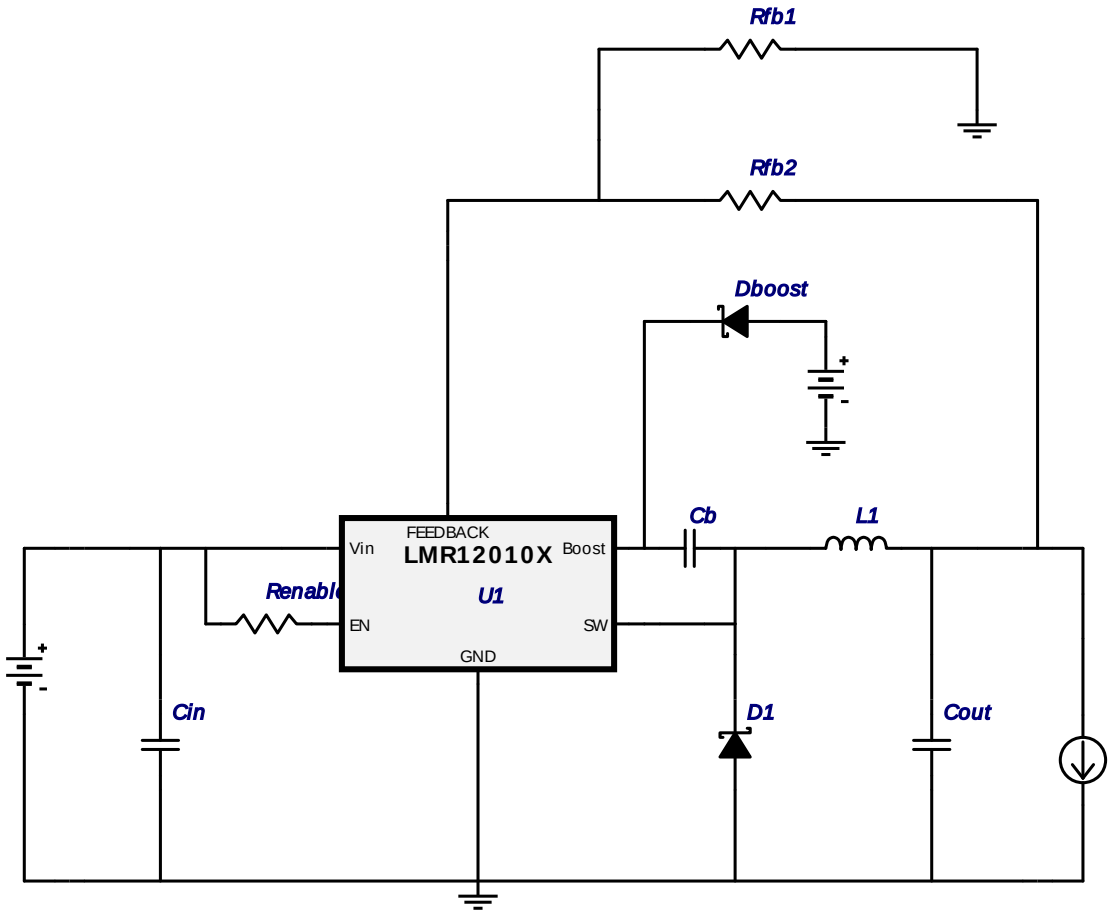
# WEBENCH® Design Report

VinMin = 6.0V
VinMax = 20.0V
Vout = 5.0V
Iout = 1.0A

Device = LMR12010XMK/NOPB
Topology = Buck
Created = 11/19/12 1:48:30 PM
BOM Cost = $1.33
Total Pd = 1.31 W
Footprint = 251.0 mm2
BOM Count = 10

Design : 3458594/11 LMR12010XMK/NOPB
LMR12010XMK/NOPB 6.0V-20.0V to 5.0V @ 1.0A




## Electrical BOM

| # | Name | Manufacturer | Part Number | Quantity | Price | Properties | Footprint |
|---|---|---|---|---|---|---|---|
| 1. | Cb | MuRata | GRM216R71H103KA01D<br>Series= X7R | 1 | $0.01 | Cap= 10.0 nF<br>VDC= 50.0 V<br>IRMS= 0.0 A | 0805 13mm2 |
| 2. | Cin | TDK | C3225X5R1E106K<br>Series= X5R | 1 | $0.15 | Cap= 10.0 µF<br>ESR= 15.0 mOhm<br>VDC= 25.0 V<br>IRMS= 3.0 A | 1210 23mm2 |
| 3. | Cout | TDK | C3216X5R0J106K<br>Series= X5R | 1 | $0.04 | Cap= 10.0 µF<br>ESR= 3.1 mOhm<br>VDC= 6.3 V<br>IRMS= 4.1 A | 1206 19mm2 |
| 4. | D1 | Diodes Inc. | B140-13-F | 1 | $0.06 | VF@Io= 500.0 mV<br>VRRM= 40.0 V | SMA 37mm2 |
| 5. | Dboost | Diodes Inc. | B140-13-F | 1 | $0.06 | VF@Io= 500.0 mV<br>VRRM= 40.0 V | SMA 37mm2 |
| 6. | L1 | Bourns | SRN6045-220M | 1 | $0.18 | L= 22.0 µH<br>DCR= 142.0 mOhm | SRN6045 64mm2 |

