

FEATURES

Low cost

Small Size

Simulation results demonstrating stability

Reasonable Efficiency (>60% at full load)

DESCRIPTION

This design uses a boost converter with quadrupler charge pump. It utilizes an innovative 4 stage charge pump to increase the output voltage of the boost stage by a factor of 4. This enables the use of many parts not rated to the full output voltage. In addition, a cascoded FET (Q1) is used to increase the voltage capability of the ADP1613. This enable us to use a very inexpensive integrated FET boost controller. The power draw was tested at 33 mA with no load.

Table 1. Basic Specifications

| <i>Spec</i> | <i>Value</i> | <i>Units</i> |
|---------------|--------------|--------------|
| Vout | 200V | Volts |
| Iout | 0.002 | Amps |
| Tamb | 55 | degC |
| Vinmin | 5.0 | Volts |
| Vinmax | 5.0 | Volts |

Table 2. Dissipation Estimates

| <i>Spec</i> | <i>Value</i> | <i>Units</i> |
|---------------|--------------|--------------|
| ADP1613 | 0.029 | W |
| Diodes(total) | 0.0114 | W |
| Q1 | 0.132 | W |
| L1 | 0.079 | W |
| Total | 0.251 | W |

Rev. 0

Reference designs are as supplied "as is" and without warranties of any kind, express, implied, or statutory including, but not limited to, any implied warranty of merchantability or fitness for a particular purpose. No license is granted by implication or otherwise under any patents or other intellectual property by application or use of reference designs. Information furnished by Analog Devices is believed to be accurate and reliable. However, no responsibility is assumed by Analog Devices for its use, nor for any infringements of patents or other rights of third parties that may result from its use. Analog Devices reserves the right to change devices or specifications at any time without notice. Trademarks and registered trademarks are the property of their respective owners. Reference designs are not authorized to be used in life support devices or systems.

Table 3. Temperature Estimates

| <i>Spec</i> | <i>Value</i> | <i>Units</i> |
|---------------------|--------------|--------------|
| <i>Ambient Temp</i> | 55 | degC |
| <i>ADP1613</i> | 58 | degC |
| Diodes(total) | 56 | degC |
| Q1 | 67 | degC |
| L1 | 64 | degC |

Table 4. Operational Estimates

| <i>Spec</i> | <i>Value</i> | <i>Units</i> |
|------------------|--------------|--------------|
| Iin (simulation) | 0.142 | A |
| Irms L1 | 0.245 | A |
| Ipk L1 | 0.632 | A |
| Irms Fet | 0.242 | A |
| Pk Voltage FET | 51 | V |

Table 5. Measured results

| <i>Spec</i> | <i>Value</i> | <i>Units</i> |
|----------------------------|--------------|--------------|
| Total Loss (Iout =2 mA) | 0.257 | W |
| Vout ripple RMS | 0.025 | Vrms |

TABLE OF CONTENTS

| | |
|------------------------|---|
| Features | 1 |
| Description | 1 |
| Revision History | 3 |
| Schematic | 4 |
| Bill of Materials..... | 4 |
| Graphs | 5 |

TABLE OF FIGURES

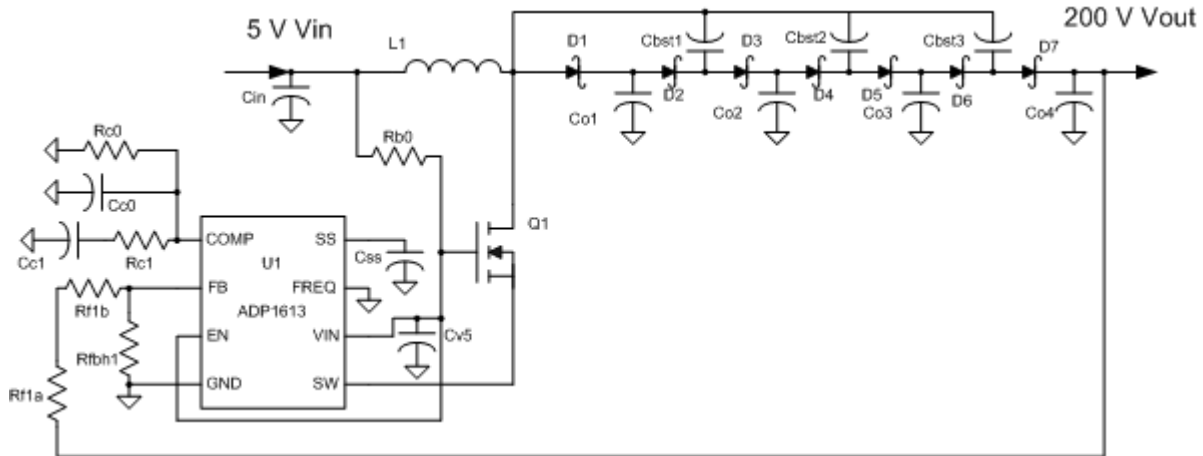
| | |
|--|---|
| Figure 1. Boost Converter with Quadrupler Charge Pump Topology | 4 |
| Figure 2. Bode Plot | 5 |
| Figure 3. Measured Efficiency over Load..... | 6 |
| Figure 4..... | 7 |
| Figure 5..... | 7 |
| Figure 6..... | 7 |

