# Design Solution # 61

# SP7662 Buck Converter for up to 12A LED Driver

**Designed by:** Tim Sullivan

**Part Number:** SP7662

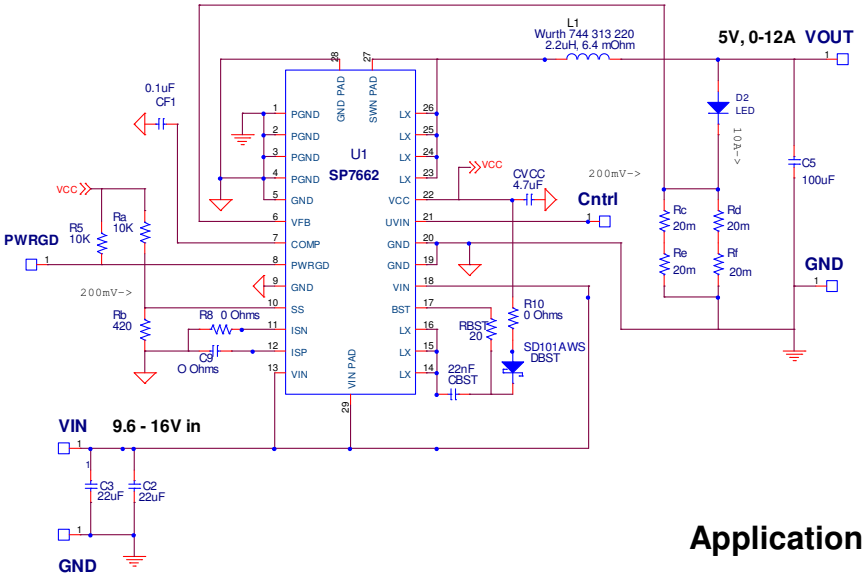
**Application Description:** 15Vin Buck Converter for an up to 12 Amp LED driver

**Electrical Requirements:**

| | |
|---|---|
| Input Voltage | 15V +/-5volts |
| Output Voltage | 5Volts Max.<br>LED forward voltage ~3.6volts<br>LED test bank: 16X Luxeon LXHLMW1D |
| Output Current | up to 12A capable. ~10 Amps solution tested |

**Circuit Description:**

This circuit has been designed to provide up to 5 volts at up to 12 amps from a 15 volt nominal supply. By using low-ohm sense resistors in series with the LED and using the sense resistors as our feedback reference the supply was configured as a current source. (see schematic figure 7) To minimize power dissipation in these resistors the nominal 0.8V reference was not used. The softstart pin on the 7662 is also the non-inverting input to the internal error amplifier - this allows a divider to be created to lower the internal reference used for voltage regulation. This report includes the application schematic complete with component part numbers and figures 1-8 illustrating electrical performance of the design.




**Application Schematic**

A divider was created from the Vcc output creating 0.2Volts to be fed in to the softstart pin and used as the new feedback reference. This also means the voltage on the softstart pin could be used to vary LED intensity by varying the current through the device. A pin was also provided on the demo board to vary LED intensity by cycling power to the LED via the 7662 UVin input. The LED was cycled from 60Hz to 1kHz at varying duty cycles to vary light intensity and LED average current. Detailed results for operation at 100Hz and 1kHz are provided.

The converter was configured using type 1 compensation for simplicity. Over-current sensing was disabled by shorting the ISN/ISP pins to ground as the over current feature can not be used for output voltages >3.3 volts.