| # | Name | Manufacturer | Part Number | Quantity | Price | Properties | Footprint |
|---|---|---|---|---|---|---|---|
| 7. | Renable | Vishay-Dale | CRCW080510K0FKEA<br>Series= CRCW..e3 | 1 | $0.01 | Res= 10.0 kOhm<br>Power= 125.0 mW<br>Tolerance= 1.0% | 0805 13mm2 |
| 8. | Rfb1 | Vishay-Dale | CRCW080510K0FKEA<br>Series= CRCW..e3 | 1 | $0.01 | Res= 10.0 kOhm<br>Power= 125.0 mW<br>Tolerance= 1.0% | 0805 13mm2 |
| 9. | Rfb2 | Vishay-Dale | CRCW080552K3FKEA<br>Series= CRCW..e3 | 1 | $0.01 | Res= 52.3 kOhm<br>Power= 125.0 mW<br>Tolerance= 1.0% | 0805 13mm2 |
| 10. | U1 | Texas Instruments | LMR12010XMK/NOPB | 1 | $0.80 | Switcher | MK06A 18mm2 |

## Operating Values

| # | Name | Value | Category | Description |
|---|---|---|---|---|
| 1. | BOM Count | 10.0 | | Total Design BOM count |
| 2. | Total BOM | $1.33 | | Total BOM Cost |
| 3. | Cin IRMS | 444.634 m A | Current | Input capacitor RMS ripple current |
| 4. | Cout IRMS | 33.375 m A | Current | Output capacitor RMS ripple current |
| 5. | IC Ipk | 1.058 A | Current | Peak switch current in IC |
| 6. | Iin Avg | 315.61 m A | Current | Average input current |
| 7. | L Ipp | 115.614 m A | Current | Peak-to-peak inductor ripple current |
| 8. | M1 Irms | 520.872 m A | Current | Q Iavg |
| 9. | FootPrint | 251.0 mm2 | General | Total Foot Print Area of BOM components |
| 10. | Frequency | 1.6 M Hz | General | Switching frequency |
| 11. | IC Tolerance | 16.0 m V | General | IC Feedback Tolerance |
| 12. | M Vds Act | 227.775 m V | General | |
| 13. | Mode | CCM | General | Conduction Mode |
| 14. | Pout | 5.0 W | General | Total output power |
| 15. | Duty Cycle | 27.131 % | Op_point | Duty cycle |
| 16. | Efficiency | 79.212 % | Op_point | Steady state efficiency |
| 17. | IC Tj | 123.059 degC | Op_point | IC junction temperature |
| 18. | ICThetaJA | 118.0 degC/W | Op_point | IC junction-to-ambient thermal resistance |
| 19. | IOUT_OP | 1.0 A | Op_point | Iout operating point |
| 20. | VIN_OP | 20.0 V | Op_point | Vin operating point |
| 21. | Vout p-p | 971.742 µ V | Op_point | Peak-to-peak output ripple voltage |
| 22. | Cin Pd | 2.965 m W | Power | Input capacitor power dissipation |
| 23. | Cout Pd | 3.453 µ W | Power | Output capacitor power dissipation |
| 24. | Diode Pd | 364.346 m W | Power | Diode power dissipation |
| 25. | IC Pd | 788.638 m W | Power | IC power dissipation |
| 26. | L Pd | 156.2 m W | Power | Inductor power dissipation |
| 27. | Total Pd | 1.312 W | Power | Total Power Dissipation |

## Design Inputs

| # | Name | Value | Description |
|---|---|---|---|
| 1. | Iout | 1.0 A | Maximum Output Current |
| 2. | Iout1 | 1.0 Amps | Output Current #1 |
| 3. | VinMax | 20.0 V | Maximum input voltage |
| 4. | VinMin | 6.0 V | Minimum input voltage |
| 5. | Vout | 5.0 V | Output Voltage |
| 6. | Vout1 | 5.0 Volt | Output Voltage #1 |
| 7. | base_pn | LMR12010X | National Based Product Number |
| 8. | Ta | 30.0 degC | Ambient temperature |

## Design Assistance

1. **LMR12010X** Product Folder : http://www.ti.com/product/lmr12010 : contains the data sheet and other resources.