REVISION HISTORY

2/18/2010—Revision 1: Initial Version

SCHEMATIC

Figure 1. Boost Converter with Quadrupler Charge Pump Topology



BILL OF MATERIALS

Table 6. Bill of Materials

| Des | MFG | Part Number | Component Specs | Pkg | Qty | Area (mm ²) | Cost* |
|-------|-------------|----------------|--------------------------------|-----------------|-----|-------------------------|---------|
| U1 | ADI | ADP1613ARMZ-R7 | Integrated Switching Regulator | MSOP-8 | 1 | 14.70 | \$0.700 |
| L1 | Coilcraft | ME3220-332 | 3.3uH, 138mOhms, 1.7 Apk | 3mm x 3mm x 2mm | 1 | 8.00 | \$0.230 |
| D1 | Diodes Inc. | 1N4148W | 150mA ,100V | SOD123 | 1 | 6.5 | \$0.060 |
| D2 | Diodes Inc. | 1N4148W | 150mA ,100V | SOD123 | 1 | 6.5 | \$0.060 |
| D3 | Diodes Inc. | 1N4148W | 150mA ,100V | SOD123 | 1 | 6.5 | \$0.060 |
| D4 | Diodes Inc. | 1N4148W | 150mA ,100V | SOD123 | 1 | 6.5 | \$0.060 |
| D5 | Diodes Inc. | 1N4148W | 150mA ,100V | SOD123 | 1 | 6.5 | \$0.060 |
| D6 | Diodes Inc. | 1N4148W | 150mA ,100V | SOD123 | 1 | 6.5 | \$0.060 |
| D7 | Diodes Inc. | 1N4148W | 150mA ,100V | SOD123 | 1 | 6.5 | \$0.060 |
| Co1 | Murata | GRM188R72A104K | 0.1uF, 100V, 0603, X7R | 0603 | 1 | 1.28 | \$0.031 |
| Co2 | TDK | C3216X7R2E104K | 0.1uF, 250V, 1206, X7R | 1206 | 1 | 5.1 | \$0.063 |
| Co3 | TDK | C3216X7R2E104K | 0.1uF, 250V, 1206, X7R | 1206 | 1 | 5.1 | \$0.063 |
| Co4 | TDK | C3216X7R2E104K | 0.1uF, 250V, 1206, X7R | 1206 | 2 | 10.2 | \$0.126 |
| Cbst1 | Murata | GRM188R72A104K | 0.1uF, 100V, 0603, X7R | 0603 | 1 | 1.28 | \$0.031 |
| Cbst2 | Murata | GRM188R72A104K | 0.1uF, 100V, 0603, X7R | 0603 | 1 | 1.28 | \$0.031 |

| Des | MFG | Part Number | Component Specs | Pkg | Qty | Area (mm ²) | Cost* |
|--------|-------------|------------------|------------------------|---------|-----|-------------------------|---------|
| Cbst3 | Murata | GRM188R72A104K | 0.1uF, 100V, 0603, X7R | 0603 | 1 | 1.28 | \$0.031 |
| Cin | Taiyo Yuden | LMK212 B7105MG-T | 1uF, 10V, 805, X7R | 0805 | 1 | 2.50 | \$0.012 |
| Q1 | Vishay | Si3458BDV | 128 mΩ, 2 9Vth,60 V | SOT23-6 | 1 | 9.3 | \$0.66 |
| Cv5 | Murata | GRM188R61A105K | 1uF,10V,X5R | 0603 | 1 | 1.30 | \$0.010 |
| Css | Vishay | 10% tolerance | 100 nF | 0402 | 1 | 0.70 | \$0.005 |
| Rc1 | Vishay | 5% tolerance | 200 kohm | 0402 | 1 | 0.70 | \$0.005 |
| Cc1 | Vishay | 10% tolerance | 1.2 nF | 0402 | 1 | 0.70 | \$0.005 |
| Cc0 | Vishay | 10% tolerance | 10 pF | 0402 | 1 | 0.70 | \$0.005 |
| Rf1a | Vishay | 1% tolerance | 402 kohm | 0805 | 1 | 0.70 | \$0.005 |
| Rf1b | Vishay | 1% tolerance | 422 kohm | 0805 | 1 | 0.70 | \$0.005 |
| Rf2 | Vishay | 1% tolerance | 5.11 kohm | 0402 | 1 | 0.70 | \$0.005 |
| Rb0 | Vishay | 5% tolerance | 1 Ohm | 0402 | 1 | 0.70 | \$0.005 |
| Totals | | | | | 27 | 112.4 | 2.448 |

