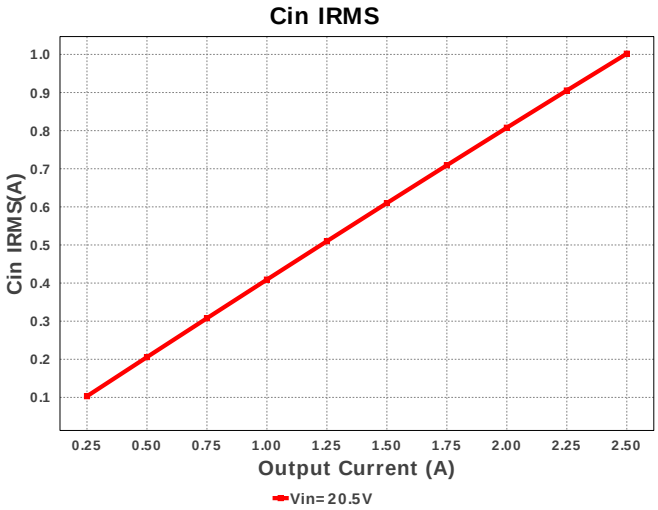

## Electrical BOM

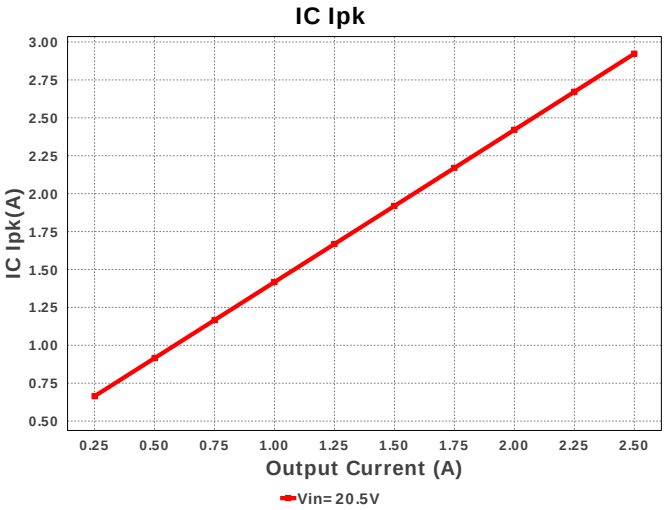
| # | Name | Manufacturer | Part Number | Properties | Qty | Price | Footprint |
|---|---|---|---|---|---|---|---|
| 1. | Cboot | MuRata | GRM21BR71E104KA01L<br>Series= X7R | Cap= 100.0 nF<br>VDC= 25.0 V<br>IRMS= 0.0 A | 1 | $0.01 | 0805 7 mm² |
| 2. | Ccomp | Yageo America | CC0805KRX7R9BB682<br>Series= X7R | Cap= 6.8 nF<br>VDC= 50.0 V<br>IRMS= 0.0 A | 1 | $0.01 | 0805 7 mm² |
| 3. | Ccomp2 | Yageo America | CC0805JRNP09BN100<br>Series= C0G/NP0 | Cap= 10.0 pF<br>VDC= 50.0 V<br>IRMS= 0.0 A | 1 | $0.01 | 0805 7 mm² |
| 4. | Cext | MuRata | GRM155R61A105KE15D<br>Series= X5R | Cap= 1.0 uF<br>VDC= 10.0 V<br>IRMS= 0.0 A | 1 | $0.01 | 0402 3 mm² |
| 5. | Cin | Panasonic | EEHZA1V470P<br>Series= ? | Cap= 47.0 uF<br>ESR= 60.0 mOhm<br>VDC= 35.0 V<br>IRMS= 1.3 A | 1 | $0.56 | SM_RADIAL_6.3AMM 80 mm² |
| 6. | Cout | MuRata | GRM32ER61E226KE15L<br>Series= X5R | Cap= 22.0 uF<br>ESR= 2.0 mOhm<br>VDC= 25.0 V<br>IRMS= 3.67 A | 1 | $0.28 | 1210 15 mm² |
| 7. | Css | Yageo America | CC0805KRX7R9BB682<br>Series= X7R | Cap= 6.8 nF<br>VDC= 50.0 V<br>IRMS= 0.0 A | 1 | $0.01 | 0805 7 mm² |
| 8. | L1 | Coilcraft | XAL5050-682MEB | L= 6.8 µH<br>DCR= 26.75 mOhm | 1 | $0.92 | XAL5050 54 mm² |
| 9. | Rcomp | Vishay-Dale | CRCW040220K0FKED<br>Series= CRCW..e3 | Res= 20.0 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | 0402 3 mm² |
| 10. | Rfbb | Vishay-Dale | CRCW040211K3FKED<br>Series= CRCW..e3 | Res= 11.3 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | 0402 3 mm² |
| 11. | Rfbt | Vishay-Dale | CRCW0402215KFKED<br>Series= CRCW..e3 | Res= 215.0 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | 0402 3 mm² |

