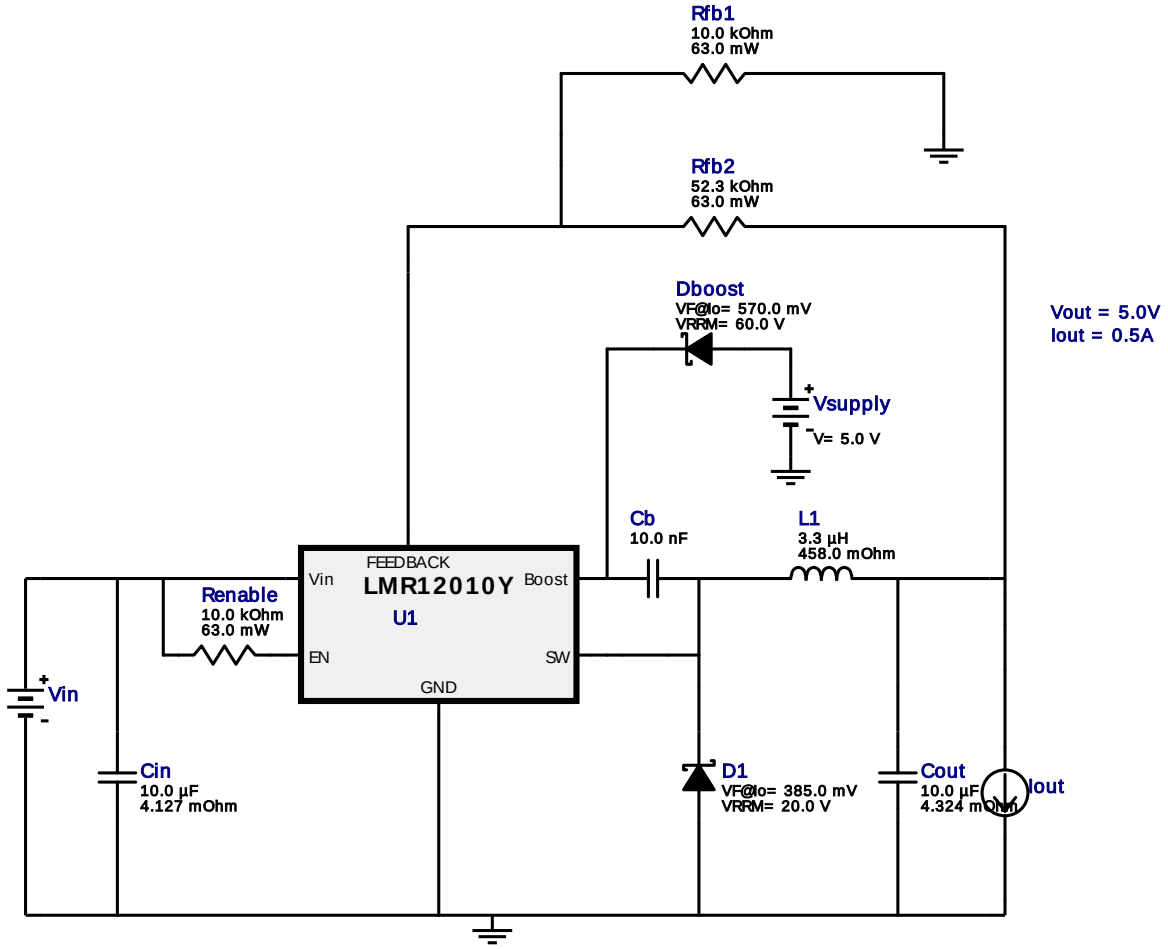
# WEBENCH® Design Report

VinMin = 10.0V
VinMax = 12.0V
Vout = 5.0V
Iout = 0.5A

Device = LMR12010YMK/NOPB
Topology = Buck
Created = 7/21/16 8:58:02 PM
BOM Cost = $1.35
BOM Count = 10
Total Pd = 0.54W

