

WEBENCH® Design Report

Design: 3729827/5 LM3478MM/NOPB LM3478MM/NOPB 5.5V-8.4V to 6.0V @ 2.0A

VinMin = 5.5V VinMax = 8.4VVout = 6.0Vlout = 2.0A

Device = LM3478MM/NOPB Topology = SEPIC Created = 7/31/13 9:49:15 AM BOM Cost = \$1.58 Total Pd = 3.35W Footprint = 269.0mm2 BOM Count = 14

Electrical BOM

| # | Name | Manufacturer | Part Number | Properties | Qty | Price | Footprint |
|-----|--------|----------------------|---------------------------------------|--|-----|--------|---------------------|
| 1. | Cbp | Kemet | C0603C104Z4VACTU Series= Y5V | Cap= 100.0 nF VDC= 16.0 V IRMS= 0.0 A | 1 | \$0.01 | 0603 10mm2 |
| 2. | Ccomp | Taiyo Yuden | TMK212B7473KD-T Series= X7R | Cap= 47.0 nF VDC= 25.0 V IRMS= 0.0 A | 1 | \$0.01 | 0805 13mm2 |
| 3. | Ccomp2 | MuRata | GRM1885C1H162JA01D Series= C0G/NP0 | Cap= 1.6 nF VDC= 50.0 V IRMS= 0.0 A | 1 | \$0.02 | 0603 10mm2 |
| 4. | Cin | TDK | C3225X7R1C226M Series= X7R | Cap= 22.0 µF ESR= 2.0 mOhm VDC= 16.0 V IRMS= 8.11 A | 1 | \$0.22 | 1210 23mm2 |
| 5. | Cout | Nippon Chemi-Con | APXE100ARA151MF80G Series= PXE | Cap= 150.0 µF ESR= 21.0 mOhm VDC= 10.0 V IRMS= 2.88 A | 1 | \$0.53 | CAPSMT_62_F80 74mm2 |
| 6. | Cramp | Yageo America | CC0805KRX7R9BB821 Series= X7R | Cap= 820.0 pF VDC= 50.0 V IRMS= 0.0 A | 1 | \$0.01 | 0805 13mm2 |
| 7. | Csep | Kemet | C0805C225K4RACTU Series= X7R | Cap= 2.2 μF ESR= 8.0 mOhm VDC= 16.0 V IRMS= 15.55 A | 1 | \$0.08 | 0805 13mm2 |
| 8. | D1 | Vishay-Semiconductor | 50WQ04FNPBF | VF@Io= 510.0 mV VRRM= 40.0 V | 1 | \$0.40 | DPAK 102mm2 |
| 9. | Lin | Bourns | SRP5030T-6R8M | L= 6.8 μH DCR= 76.2 mOhm | 1 | \$0.54 | SRP5030T 59mm2 |
| 10. | Lout | Coilcraft | XAL5050-153MEB | L= 15.0 μH DCR= 69.7 mOhm | 1 | \$0.60 | XAL5050 54mm2 |
| 11. | M1 | Vishay-Siliconix | SI2316BDS-T1-E3 | VdsMax= 30.0 V IdsMax= 4.5 Amps | 11 | \$0.16 | SOT-23 22mm2 |
| 12. | Rbp | Vishay-Dale | CRCW040220R0FKED Series= CRCWe3 | Res= 20.0 Ohm Power= 63.0 mW Tolerance= 1.0% | 1 | \$0.01 | 0402 8mm2 |
| 13. | Rcomp | Vishay-Dale | CRCW04021K62FKED Series= CRCWe3 | Res= 1.62 kOhm Power= 63.0 mW Tolerance= 1.0% | 1 | \$0.01 | 0402 8mm2 |
| 14. | Rfadj | Vishay-Dale | CRCW040238K3FKED Series= CRCWe3 | Res= 38.3 kOhm Power= 63.0 mW Tolerance= 1.0% | 1 | \$0.01 | 0402 8mm2 |
| 15. | Rfb1 | Vishay-Dale | CRCW040210K0FKED Series= CRCWe3 | Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0% | 1 | \$0.01 | 0402 8mm2 |
| 16. | Rfb2 | Vishay-Dale | CRCW040237K4FKED Series= CRCWe3 | Res= 37.4 kOhm Power= 63.0 mW Tolerance= 1.0% | 1 | \$0.01 | 0402 8mm2 |

| # Name | Manufacturer | Part Number | Properties | Qty | Price | Footprint |
|------------|---------------------------|------------------------------------|--|-----|--------|--------------|
| 17. Rramp | Vishay-Dale | CRCW0402100RFKED Series= CRCWe3 | Res= 100.0 Ohm Power= 63.0 mW Tolerance= 1.0% | 1 | \$0.01 | 0402 8mm2 |
| 18. Rsense | Stackpole Electronics Inc | CSR1206FK15L0 Series= ? | Res= 15.0 mOhm Power= 500.0 mW Tolerance= 1.0% | 1 | \$0.11 | 1206 19mm2 |
| 19. U1 | Texas Instruments | LM3478MM/NOPB | Switcher | 1 | \$0.80 | MUA08A 34mm2 |