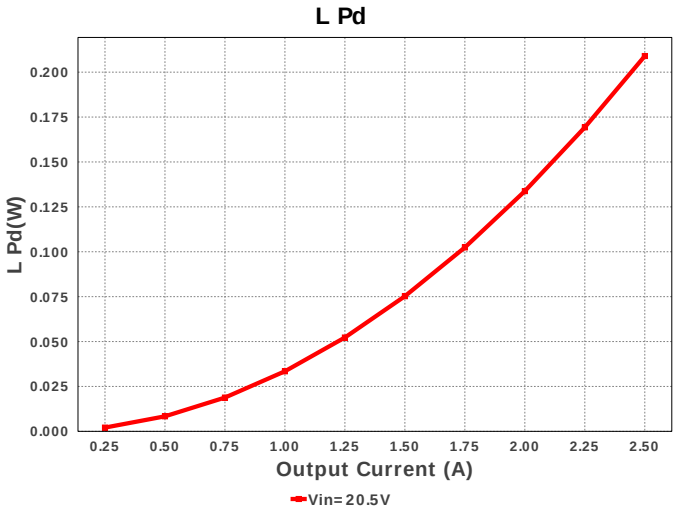
| # | Name | Manufacturer | Part Number | Properties | Qty | Price | Footprint |
|---|---|---|---|---|---|---|---|
| 12. | Rpg | Vishay-Dale | CRCW040249K9FKED<br>Series= CRCW..e3 | Res= 49.9 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | 0402 3 mm² |
| 13. | Rt | Vishay-Dale | CRCW040269K8FKED<br>Series= CRCW..e3 | Res= 69.8 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | 0402 3 mm² |
| 14. | U1 | Texas Instruments | LM20343MHX/NOPB | Switcher | 1 | $1.85 | MXA20A 71 mm² |

