# Design Solution # 40

# SP7655 Buck Converter for 12V to 1.2V conversion

**Part Number:** SP7655

**Designed by:** Tim Sullivan

**Application Description:** An SP7655 PowerBlox™ is used to create a 1.2volt output from a 12volt source.

**Electrical Requirements:**

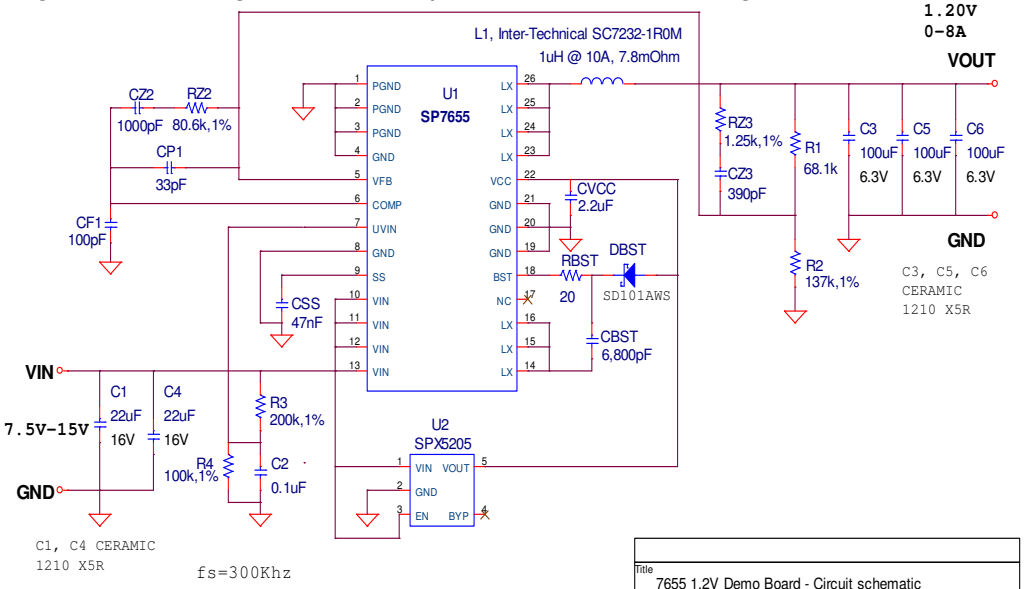
| | |
|---|---|
| Input Voltage: | 12V +/-2volts |
| Output Voltage: | 1.2 Volts |
| Output Current: | up to 8A capable |

**Circuit Description:**

This circuit has been designed to provide 1.2 volts from a 12volt nominal supply. It uses the PowerBlox™ solution SP7655 and 24 discrete parts (not including PCB and I/O pins) and uses approximately 2 square inches of board space. It is possible to maintain this small area usage by the incorporation of the high and low side FETs and the PWM controller into one package.

The solution uses an Inter-Technical 7mm X 7mm, low resistance inductor which is a good balance of size and performance for this solution. An inexpensive Sipex SPX5205 LDO was used to provide the 5V Vcc for the part. Ceramic capacitors were used on the converter input and output and a type 3 feedback configuration was implemented to provide excellent transient response.

This report includes an application schematic complete with component values, a complete Bill of Materials, and figures illustrating the electrical performance of the design.




