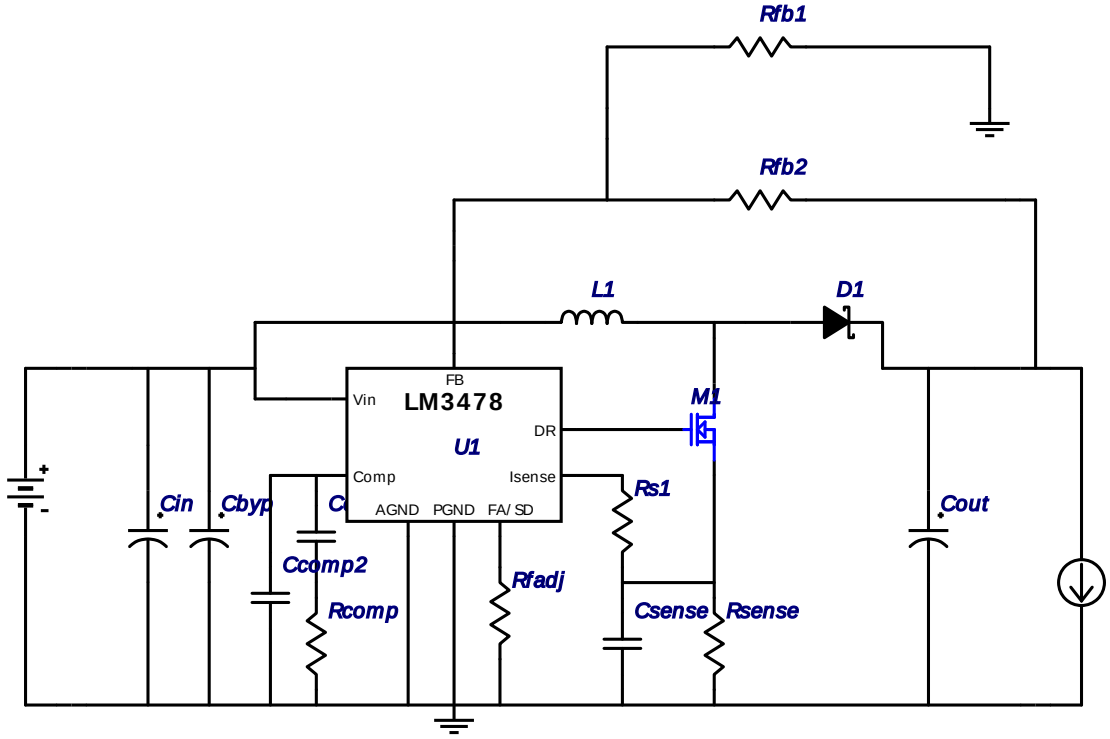
# WEBENCH® Design Report

VinMin = 24.0V
VinMax = 26.0V
Vout = 32.0V
Iout = 5.0A

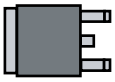
Device = LM3478MM
Topology = Boost
Created = 4/25/12 6:00:19 AM
BOM Cost = $5.51
Total Pd = 7.55 W
Footprint = 2,013.0 mm2
BOM Count = 23