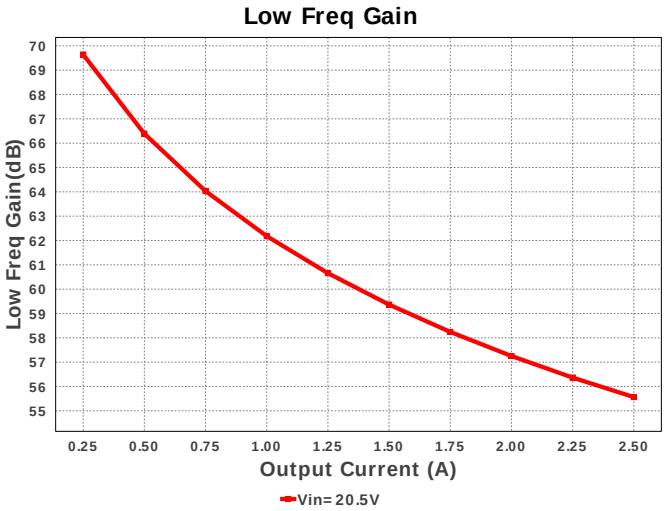


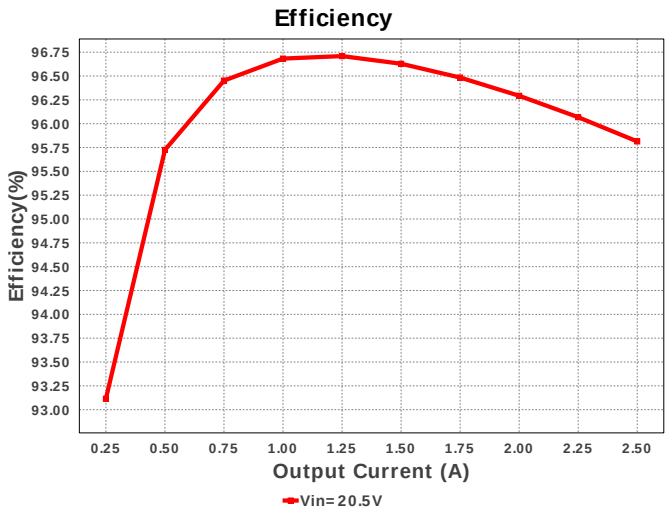



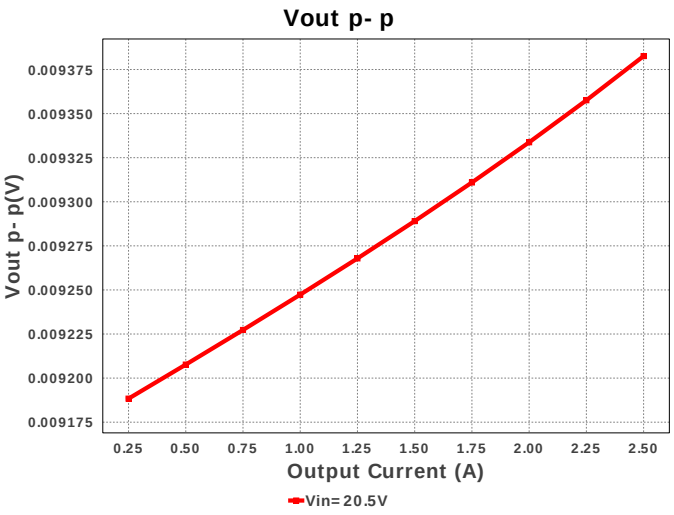



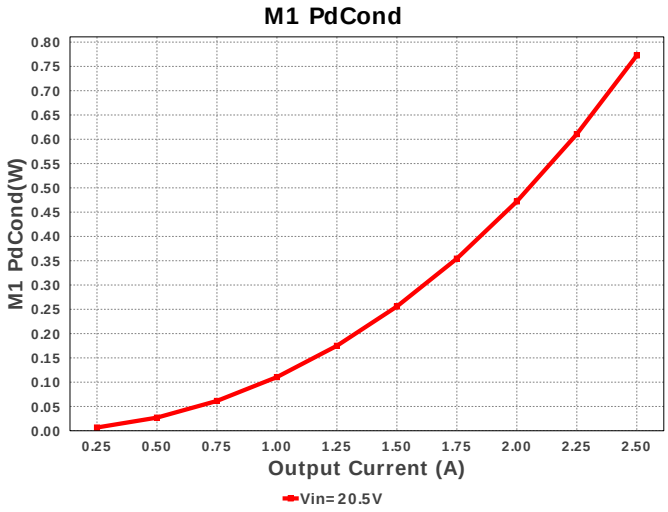



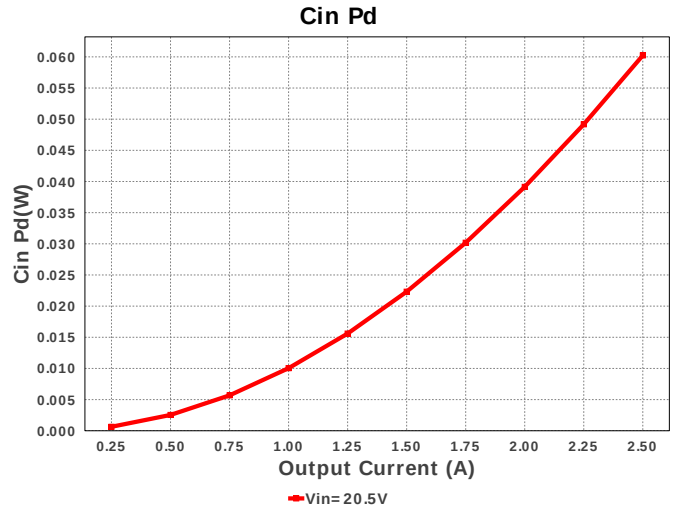



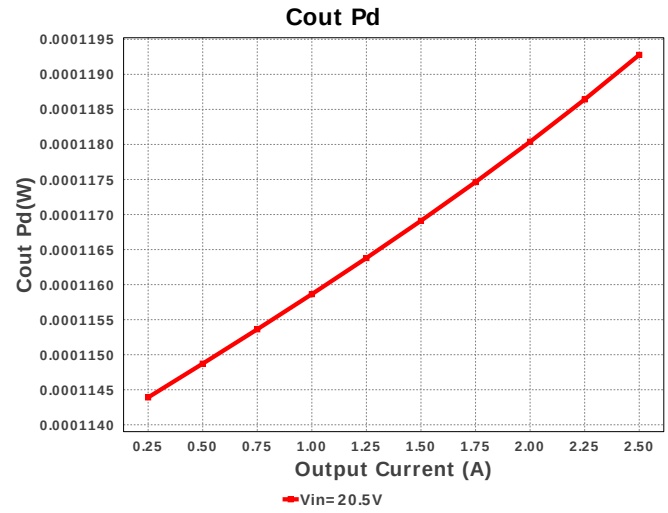



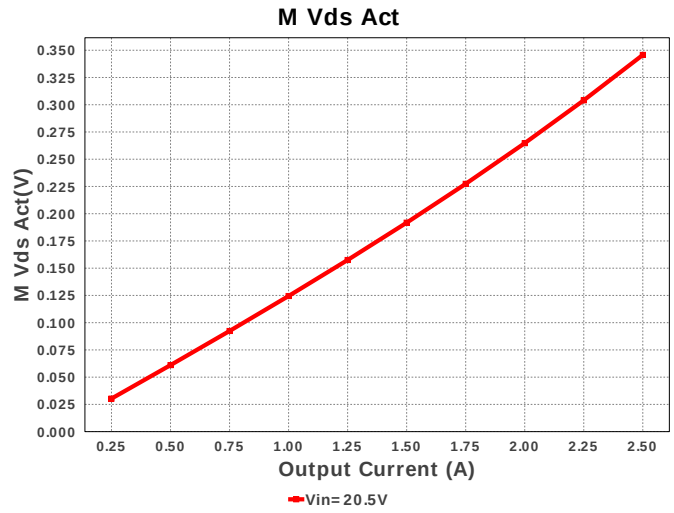


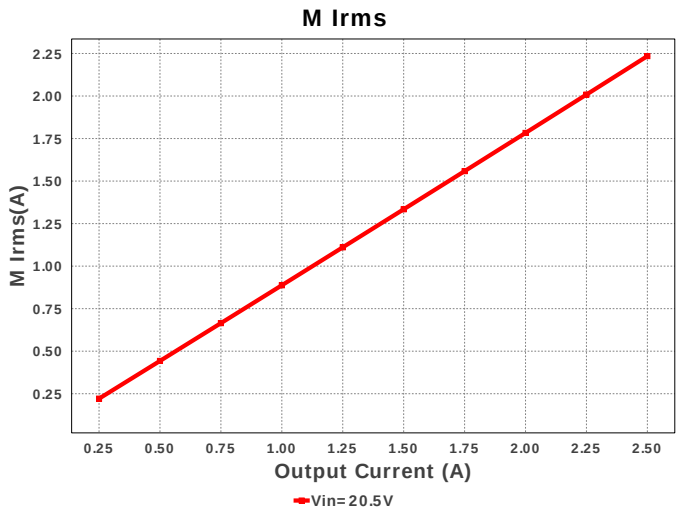



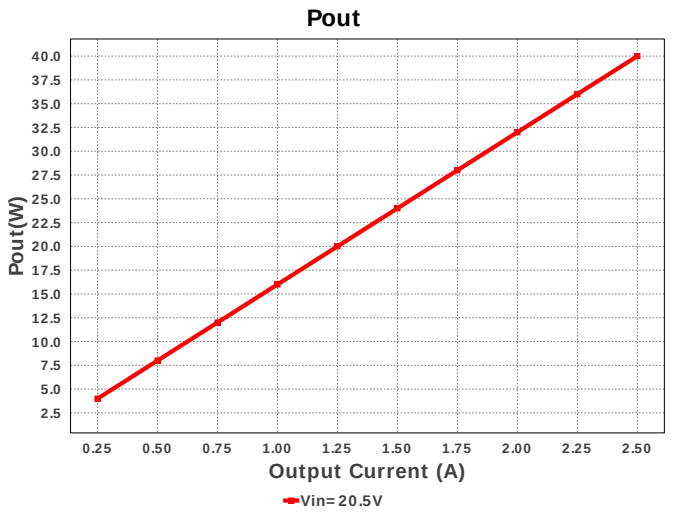



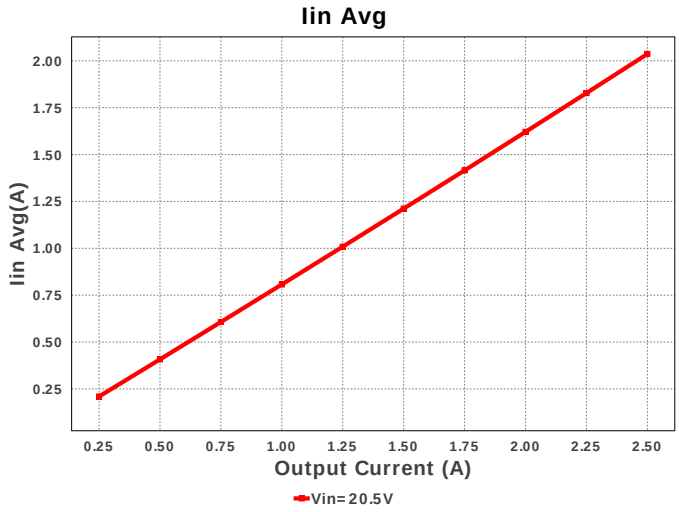



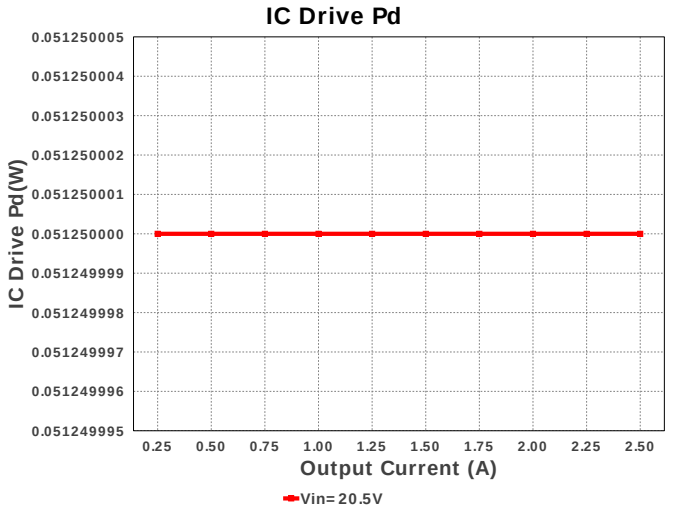



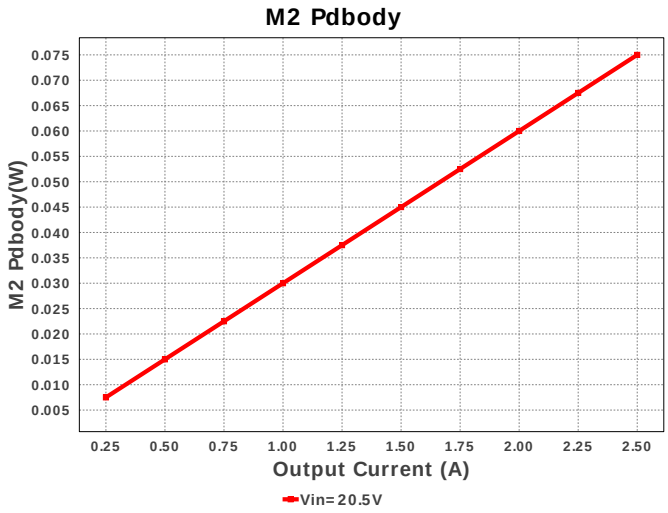



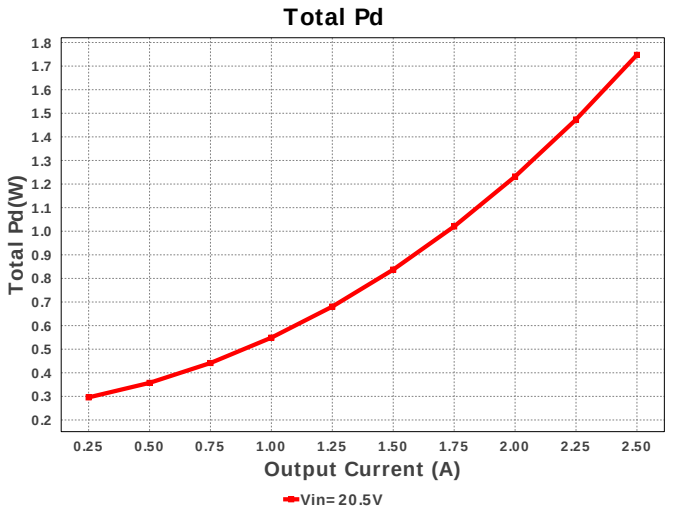


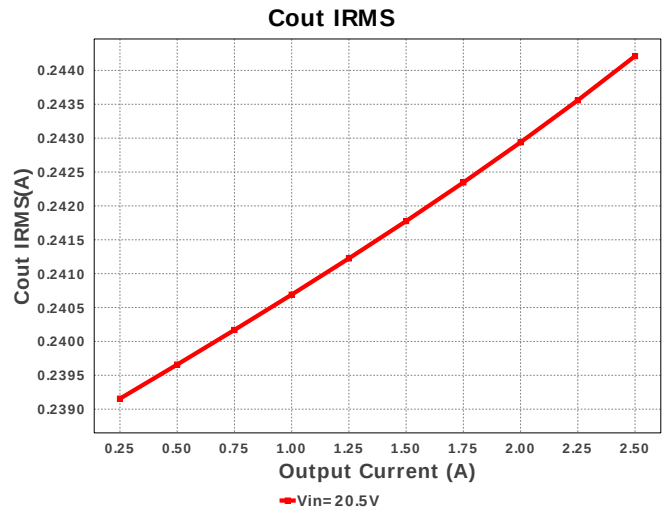



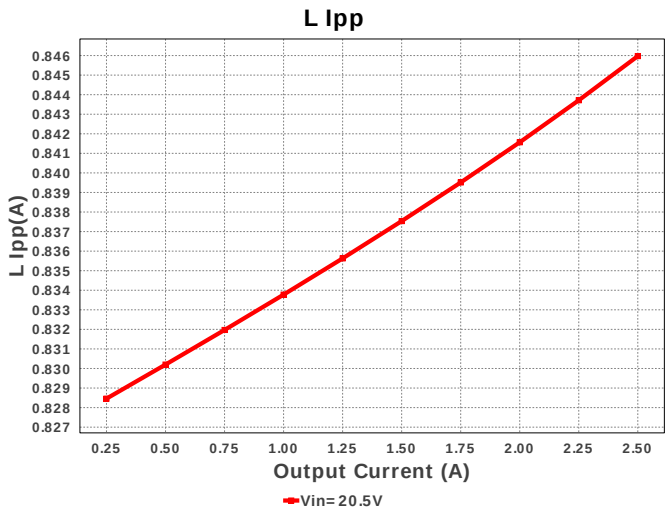



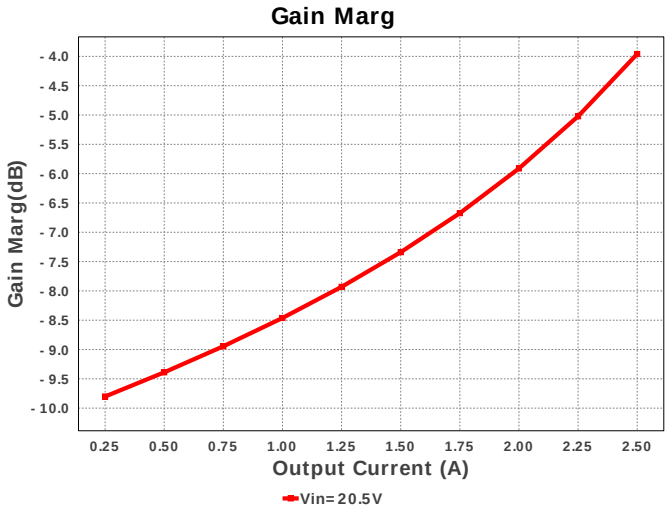