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

Converter Performance Data 100Hz

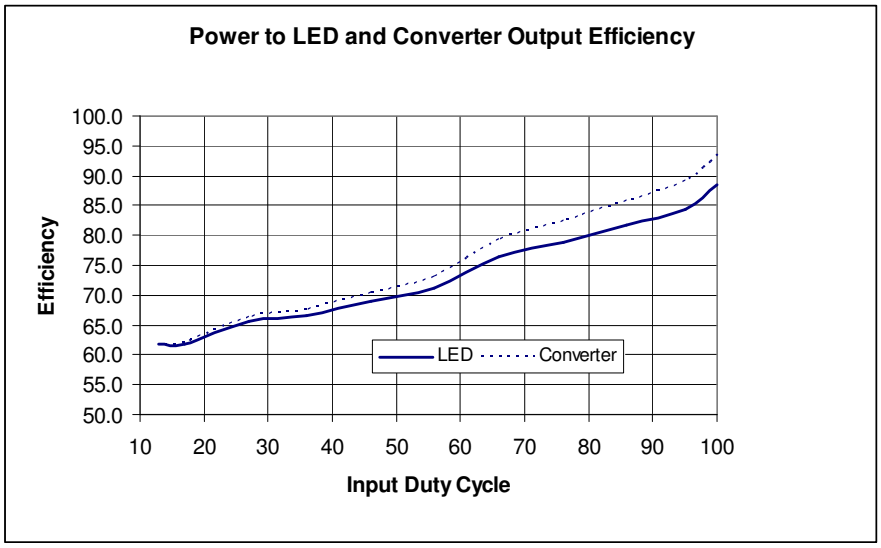
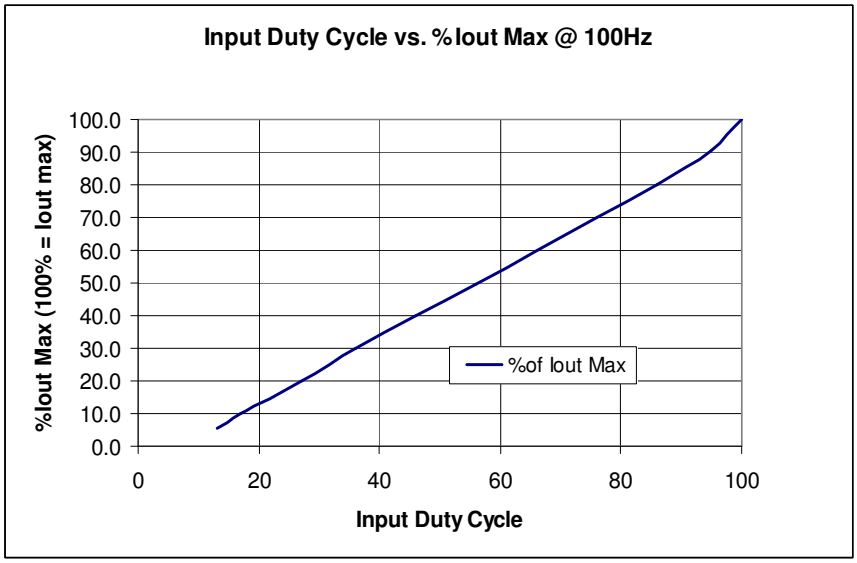



Figure 1

7662 LED Driver Efficiency
(LED pulsed at 100Hz at noted duty cycle)

| DutyCycle | LED | Converter |
|---|---|---|
| 100 | 88.4 | 93.8 |
| 95 | 84.5 | 89.3 |
| 86 | 81.8 | 86.1 |
| 76 | 78.9 | 82.7 |
| 66 | 76.4 | 79.7 |
| 56 | 71.2 | 73.2 |
| 46 | 68.9 | 70.6 |
| 36 | 66.7 | 67.9 |
| 27 | 65.6 | 66.5 |
| 17 | 61.8 | 62.2 |
| 13 | 61.8 | 62.1 |

Note: Input duty cycle to Uvin shown above. Actual duty cycle to LED shown in chart below as %of Iout Max