All resistance values are in Ohms

## Performance Measurements

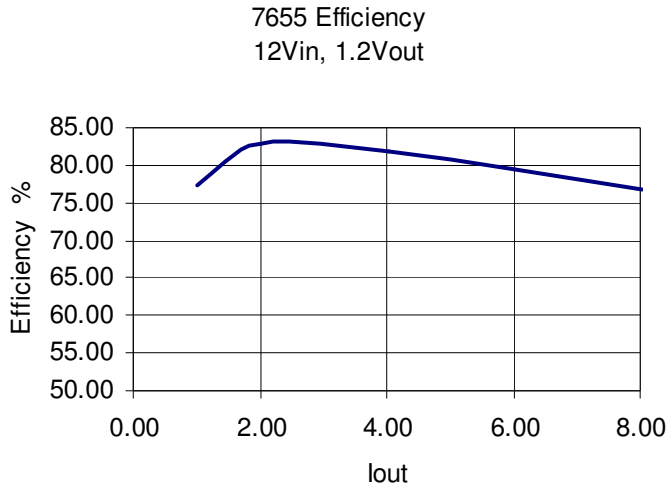



Figure 1 – Efficiency vs Load

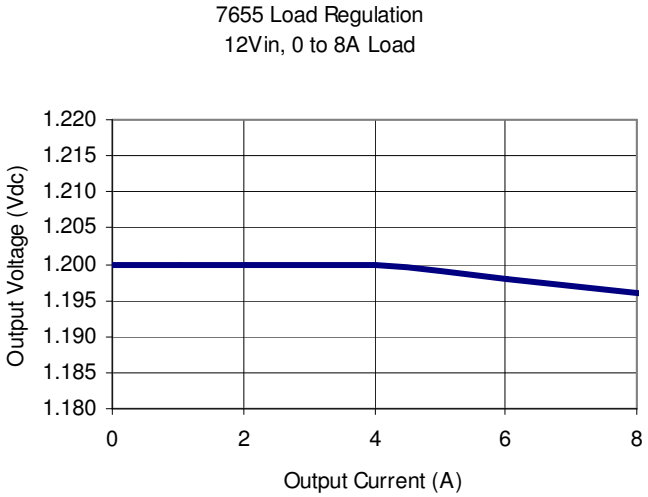



Figure 2 – Load Regulation

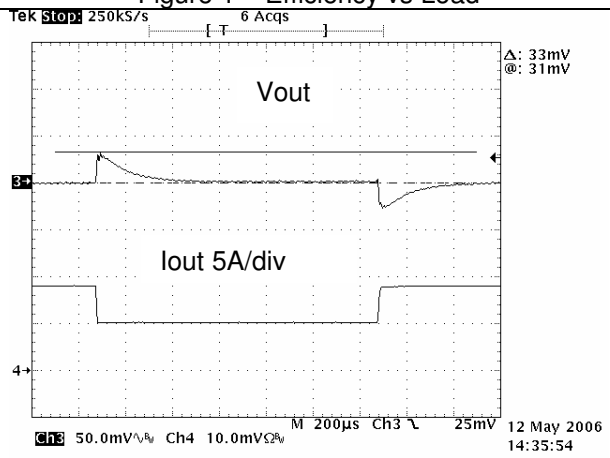



Figure 2 – Load Step Response 5->8 Amps