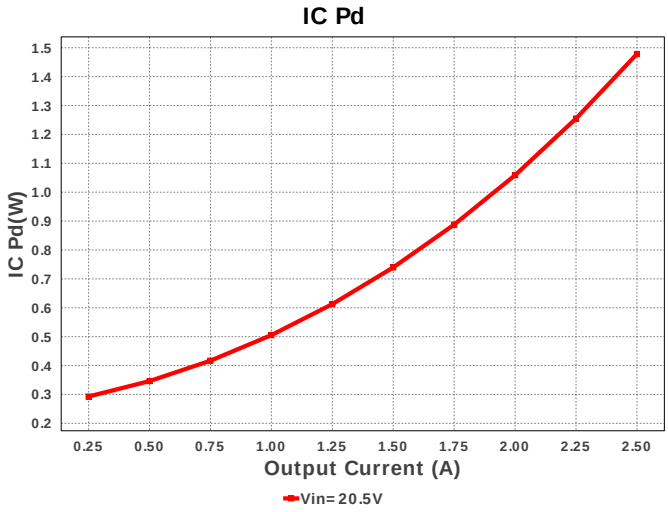



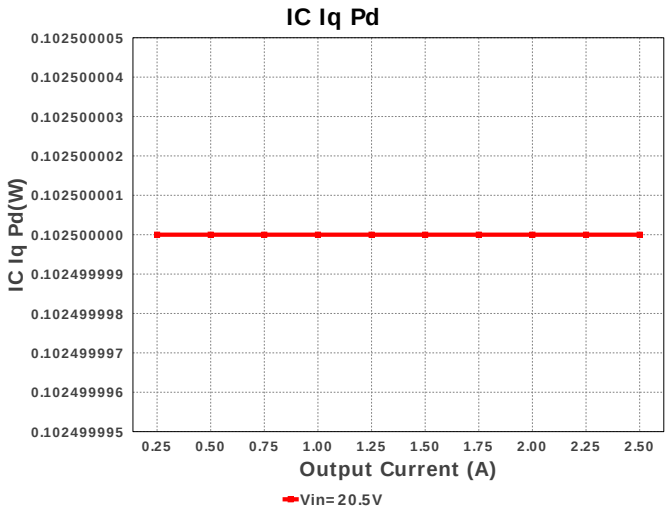



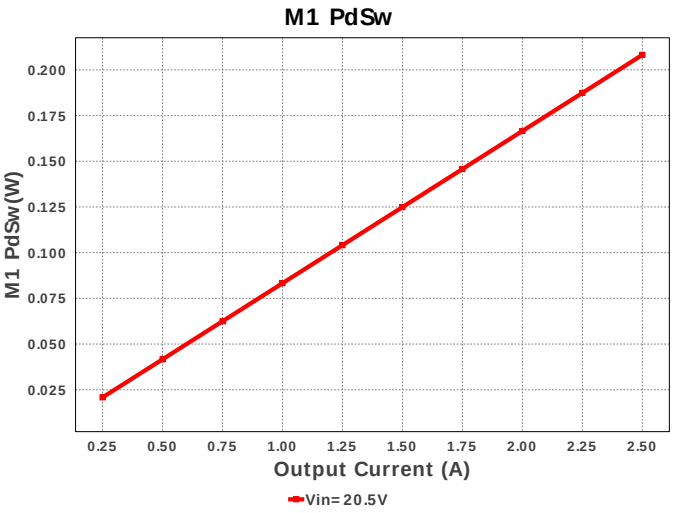


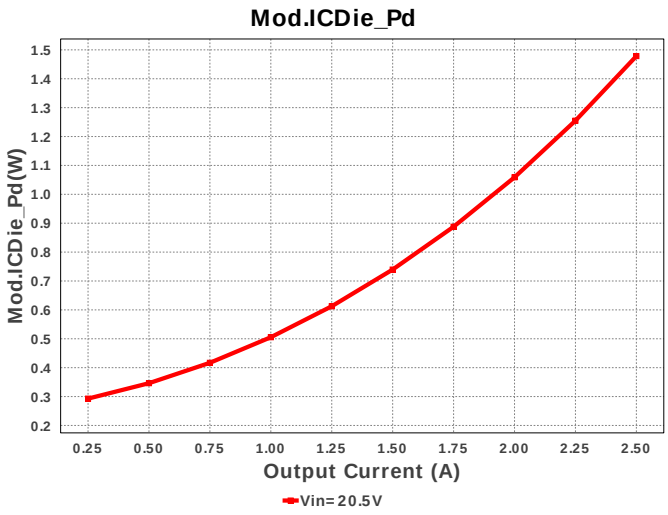



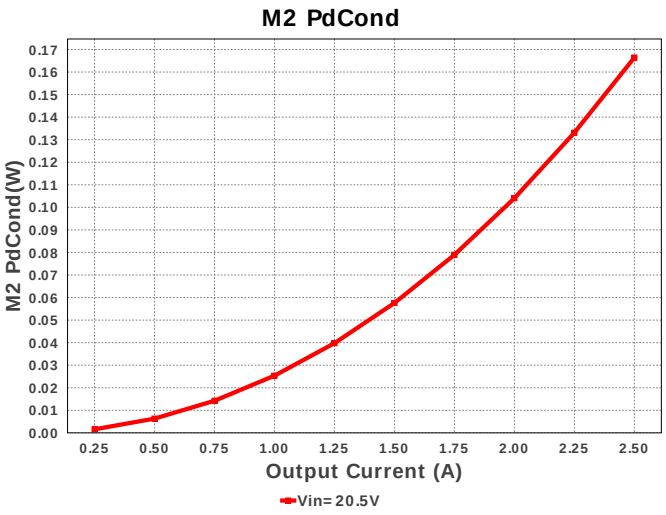



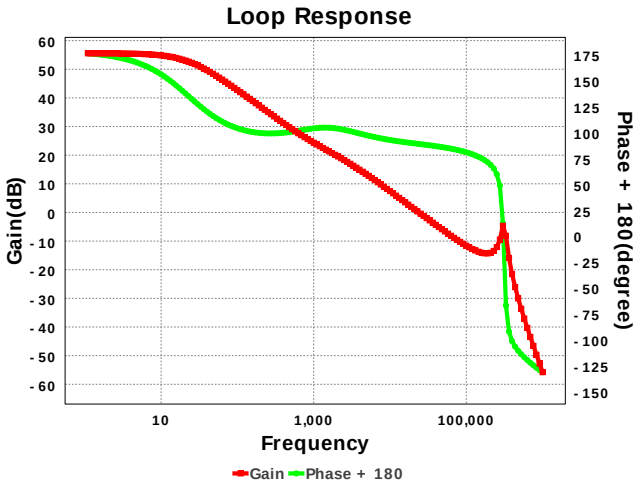






## Operating Values

| # | Name | Value | Category | Description |
|---|---|---|---|---|
| 1. | Cin IRMS | 1.002 A | Current | Input capacitor RMS ripple current |
| 2. | Cout IRMS | 244.211 mA | Current | Output capacitor RMS ripple current |
| 3. | IC Ipk | 2.923 A | Current | Peak switch current in IC |
| 4. | Iin Avg | 2.036 A | Current | Average input current |
| 5. | L Ipp | 845.972 mA | Current | Peak-to-peak inductor ripple current |