GRAPHS

Figure 2. Bode Plot

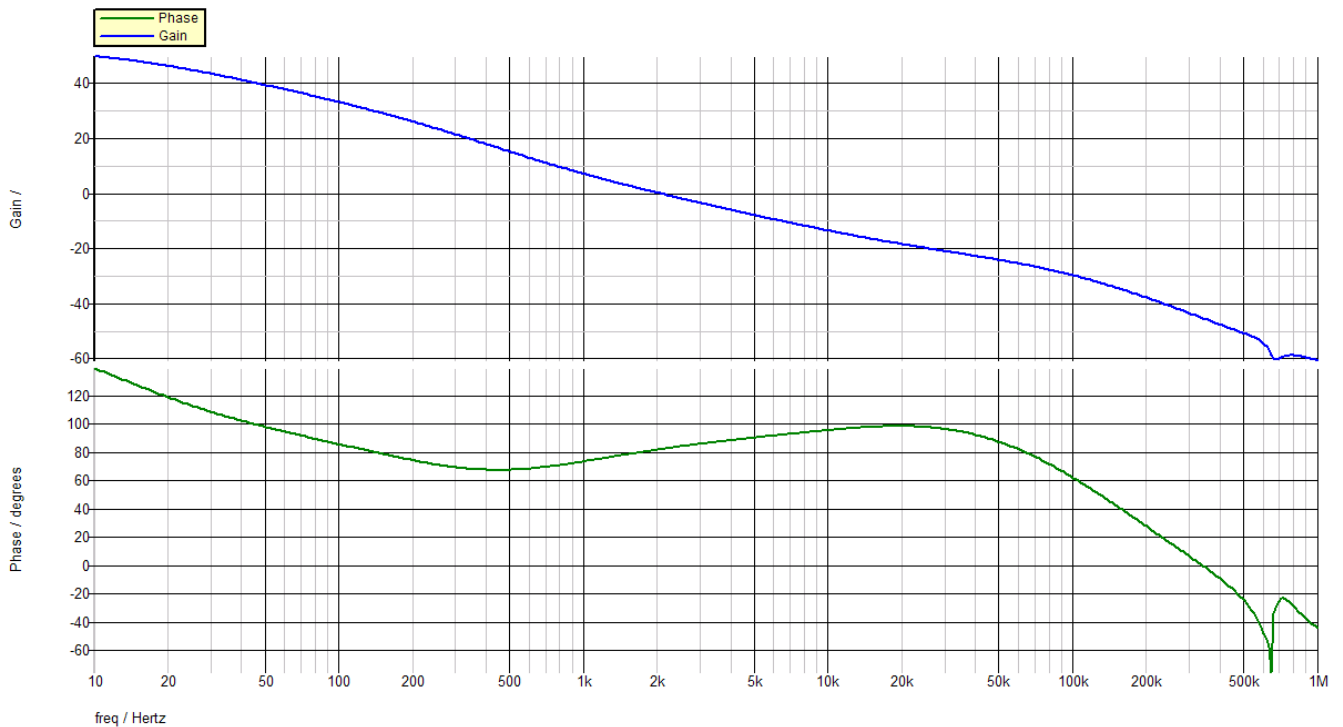


Figure 3. Measured Efficiency over Load