Design : 4742013/253 LMR12010YMK/NOPB
LMR12010YMK/NOPB 10.0V-12.0V to 5.00V @ 0.5A

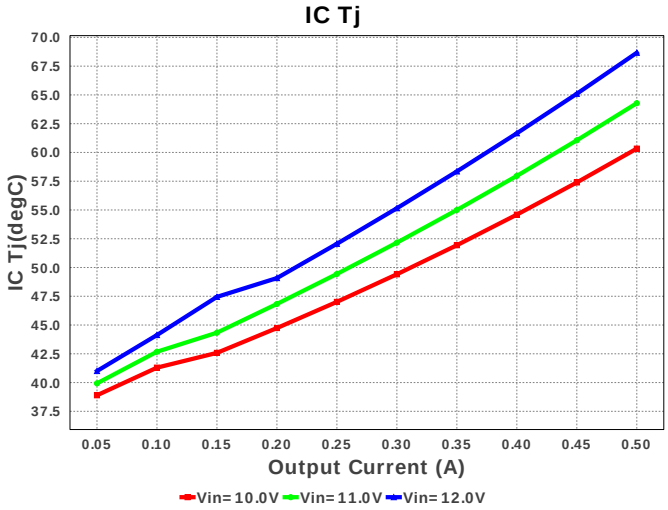


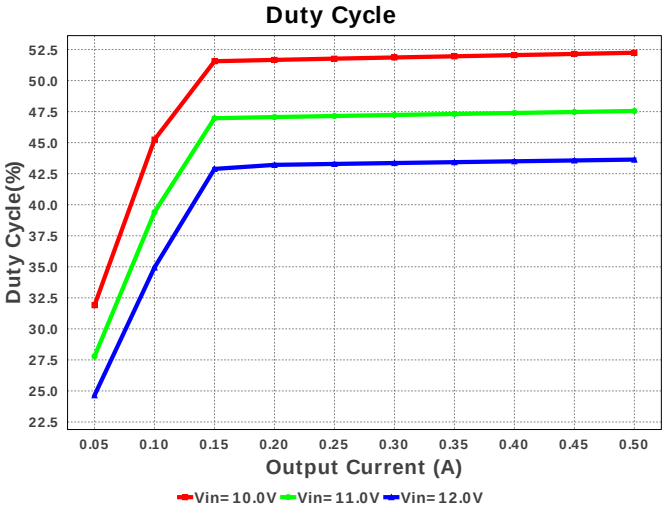

1. The Boost pin voltage must be supplied from a source of less than 5.5V. Recommended methods are described in the LM2734 datasheet Application Information.

