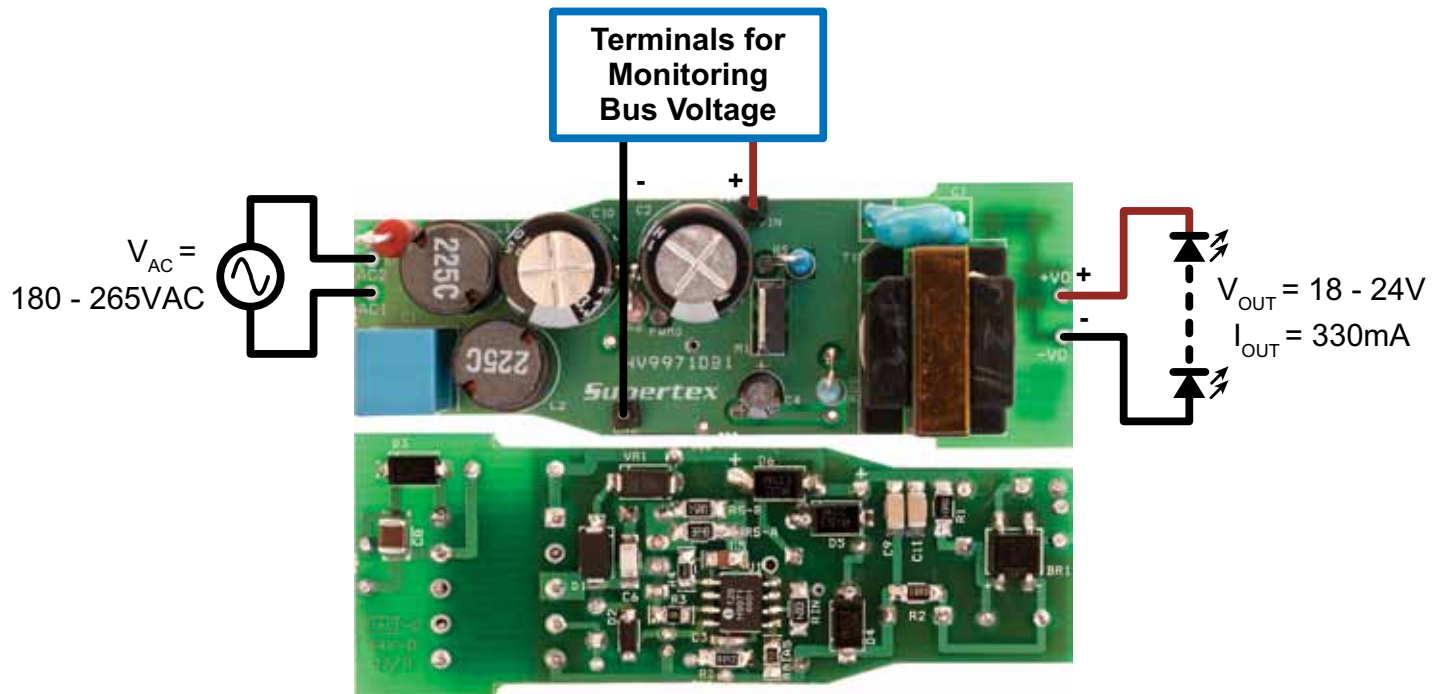


Isolated, Constant Current HV9971 LED Driver Demoboard

Board Layout and Connection Diagram



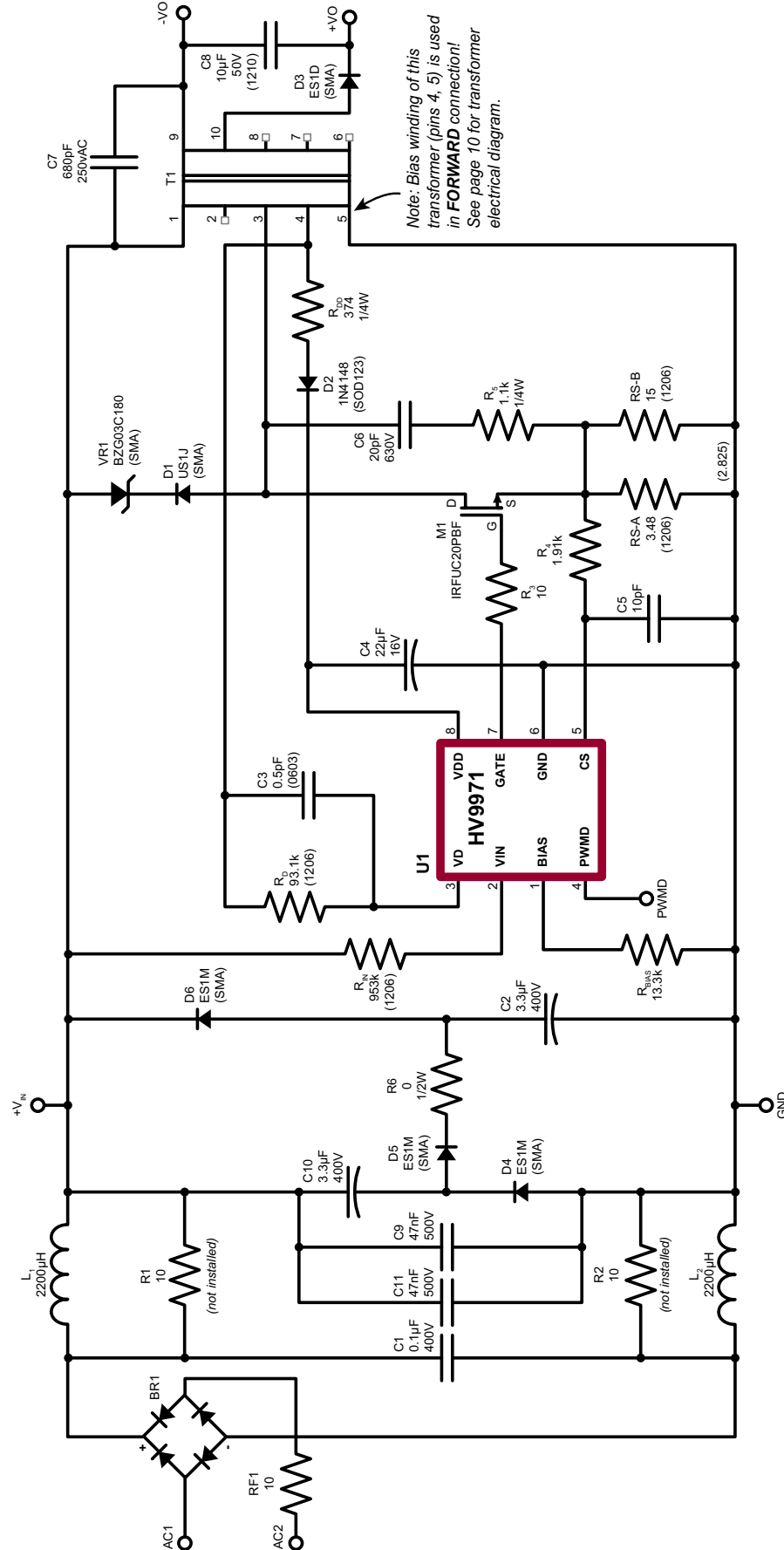
Connections

- 1. Input Voltage:** Connect the AC input voltage between input terminals as shown.
- 2. LED String:** Connect the LED strings between $+V_O$ and $-V_O$ as shown (anode of the string to $+V_O$ and cathode to $-V_O$).
- 3. DC Voltage:** Use terminals either for measurement of the bus voltage or the DC voltage input