Operating Values

| # | Name | Value | Category | Description |
|-----|-----------------|-------------|----------|---|
| 1. | Cin IRMS | 132.904 mA | Current | Input capacitor RMS ripple current |
| 2. | Cout IRMS | 2.294 A | Current | Output capacitor RMS ripple current |
| 3. | Csep IRMS | 2.312 A | Current | SEPIC capacitor RMS ripple current |
| 4. | D1 Irms | 3.024 A | Current | D1 Irms |
| 5. | IC lpk | 4.248 mA | Current | Peak switch current in IC |
| 6. | lin Avg | 2.792 A | Current | Average input current |
| 7. | Lin lpk | 3.221 A | Current | Lin peak current |
| 8. | Lin Ipp | 1.035 A | Current | Peak-to-peak input inductor ripple current |
| 9. | Lin Irms | 2.736 A | Current | Lin ripple current |
| 10. | Lout lpk | 2.156 A | Current | Lout peak current |
| 11. | Lout Ipp | 466.059 mA | Current | Peak-to-peak output inductor ripple current |
| 12. | Lout Irms | 1.938 A | Current | Lout ripple current |
| 13. | M1 Irms | 3.562 A | Current | M1 MOSFET Irms |
| 14. | BOM Count | 14 | General | Total Design BOM count |
| 15. | FootPrint | 269.0 mm2 | General | Total Foot Print Area of BOM components |
| 16. | Frequency | 395.0 kHz | General | Switching frequency |
| 17. | IC Tolerance | 24.3 mV | General | IC Feedback Tolerance |
| 18. | Mode | CCM | General | Conduction Mode |
| 19. | Total BOM | \$1.58 | General | Total BOM Cost |
| 20. | D1 Tj | 76.481 degC | Op_Point | D1 junction temperature |
| 21. | SEPIC Resonance | 24.892 kHz | Op_Point | SEPIC Resonance Frequency |
| | Freq | | | |
| 22. | V SEPIC damping | 122.52 m | Op_Point | V SEPIC damping factor |
| | factor | | | |
| 23. | Vin p-p | 7.658 mV | Op_Point | Peak-to-peak input voltage |
| 24. | Vsep p-p | 1.473 V | Op_Point | Peak-to-peak sepic voltage |
| 25. | Cross Freq | 8.214 kHz | Op_point | Bode plot crossover frequency |
| 26. | Duty Cycle | 58.0 % | Op_point | Duty cycle |
| 27. | Efficiency | 78.154 % | Op_point | Steady state efficiency |

| # | Name | Value | Category | Description |
|-----|-------------|-------------|----------|------------------------------------|
| 28. | Gain Marg | 9.994 db | Op_point | Bode Plot Gain Margin |
| 29. | IC Tj | 34.673 degC | Op_point | IC junction temperature |
| 30. | IOUT_OP | 2.0 A | Op_point | lout operating point |
| 31. | M1 TjOP | 30.3 degC | Op_point | M1 MOSFET junction temperature |
| 32. | Phase Marg | 58.335 deg | Op_point | Bode Plot Phase Margin |
| 33. | Phase Shift | 59.114 deg | Op_point | Bode Plot Phase Shift |
| 34. | VIN_OP | 8.4 V | Op_point | Vin operating point |
| 35. | Vout p-p | 112.411 mV | Op_point | Peak-to-peak output ripple voltage |
| 36. | Cin Pd | 35.327 µW | Power | Input capacitor power dissipation |
| 37. | Cout Pd | 110.543 mW | Power | Output capacitor power dissipation |
| 38. | Csep Pd | 42.75 mW | Power | SEPIC capacitor power dissipation |
| 39. | D1 Pd | 1.033 W | Power | Diode power dissipation |
| 40. | D1 PdCond | 1.02 W | Power | Diode conduction losses |
| 41. | D1 PdSw | 12.901 mW | Power | Diode switching losses |
| 42. | IC Pd | 23.365 mW | Power | IC power dissipation |
| 43. | Lin Pd | 580.245 mW | Power | Lin power dissipation |
| 44. | Lout Pd | 263.701 mW | Power | Lout power dissipation |
| 45. | M1 Pd | 1.036 W | Power | M1 MOSFET total power dissipation |
| 46. | M1 PdCond | 870.546 mW | Power | M1 MOSFET conduction losses |
| 47. | M1 PdSw | 165.165 mW | Power | M1 MOSFET switching losses |
| 48. | Rsense Pd | 190.364 mW | Power | LED Current Rsns Power Dissipation |
| 49. | Total Pd | 3.354 W | Power | Total Power Dissipation |

Design Inputs

| # | Name | Value | Description |
|----|---------|-----------|------------------------|
| 1. | lout | 2.0 A | Maximum Output Current |
| 2. | lout1 | 2.0 Amps | Output Current #1 |
| 3. | VinMax | 8.4 V | Maximum input voltage |
| 4. | VinMin | 5.5 V | Minimum input voltage |
| 5. | Vout | 6.0 V | Output Voltage |
| 6. | Vout1 | 6.0 Volt | Output Voltage #1 |
| 7. | base_pn | LM3478 | Base Product Number |
| 8. | source | DC | Input Source Type |
| 9. | Та | 30.0 degC | Ambient temperature |

Design Assistance

1. LM3478 Product Folder: http://www.ti.com/product/lm3478: contains the data sheet and other resources.

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