| 6. | M Irms | 2.235 A | Current | MOSFET RMS current |
| 7. | BOM Count | 14 | General | Total Design BOM count |
| 8. | FootPrint | 266.0 $mm^2$ | General | Total Foot Print Area of BOM components |
| 9. | Frequency | 625.0 kHz | General | Switching frequency |
| 10. | IC Tolerance | 12.0 mV | General | IC Feedback Tolerance |
| 11. | M Vds Act | 345.707 mV | General | Voltage drop across the MosFET |
| 12. | Pout | 40.0 W | General | Total output power |
| 13. | Total BOM | $3.71 | General | Total BOM Cost |
| 14. | Vout OP | 16.0 V | Op_Point | Operational Output Voltage |
| 15. | Cross Freq | 23.94 kHz | Op_point | Bode plot crossover frequency |
| 16. | Duty Cycle | 79.897 % | Op_point | Duty cycle |
| 17. | Efficiency | 95.814 % | Op_point | Steady state efficiency |
| 18. | Gain Marg | -3.959 dB | Op_point | Bode Plot Gain Margin |
| 19. | IC Tj | 69.917 degC | Op_point | IC junction temperature |
| 20. | ICThetaJA | 27.0 degC/W | Op_point | IC junction-to-ambient thermal resistance |
| 21. | IOUT_OP | 2.5 A | Op_point | Iout operating point |
| 22. | Phase Marg | 90.01 deg | Op_point | Bode Plot Phase Margin |
| 23. | VIN_OP | 20.5 V | Op_point | Vin operating point |
| 24. | Vout p-p | 9.383 mV | Op_point | Peak-to-peak output ripple voltage |
| 25. | Cin Pd | 60.23 mW | Power | Input capacitor power dissipation |