Design : 1137733/39 LM3478MM
LM3478MM 24.0V-26.0V to 32.0V @ 5.0A




## Electrical BOM

| # | Name | Manufacturer | Part Number | Quantity | Price | Properties | Footprint |
|---|---|---|---|---|---|---|---|
| 1. | Cbyp | Vishay-Sprague | 293D104X9035A2TE3<br>Series= 293D | 1 | $0.12 | Cap= 100.0 nF<br>ESR= 20.0 Ohm<br>VDC= 35.0 V<br>IRMS= 60.0 mA | 3216-18 19mm2 |
| 2. | Ccomp | MuRata | GRM216R71H103KA01D<br>Series= X7R | 1 | $0.01 | Cap= 10.0 nF<br>VDC= 50.0 V<br>IRMS= 0.0 A | 0805 13mm2 |
| 3. | Ccomp2 | Yageo America | CC0805KRX7R9BB152<br>Series= X7R | 1 | $0.01 | Cap= 1.5 nF<br>VDC= 50.0 V<br>IRMS= 0.0 A | 0805 13mm2 |
| 4. | Cin | Panasonic | EEE-FC1V221P<br>Series= FC | 1 | $0.24 | Cap= 220.0 µF<br>ESR= 150.0 mOhm<br>VDC= 35.0 V<br>IRMS= 670.0 mA | SM_RADIAL_G 172mm2 |
| 5. | Cout | Panasonic | EEE-FC1H470P<br>Series= FC | 8 | $0.24 | Cap= 47.0 µF<br>ESR= 300.0 mOhm<br>VDC= 50.0 V<br>IRMS= 500.0 mA | SM_RADIAL_G 172mm2 |
| 6. | Csense | MuRata | GRM216R71H103KA01D<br>Series= X7R | 1 | $0.01 | Cap= 10.0 nF<br>VDC= 50.0 V<br>IRMS= 0.0 A | 0805 13mm2 |

| # | Name | Manufacturer | Part Number | Quantity | Price | Properties | Footprint |
|---|---|---|---|---|---|---|---|
| 7. | D1 | Vishay-Semiconductor | 12CWQ10FNPBF | 1 | $0.69 | VF@Io= 950.0 mV<br>VRRM= 100.0 V |  <br>DPAK 102mm2 |
| 8. | L1 | Coilcraft | XAL1010-153MEB | 1 | $1.08 | L= 15.0 µH<br>DCR= 20.0 mOhm |  <br>XAL1010 160mm2 |
| 9. | M1 | Infineon Technologies | BSZ105N04NS G | 1 | $0.30 | VdsMax= 40.0 V<br>IdsMax= 40.0 Amps |  <br>PG-TSDSON-8 29mm2 |
| 10. | Rcomp | Vishay-Dale | CRCW04029K53FKED<br>Series= CRCW..e3 | 1 | $0.01 | Res= 9.53 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0% | <br>0402 8mm2 |
| 11. | Rfadj | Vishay-Dale | CRCW040288K7FKED<br>Series= CRCW..e3 | 1 | $0.01 | Res= 88.7 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0% | <br>0402 8mm2 |
| 12. | Rfb1 | Vishay-Dale | CRCW04021K00FKED<br>Series= CRCW..e3 | 1 | $0.01 | Res= 1,000 Ohm<br>Power= 63.0 mW<br>Tolerance= 1.0% | <br>0402 8mm2 |
| 13. | Rfb2 | Vishay-Dale | CRCW040224K3FKED<br>Series= CRCW..e3 | 1 | $0.01 | Res= 24.3 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0% | <br>0402 8mm2 |
| 14. | Rs1 | Vishay-Dale | CRCW0402100RFKED<br>Series= CRCW..e3 | 1 | $0.01 | Res= 100.0 Ohm<br>Power= 63.0 mW<br>Tolerance= 1.0% | <br>0402 8mm2 |
| 15. | Rsense | Panasonic | ERJ-M1WSF10MU<br>Series= 1119 | 1 | $0.15 | Res= 10.0 mOhm<br>Power= 1.0 W<br>Tolerance= 1.0% |  <br>2512 43mm2 |
| 16. | U1 | Texas Instruments | LM3478MM | 1 | $0.93 | Switcher |  <br>MUA08A 34mm2 |