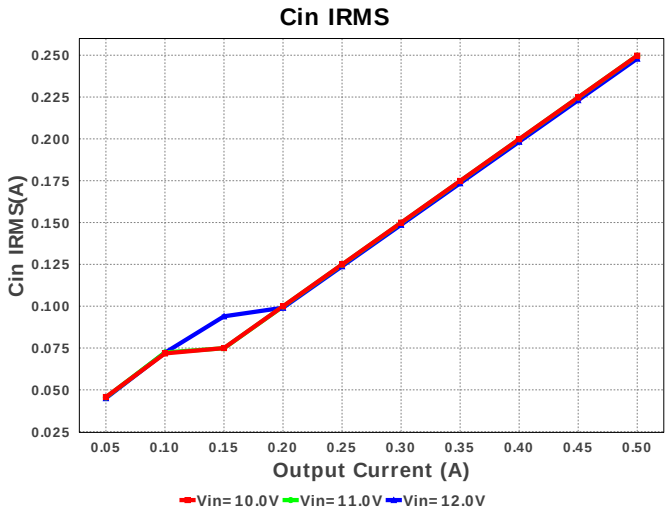
## Electrical BOM

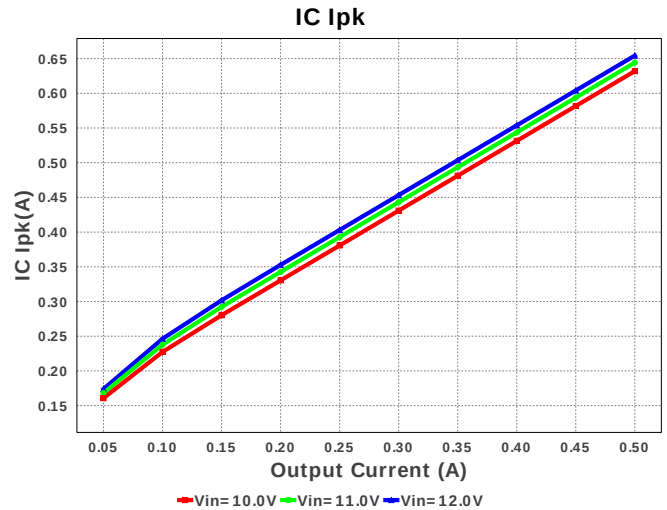
| # | Name | Manufacturer | Part Number | Properties | Qty | Price | Footprint |
|---|---|---|---|---|---|---|---|
| 1. | Cb | MuRata | GRM216R71H103KA01D<br>Series= X7R | Cap= 10.0 nF<br>VDC= 50.0 V<br>IRMS= 0.0 A | 1 | $0.01 | 0805 7 mm² |
| 2. | Cin | MuRata | GRM21BR61C106KE15L<br>Series= X5R | Cap= 10.0 uF<br>ESR= 4.127 mOhm<br>VDC= 16.0 V<br>IRMS= 2.46634 A | 1 | $0.03 | 0805 7 mm² |
| 3. | Cout | MuRata | GRM219R60J106KE19D<br>Series= X5R | Cap= 10.0 uF<br>ESR= 4.324 mOhm<br>VDC= 6.3 V<br>IRMS= 2.8728 A | 1 | $0.02 | 0805 7 mm² |
| 4. | D1 | ON Semiconductor | MBR0520LT1G | VF@Io= 385.0 mV<br>VRRM= 20.0 V | 1 | $0.06 | SOD-123 13 mm² |
| 5. | Dboost | NXP Semiconductor | PMEG6010CEH,115 | VF@Io= 570.0 mV<br>VRRM= 60.0 V | 1 | $0.04 | SOD-123F 12 mm² |

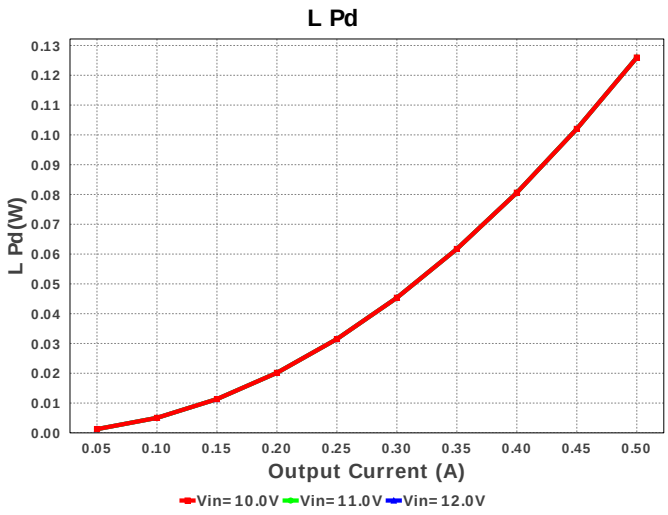
| # | Name | Manufacturer | Part Number | Properties | Qty | Price | Footprint |
|---|---|---|---|---|---|---|---|
| 6. | L1 | TDK | VLS201610ET-3R3M | L= 3.3 µH<br>DCR= 458.0 mOhm | 1 | $0.17 | VLS201610ET 8 mm² |
| 7. | Renable | Vishay-Dale | CRCW040210K0FKED<br>Series= CRCW..e3 | Res= 10.0 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | 0402 3 mm² |
| 8. | 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 mm² |
| 9. | Rfb2 | Vishay-Dale | CRCW040252K3FKED<br>Series= CRCW..e3 | Res= 52.3 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0% | 1 | $0.01 | 0402 3 mm² |
| 10. | U1 | Texas Instruments | LMR12010YMK/NOPB | Switcher | 1 | $0.99 | MK06A 11 mm² |