| 26. | Cout Pd | 119.278 $\mu$W | Power | Output capacitor power dissipation |
| 27. | IC Drive Pd | 51.25 mW | Power | Driver power dissipation |
| 28. | IC Iq Pd | 102.5 mW | Power | IC Iq Pd |
| 29. | IC Pd | 1.478 W | Power | IC power dissipation |
| 30. | L Pd | 208.984 mW | Power | Inductor power dissipation |
| 31. | M1 PdCond | 772.528 mW | Power | M1 MOSFET switching losses |

| # | Name | Value | Category | Description |
|---|---|---|---|---|
| 32. | M1 PdSw | 208.203 mW | Power | M1 MOSFET switching losses |
| 33. | M2 PdCond | 166.423 mW | Power | M2 MOSFET switching losses |
| 34. | M2 Pdbody | 75.0 mW | Power | Power dissipation through lower FET |
| 35. | Total Pd | 1.748 W | Power | Total Power Dissipation |
| 36. | Low Freq Gain | 55.564 dB | Unknown | Gain at 10Hz |

## Design Inputs

| # | Name | Value | Description |
|---|---|---|---|
| 1. | Iout | 2.5 A | Maximum Output Current |
| 2. | Iout1 | 2.5 Amps | Output Current #1 |
| 3. | VinMax | 20.5 V | Maximum input voltage |
| 4. | VinMin | 20.5 V | Minimum input voltage |
| 5. | Vout | 16.0 V | Output Voltage |
| 6. | Vout1 | 16.0 Volt | Output Voltage #1 |
| 7. | base_pn | LM20343 | Texas Instruments Base Part Number |
| 8. | source | DC | Input Source Type |
| 9. | ta | 30.0 degC | Ambient temperature |

## Design Assistance

1. LM20343 Product Folder : http://www.ti.com/product/lm20343 : contains the data sheet and other resources.