## Operating Values

| # | Name | Value | Category | Description |
|---|---|---|---|---|
| 1. | Cin IRMS | 606.545 m A | Current | Input capacitor RMS ripple current |
| 2. | Cout IRMS | 3.14 A | Current | Output capacitor RMS ripple current |
| 3. | Iin Avg | 6.981 A | Current | Average input current |
| 4. | L Ipp | 2.101 A | Current | Peak-to-peak inductor ripple current |
| 5. | L1 Irms | 6.897 A | Current | Inductor ripple current |
| 6. | M Irms | 6.575 A | Current | MOSFET RMS ripple current |
| 7. | SW Ipk | 7.921 A | Current | Peak switch current |
| 8. | BOM Count | 23.0 | General | Total Design BOM count |
| 9. | FootPrint | 2.013 k mm2 | General | Total Foot Print Area of BOM components |
| 10. | Frequency | 209.831 k Hz | General | Switching frequency |
| 11. | IC Tolerance | 24.3 m V | General | IC Feedback Tolerance |
| 12. | M Rdson | 11.76 m Ohm | General | Drain-Source On-resistance |
| 13. | M Vds Act | 77.319 m V | General | M Vds |
| 14. | Mode | CCM | General | Conduction Mode |
| 15. | Pout | 160.0 W | General | Total output power |
| 16. | Total BOM | $5.51 | General | Total BOM Cost |
| 17. | D1 Tj | 82.25 degC | Op_Point | D1 junction temperature |
| 18. | Vout OP | 32.0 V | Op_Point | Operational Output Voltage |
| 19. | Cross Freq | 4.113 k Hz | Op_point | Bode plot crossover frequency |
| 20. | Duty Cycle | 28.383 % | Op_point | Duty cycle |
| 21. | Efficiency | 95.492 % | Op_point | Steady state efficiency |
| 22. | IC Tj | 65.034 degC | Op_point | IC junction temperature |
| 23. | ICThetaJA | 200.0 degC/W | Op_point | IC junction-to-ambient thermal resistance |
| 24. | IOUT_OP | 5.0 A | Op_point | Iout operating point |
| 25. | M ThetaJA | 60.0 degC/W | Op_point | MOSFET junction-to-ambient thermal resistance |
| 26. | M TjOp | 82.933 degC | Op_point | MOSFET junction temperature |
| 27. | Phase Marg | 57.962 deg | Op_point | Bode Plot Phase Margin |
| 28. | VIN_OP | 24.0 V | Op_point | Vin operating point |
| 29. | Vout p-p | 78.792 m V | Op_point | Peak-to-peak output ripple voltage |
| 30. | Cin Pd | 55.184 m W | Power | Input capacitor power dissipation |
| 31. | Cout Pd | 369.712 m W | Power | Output capacitor power dissipation |

| # | Name | Value | Category | Description |
|---|---|---|---|---|
| 32. | Diode Pd | 4.75 W | Power | Diode power dissipation |
| 33. | IC Pd | 175.17 m W | Power | IC power dissipation |
| 34. | L Pd | 1.142 W | Power | Inductor power dissipation |
| 35. | M Pd | 882.221 m W | Power | MOSFET power dissipation |
| 36. | M1 PdCond | 642.651 m W | Power | M1 MOSFET conduction losses |
| 37. | M1 PdSw | 239.57 m W | Power | M1 MOSFET switching losses |
| 38. | Rfb Pd | 40.474 m W | Power | Rfb Power Dissipation |
| 39. | Total Pd | 7.553 W | Power | Total Power Dissipation |

## Design Inputs

| # | Name | Value | Description |
|---|---|---|---|
| 1. | Iout | 5.0 A | Maximum Output Current |
| 2. | Iout1 | 5.0 Amps | Output Current #1 |
| 3. | VinMax | 26.0 V | Maximum input voltage |
| 4. | VinMin | 24.0 V | Minimum input voltage |
| 5. | Vout | 32.0 V | Output Voltage |
| 6. | Vout1 | 32.0 Volt | Output Voltage #1 |
| 7. | base_pn | LM3478 | Texas Instruments base part number |
| 8. | Ta | 30.0 degC | Ambient temperature |

## Design Assistance

1. **LM3478** Product Folder : http://www.ti.com/product/LM3478 : contains the data sheet and other resources.