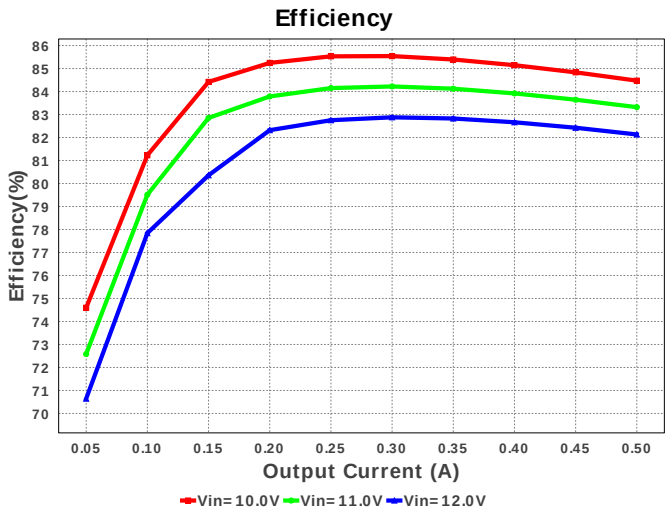


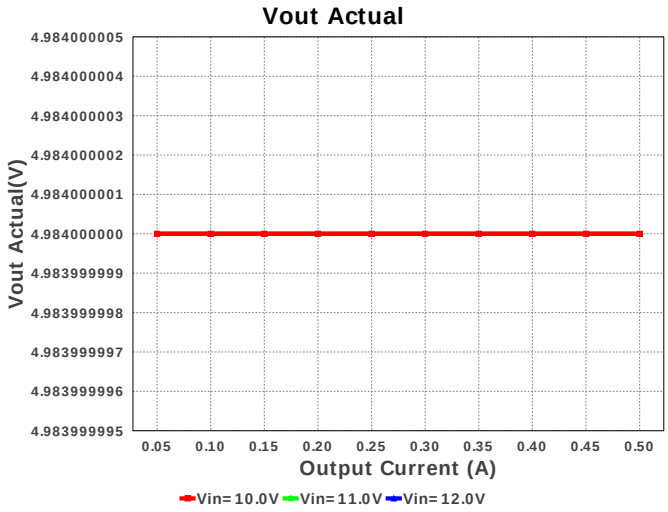



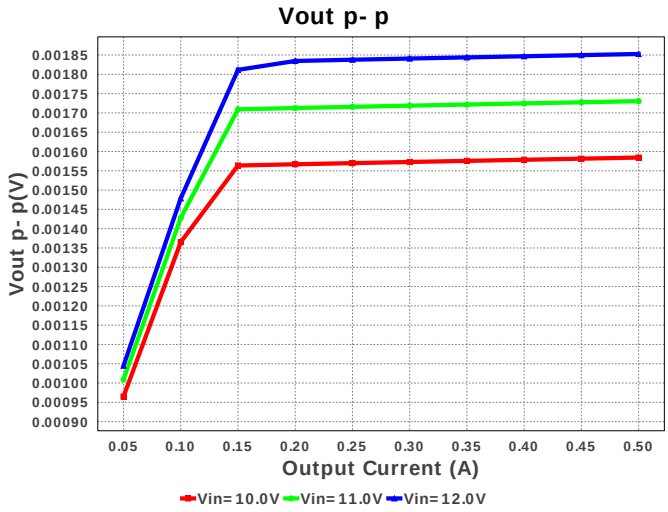



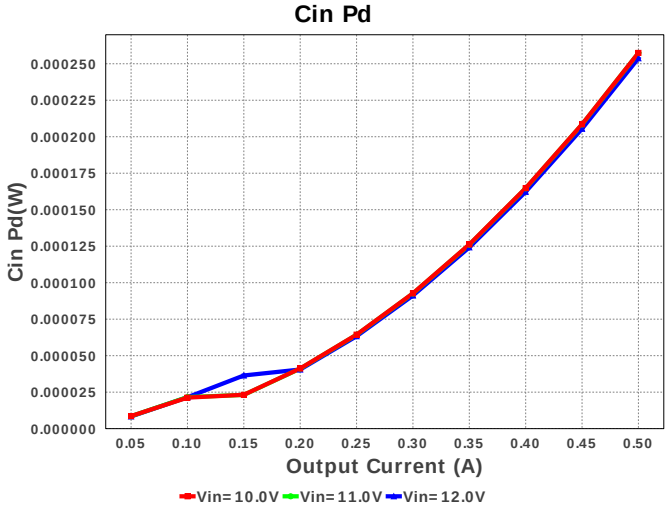



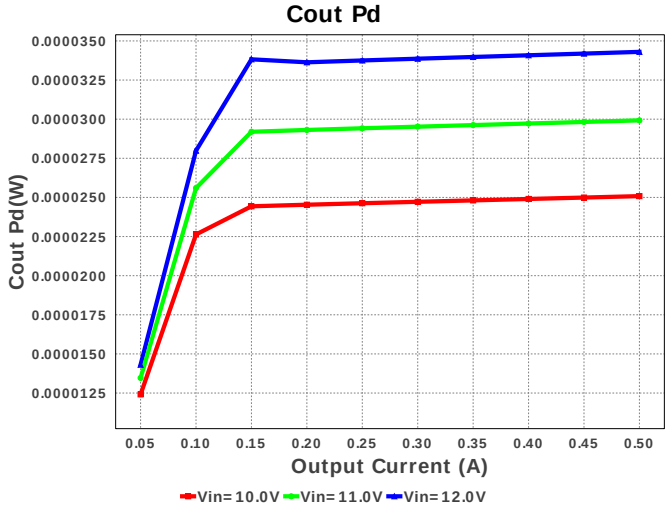


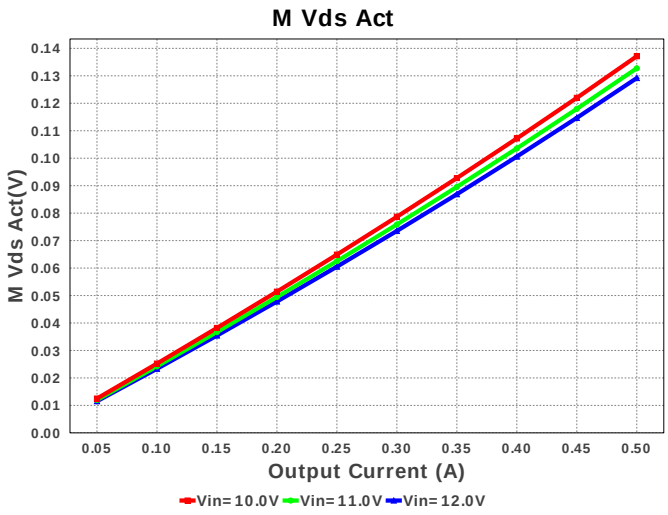



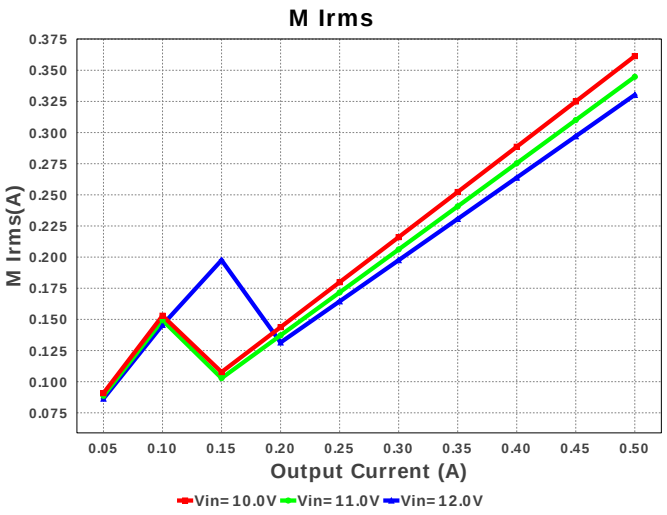



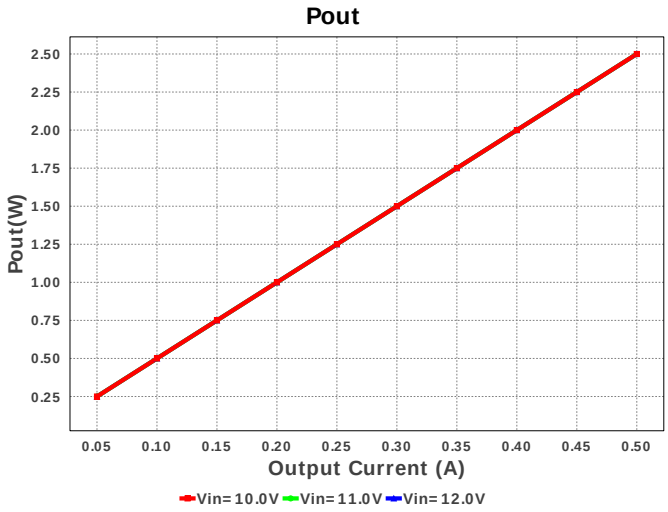



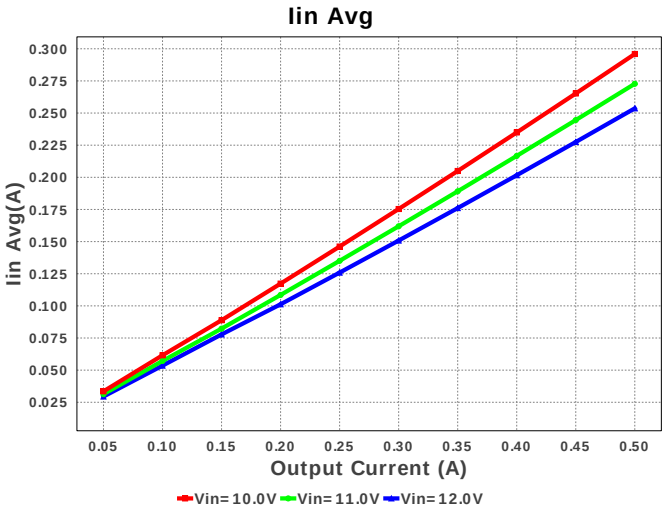



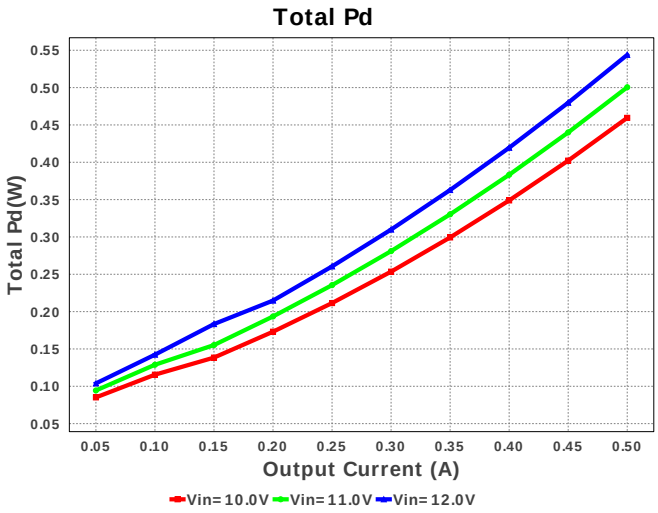



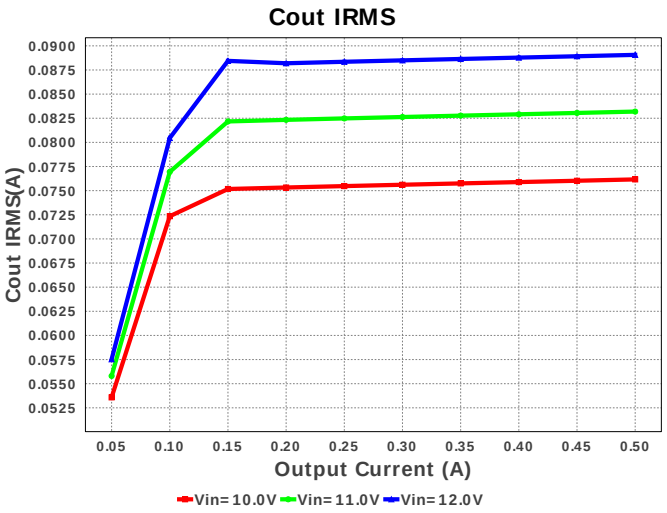


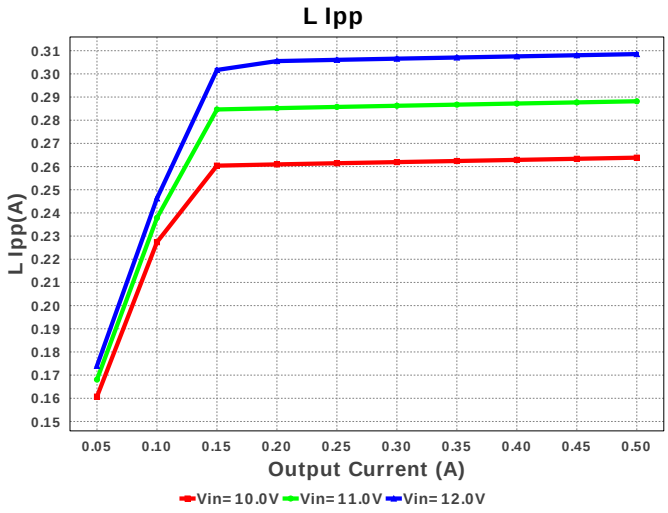



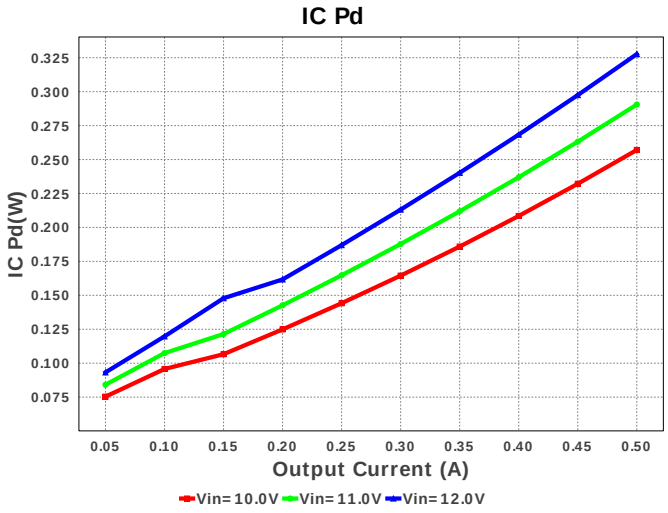



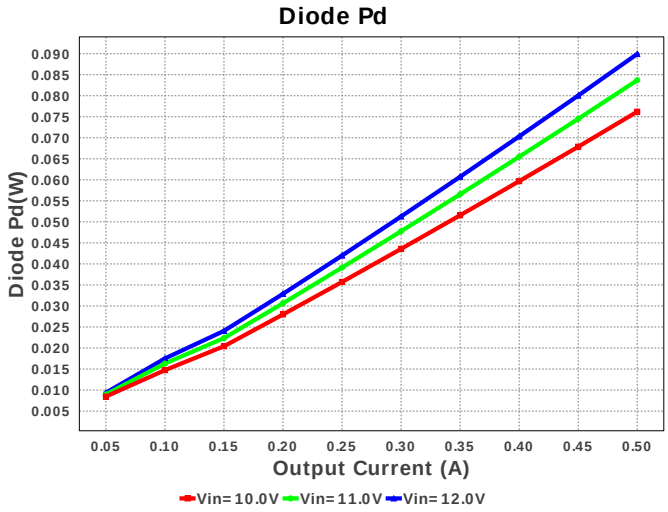