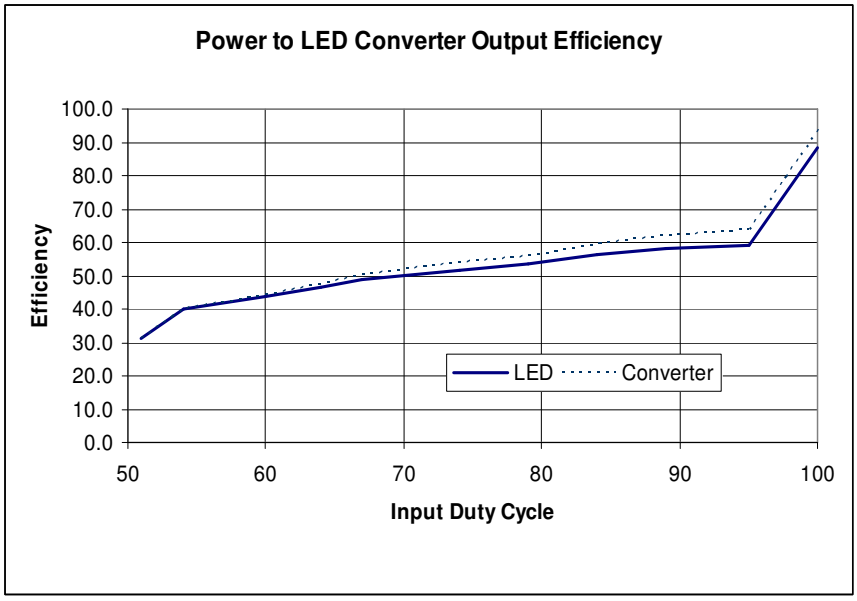



Input Duty Cycle vs. %Iout Max

| DC Input | %of Iout Max |
|---|---|
| 100 | 100 |
| 95 | 90 |
| 86 | 80 |
| 76 | 70 |
| 66 | 60 |
| 56 | 50 |
| 46 | 40 |
| 36 | 30 |
| 27 | 20 |
| 17 | 10 |
| 13 | 5.5 |

Figure 2

Converter Performance Data 1kHz

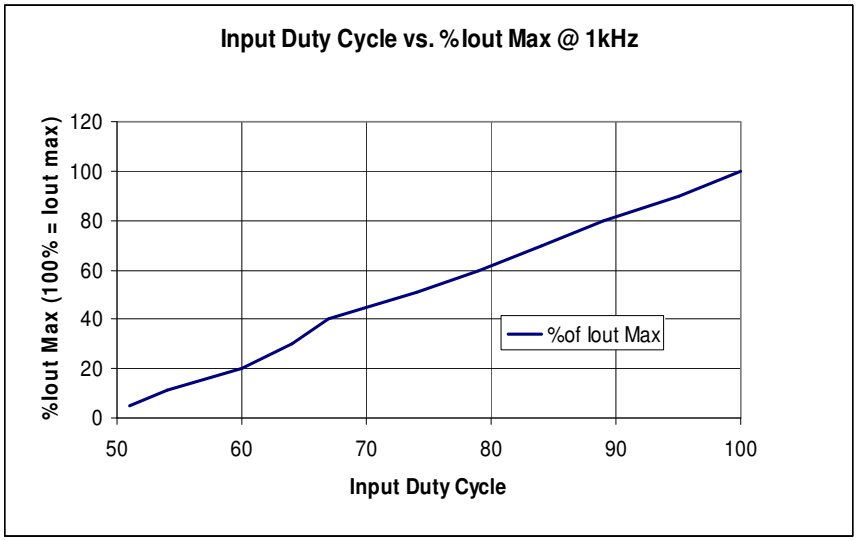



7662 LED Driver Efficiency
(LED pulsed at 1kHz at noted duty cycle)

| Duty Cycle | LED | Converter |
|---|---|---|
| 100 | 88.4 | 93.8 |
| 95 | 59.3 | 64.1 |
| 89 | 58.1 | 62.4 |
| 84 | 56.2 | 59.9 |
| 79 | 53.3 | 56.4 |
| 74 | 51.8 | 54.5 |
| 67 | 48.9 | 50.7 |
| 64 | 46.6 | 48.0 |
| 60 | 43.7 | 44.7 |
| 54 | 40.1 | 40.7 |
| 51 | 31.3 | 31.6 |

Note: Input duty cycle to Uvin shown above. Actual duty cycle to LED shown in chart below as %of Iout Max

Figure 1b




Input Duty Cycle vs. %Iout Max

| DC Input | %of Iout Max |
|---|---|
| 100 | 100 |
| 95 | 90 |
| 89 | 80 |
| 84 | 69.5 |
| 79 | 59.6 |
| 74 | 50.6 |
| 67 | 40 |
| 64 | 30.4 |
| 60 | 20 |
| 54 | 11.2 |
| 51 | 5.1 |