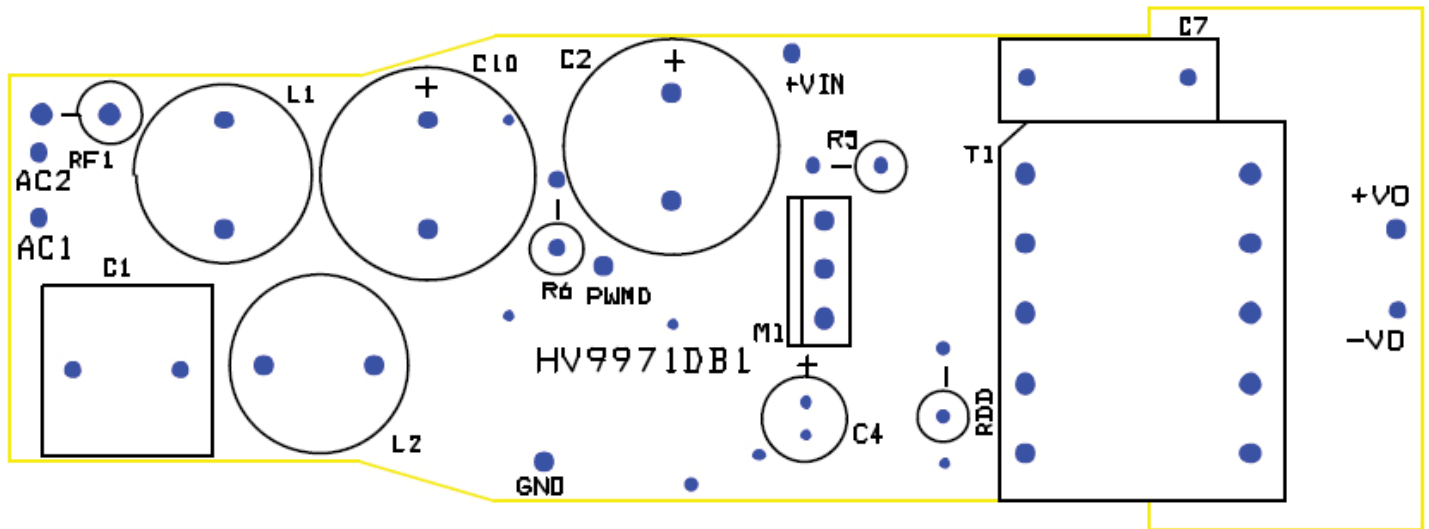
Specifications

| Specification | Value |
|---------------------------------|--------------------------------|
| Input line voltage | 180 – 265VAC |
| Output voltage | 18 – 24V |
| Output current | 330mA |
| Switching frequency | 75 – 120kHz |
| Typical efficiency | 82%@Low Line, 81%@High Line |
| Open LED protection | 30V |
| Output short circuit protection | Hiccup |
| Power factor | ≥82% |