## Operating Values

| # | Name | Value | Category | Description |
|---|---|---|---|---|
| 1. | Cin IRMS | 247.933 mA | Current | Input capacitor RMS ripple current |
| 2. | Cout IRMS | 88.96 mA | Current | Output capacitor RMS ripple current |
| 3. | IC Ipk | 654.084 mA | Current | Peak switch current in IC |
| 4. | Iin Avg | 253.39 mA | Current | Average input current |
| 5. | L Ipp | 308.17 mA | Current | Peak-to-peak inductor ripple current |
| 6. | M1 Irms | 330.09 mA | Current | Q Iavg |
| 7. | BOM Count | 10 | General | Total Design BOM count |
| 8. | FootPrint | 73.0 $mm^2$ | General | Total Foot Print Area of BOM components |
| 9. | Frequency | 3.0 MHz | General | Switching frequency |
| 10. | IC Tolerance | 16.0 mV | General | IC Feedback Tolerance |
| 11. | M Vds Act | 129.105 mV | General | |
| 12. | Pout | 2.5 W | General | Total output power |
| 13. | Total BOM | $1.35 | General | Total BOM Cost |
| 14. | Vout Actual | 4.984 V | Op_Point | Vout Actual calculated based on selected voltage divider resistors |
| 15. | Duty Cycle | 43.584 % | Op_point | Duty cycle |
| 16. | Efficiency | 82.217 % | Op_point | Steady state efficiency |
| 17. | IC Tj | 68.659 degC | Op_point | IC junction temperature |
| 18. | ICThetaJA | 118.0 degC/W | Op_point | IC junction-to-ambient thermal resistance |