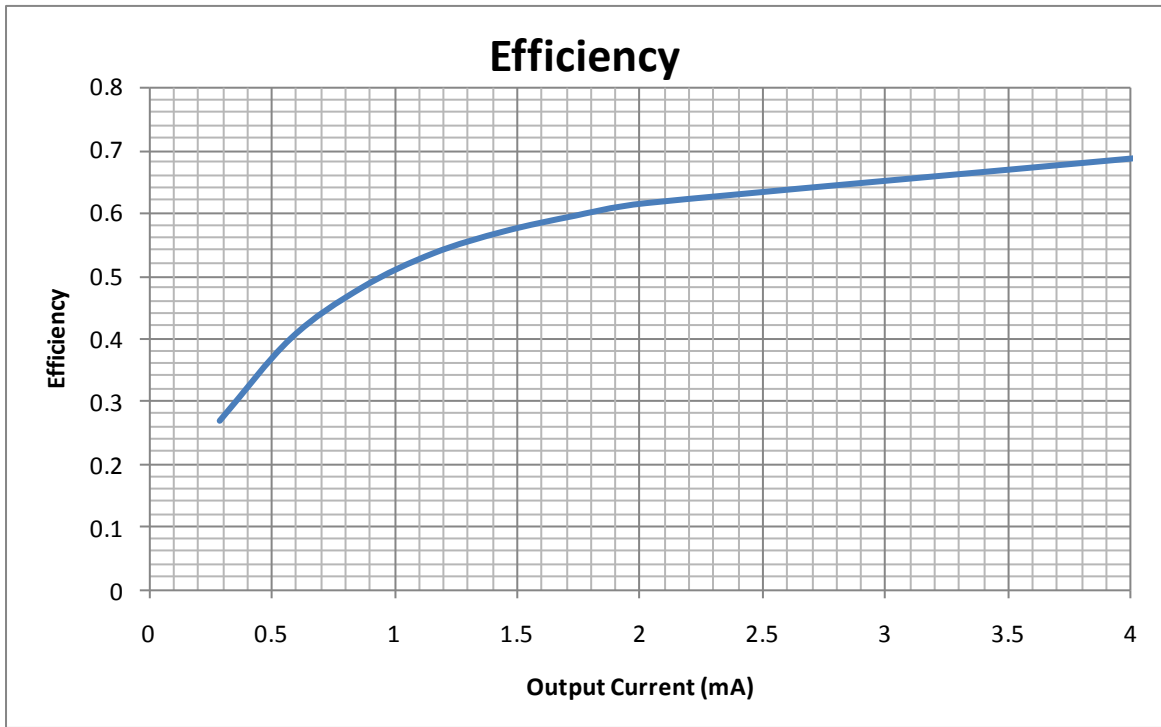


Figure 4.

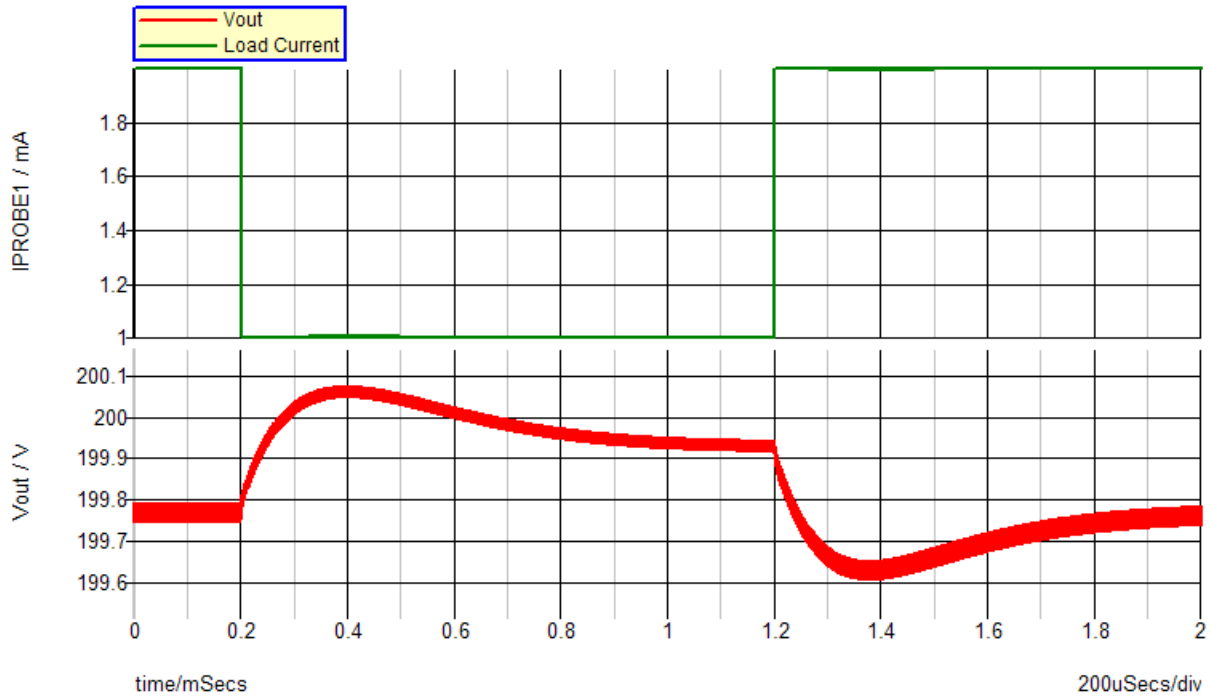


Figure 5.

Figure 6.

NOTES