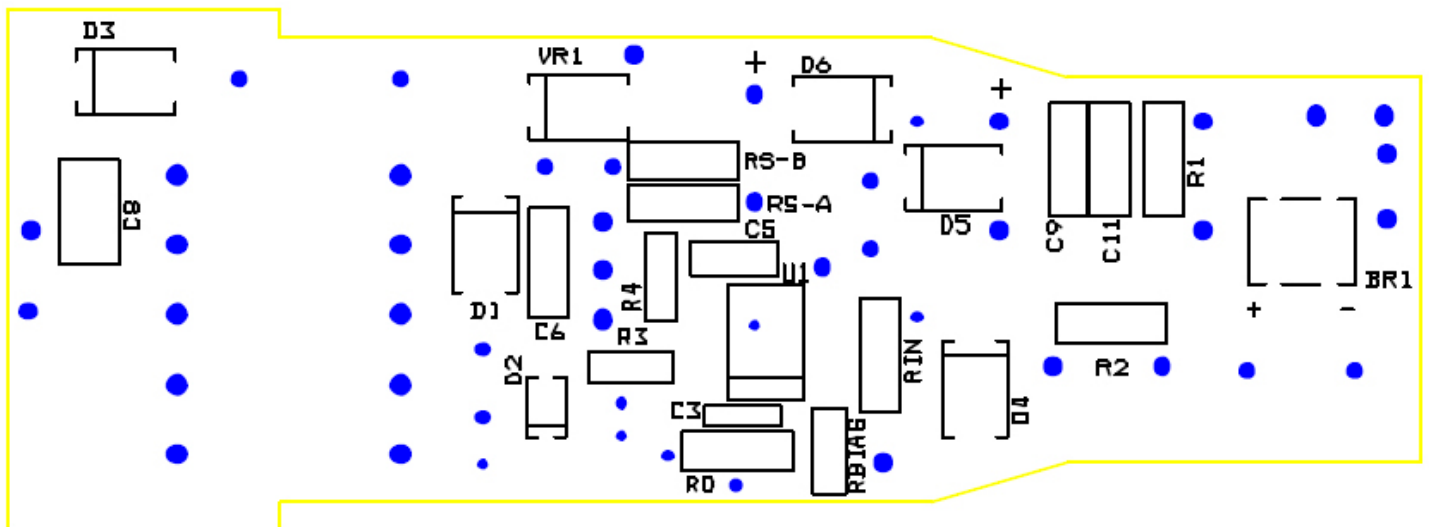
HV9971DB1 Schematic Diagram



PCB Assembly Drawings



Through-Hole Component Side



Solder Side

Typical Characteristics

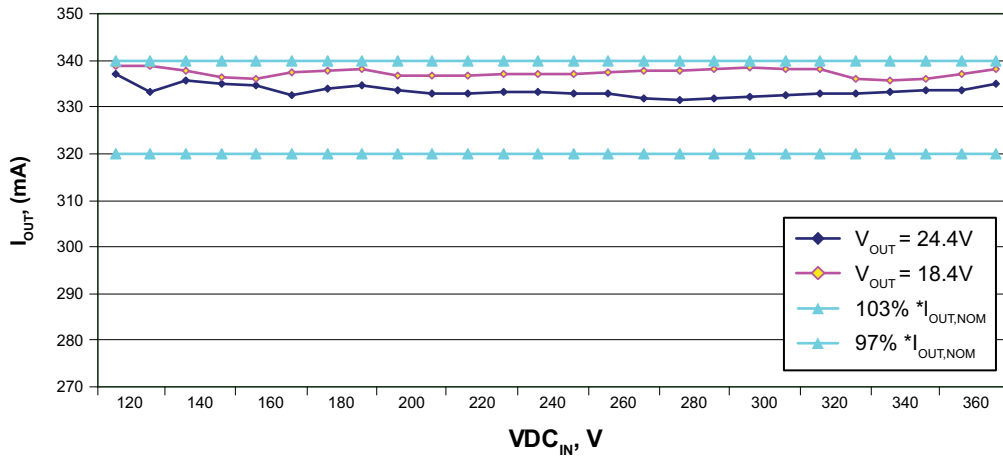


Figure 1. DC Line Regulation

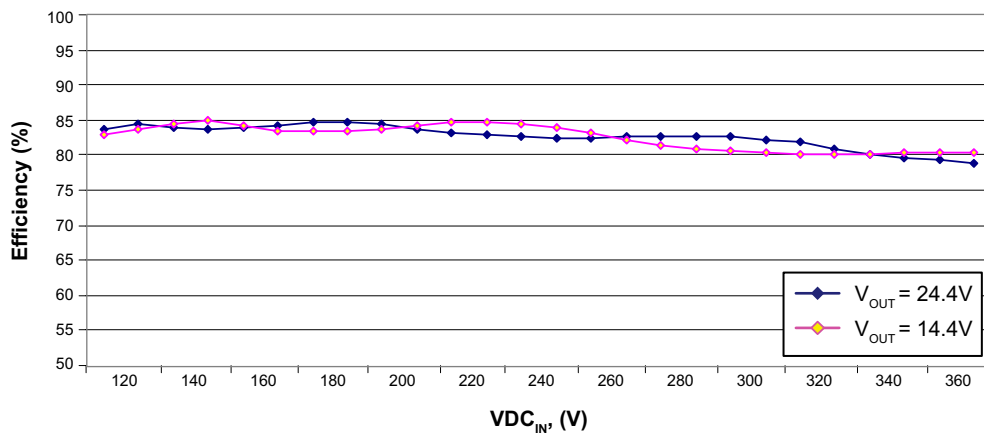