Figure 2b

## Circuit Waveforms

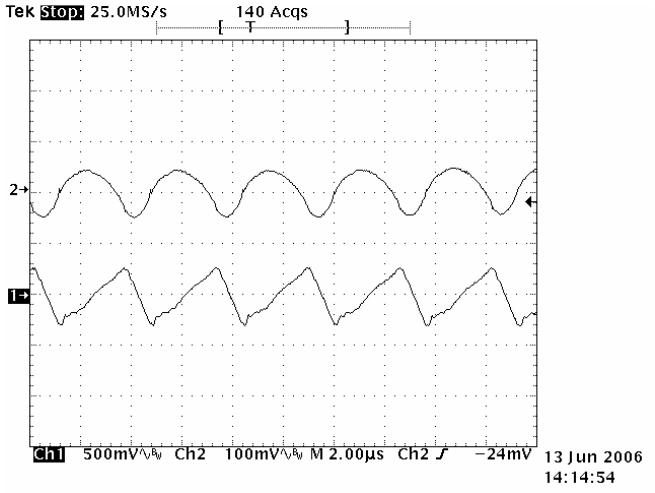



Figure 3 – Ch.2 Output Ripple Voltage
Ch.1 Input Ripple Voltage. 15Vin -10.7A Out.

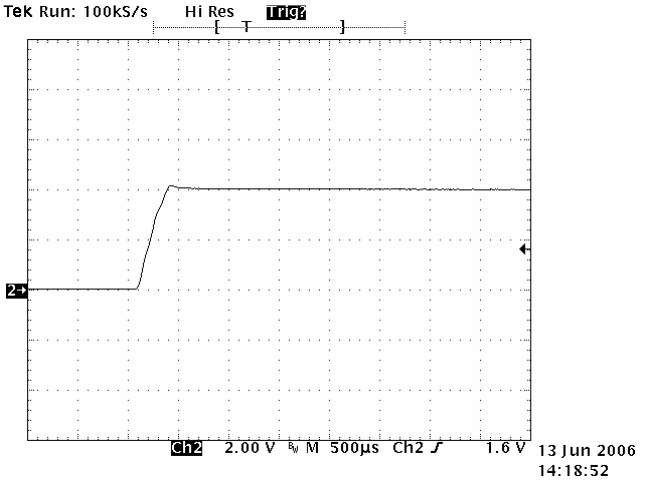



Figure 4 –
Start –up output voltage (LED and Sense Resistors)

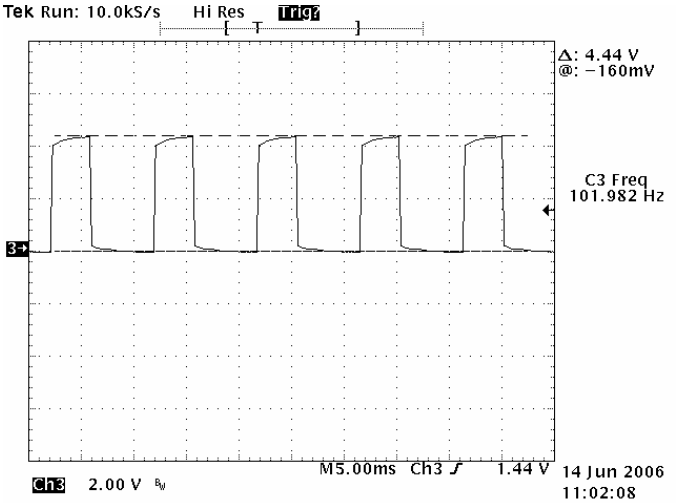



Figure 5 – Duty Cycle Signal to UVIN (CNTRL)