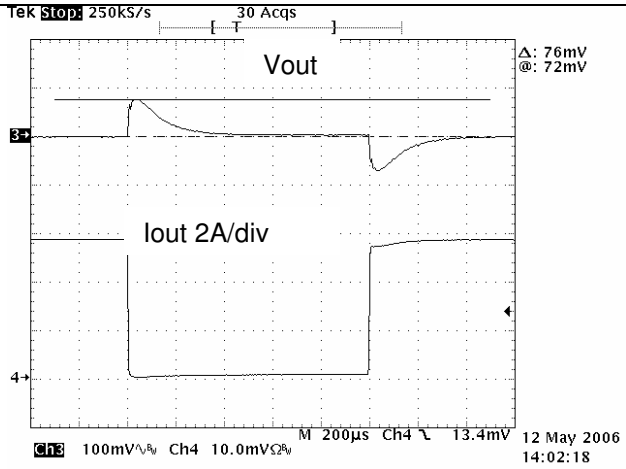



Figure 3 – Load Step Response 0->6 Amps

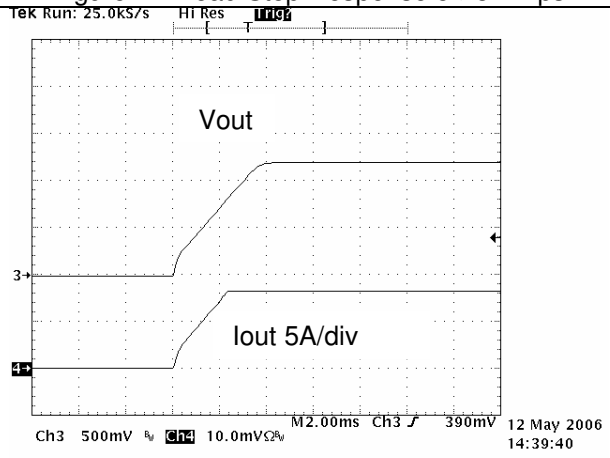



Figure 4 – Start-Up Response: Vin to 8 Amps

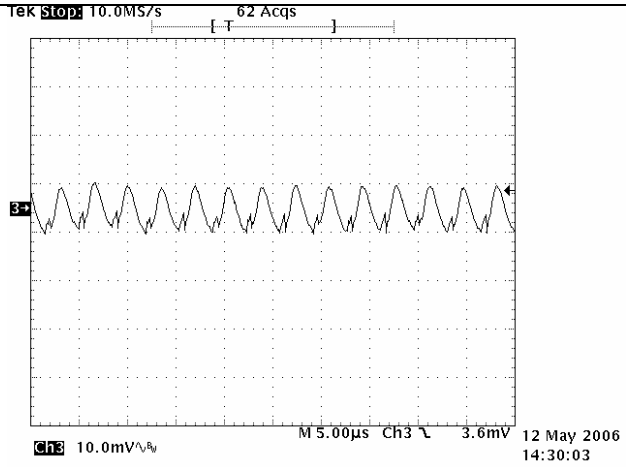
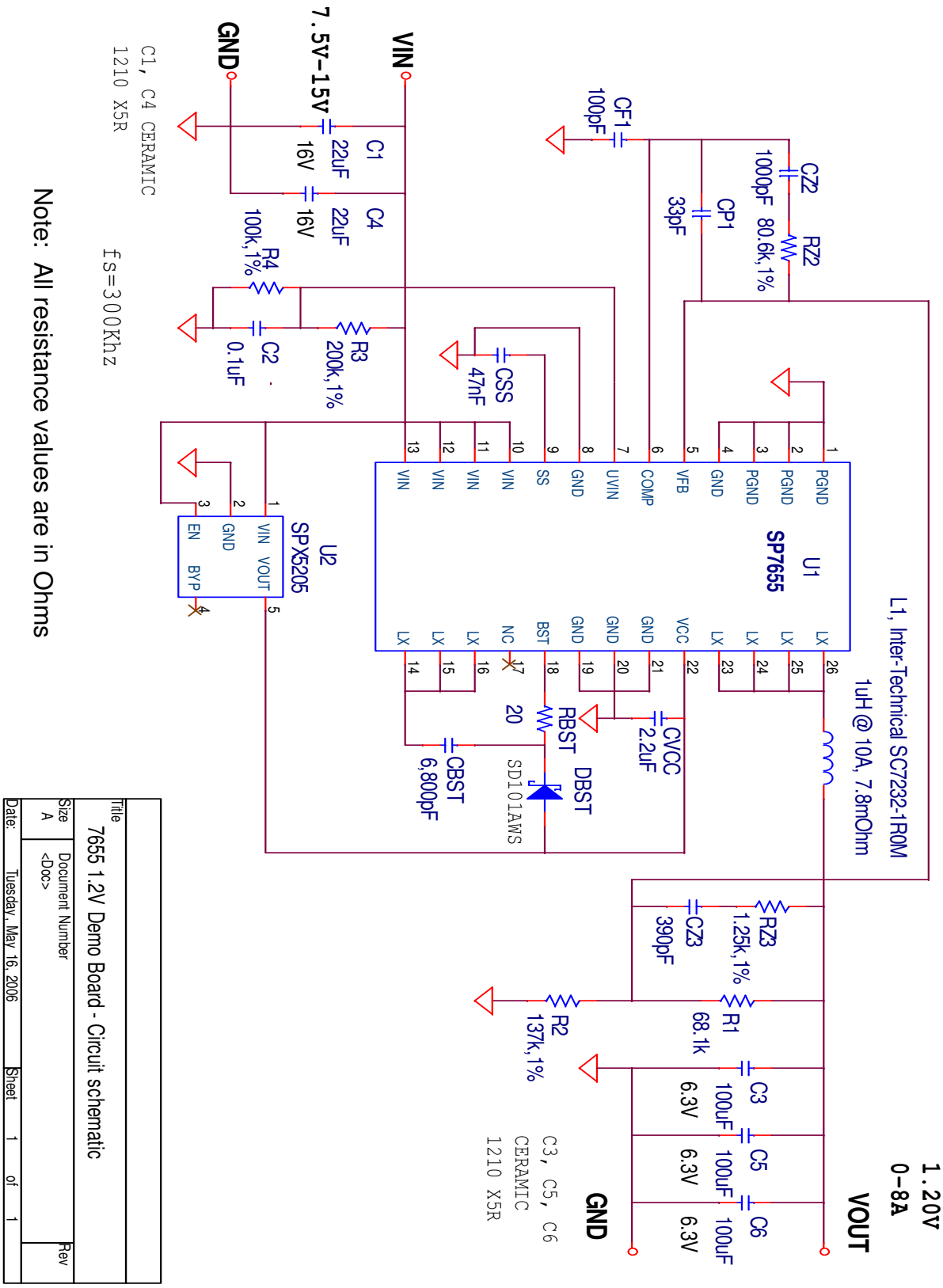