| 19. | IOUT_OP | 500.0 mA | Op_point | Iout operating point |
| 20. | VIN_OP | 12.0 V | Op_point | Vin operating point |
| 21. | Vout p-p | 1.85 mV | Op_point | Peak-to-peak output ripple voltage |
| 22. | Cin Pd | 253.69 µW | Power | Input capacitor power dissipation |
| 23. | Cout Pd | 34.22 µW | Power | Output capacitor power dissipation |
| 24. | Diode Pd | 86.886 mW | Power | Diode power dissipation |
| 25. | IC Pd | 327.616 mW | Power | IC power dissipation |
| 26. | L Pd | 125.95 mW | Power | Inductor power dissipation |
| 27. | Total Pd | 540.724 mW | Power | Total Power Dissipation |
| 28. | Vout Tolerance | 3.73 % | | Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable |

## Design Inputs

| # | Name | Value | Description |
|---|---|---|---|
| 1. | Iout | 500.0 m | Maximum Output Current |
| 2. | VinMax | 12.0 | Maximum input voltage |
| 3. | VinMin | 10.0 | Minimum input voltage |
| 4. | Vout | 5.0 | Output Voltage |
| 5. | base_pn | LMR12010Y | Base Product Number |
| 6. | source | DC | Input Source Type |
| 7. | Ta | 30.0 | Ambient temperature |

## Design Assistance

1. **LMR12010Y** Product Folder : http://www.ti.com/product/LMR12010 : contains the data sheet and other resources.