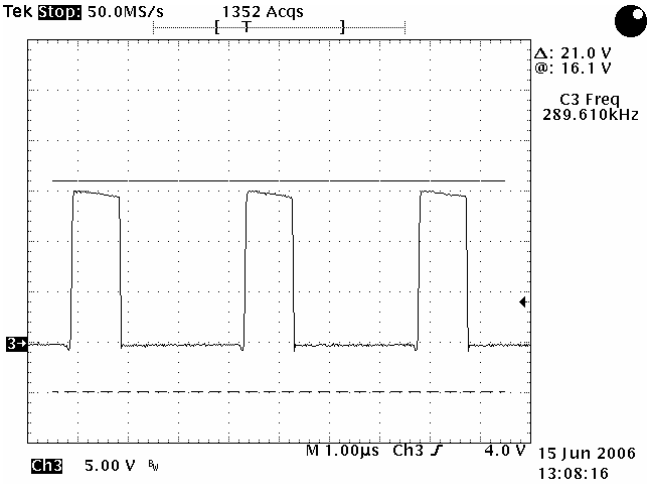



Figure 6 – LX (switchnode) of converter 15Vin

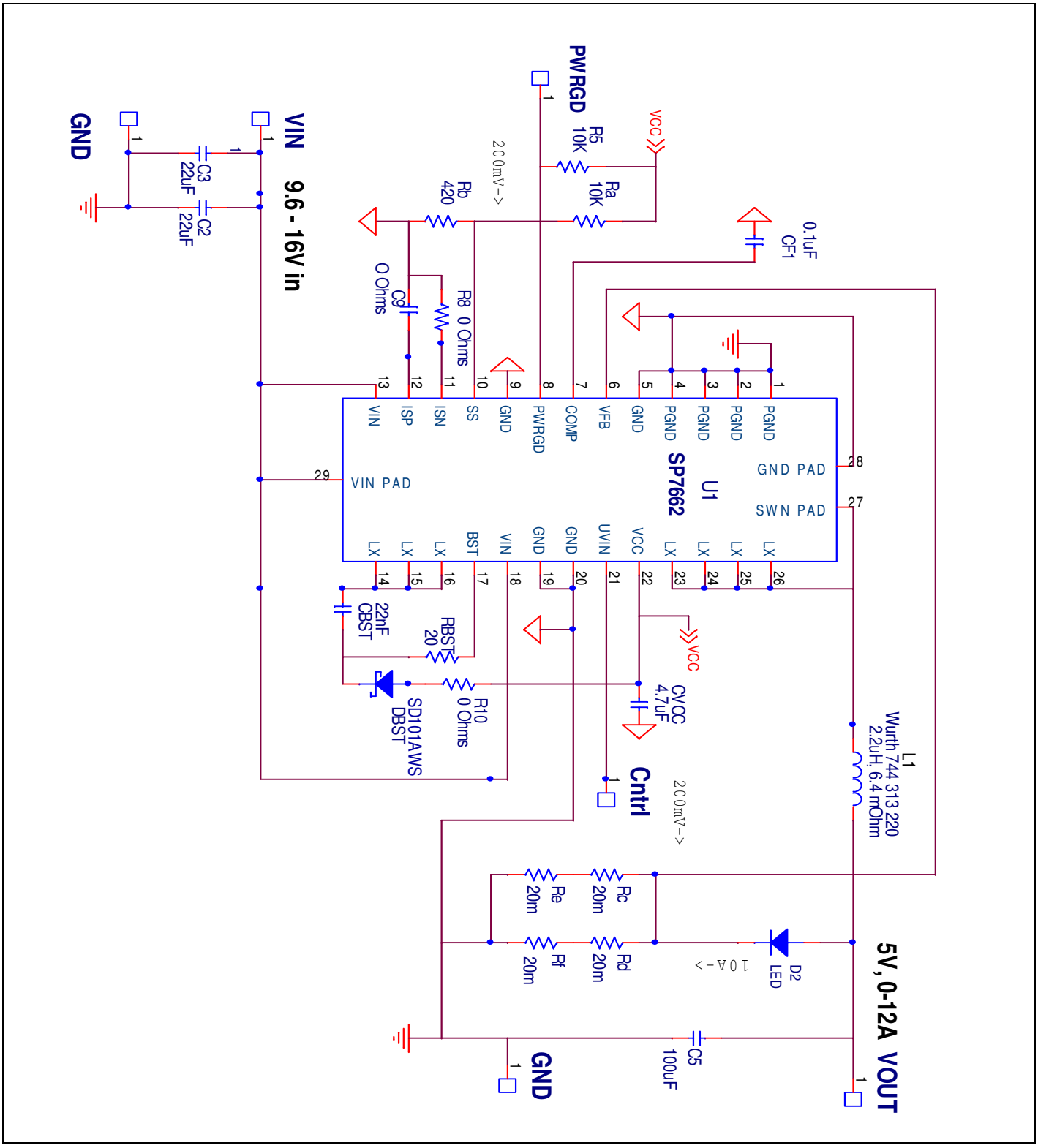



Figure 7 – Application Schematic

For further assistance:

| | |
|---|---|
| Email: | Sipexsupport@sipex.com |
| WWW Support page: | http://www.sipex.com/content.aspx?p=support |
| Sipex Application Notes: | http://www.sipex.com/applicationNotes.aspx |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