Figure 5 – Output Ripple, Output Current = 8Amps

Circuit Schematic:



Converter Bill of Materials:

| SP7655 Vin=12V Vout=1.2V Evaluation Board Rev. 00 List of Materials | | | | | | |
|---|---|---|---|---|---|---|
| Line No. | Ref. Des. | Qty. | Manuf. | Manuf. Part Number | Layout Size | Component |
| 1 | PCB | 1 | Sipex | 146-6570-01 | 1.75"X2.75" | SP7655EB |
| 2 | U1 | 1 | Sipex | SP7655EU | DFN-26 | 2-FETs Buck Ctrl |
| 3 | U2 | 1 | Sipex | SPX5205M5-5.0 | SOT-23-5 | 150mA LDO Voltage Reg |
| 4 | DBST | 1 | Vishay Semi | SD101AWS | SOD-323 | 15mA Schottky Diode |
| 6 | L1 | 1 | Inter-Technical | SC7232-2R2M | 6.8X6.8mm | 2.2uH Coil 8A 10.4mohm |
| 7 | C3, C5, C6 | 3 | TDK | C3225X5R0J107M | 1210 | 100uF Ceramic X5R 6.3V |
| 8 | C1,C4 | 2 | TDK | C3225X7R1H226M | 1210 | 22uF Ceramic X7R 16V |
| 9 | CVCC | 1 | TDK | C1608X5R1A225K | 0603 | 2.2uF Ceramic X5R 10V |
| 10 | CBST | 1 | TDK | C1608X5R1A682K | 0603 | 6800pF Ceramic X5R 10V |
| 11 | C2 | 1 | TDK | C1608X7R1H104K | 0603 | 0.1uF Ceramic X7R 50V |
| 12 | CSS | 1 | TDK | C1608X7R1H473K | 0603 | 47,000pF Ceramic X7R 50V |
| 13 | CP1 | 1 | TDK | C1608COG1H330J | 0603 | 33pF Ceramic COG 50V |
| 14 | CZ2 | 1 | TDK | C1608COG1H102J | 0603 | 1000pF Ceramic COG 50V |
| 15 | CF1 | 1 | TDK | C1608COG1H101J | 0603 | 100pF Ceramic COG 50V |
| 16 | CZ3 | 1 | TDK | C1608COG1H391J | 0603 | 390pF Ceramic COG 50V |
| 17 | RZ2 | 1 | Panasonic | ERJ-3EKF78062V | 0603 | 80.6K Ohm Thick Film Res 1% |
| 18 | R2 | 1 | Panasonic | ERJ-3EKF1373V | 0603 | 137K Ohm Thick Film Res 1% |
| 19 | RZ3 | 1 | Panasonic | ERJ-3EKF1251V | 0603 | 1.25K Ohm Thick Film Res 1% |
| 20 | R1 | 1 | Panasonic | ERJ-3EKF6812V | 0603 | 68.1K Ohm Thick Film Res 1% |
| 21 | R3 | 1 | Panasonic | ERJ-3EKF2003V | 0603 | 200K Ohm Thick Film Res 1% |
| 22 | R4 | 1 | Panasonic | ERJ-3EKF1003R0V | 0603 | 100K Ohm Thick Film Res 1% |
| 23 | RBST | 1 | Panasonic | ERJ-3EKF20R0V | 0603 | 20.0 Ohm Thick Film Res 1% |
| 24 | VIN, VOUT, GND, GND2 | 4 | Vector Electronic | K24C/M | .042 Dia | Input/Output Terminal Posts |