Figure 2. DC Efficiency @25°C

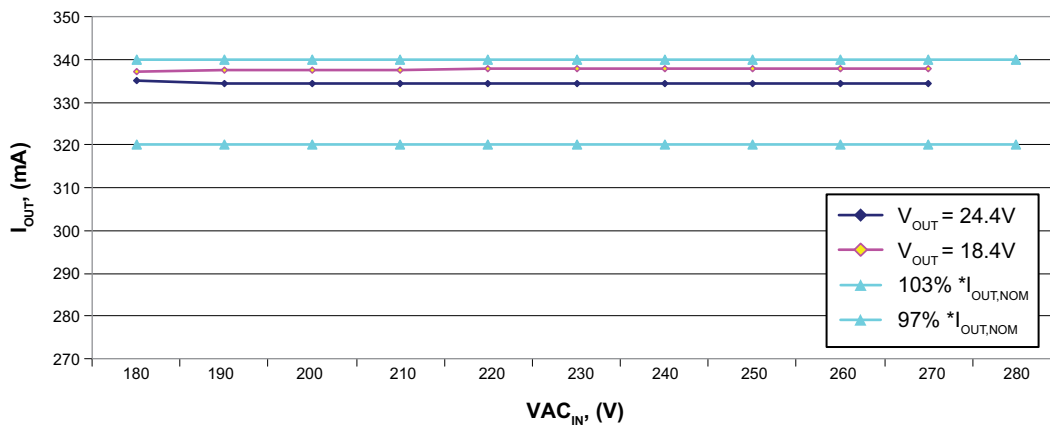


Figure 3. AC Line Regulation

Typical Characteristics (cont.)

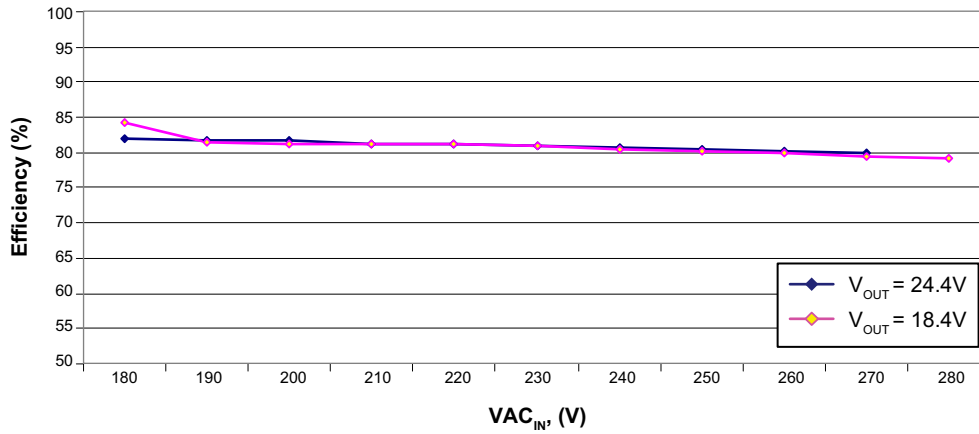


Figure 4. AC Efficiency @25°C

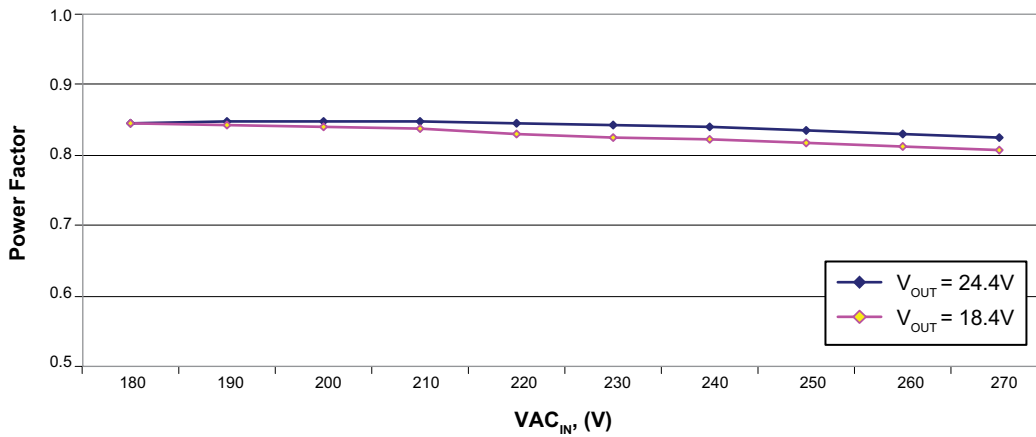


Figure 5. Power Factor

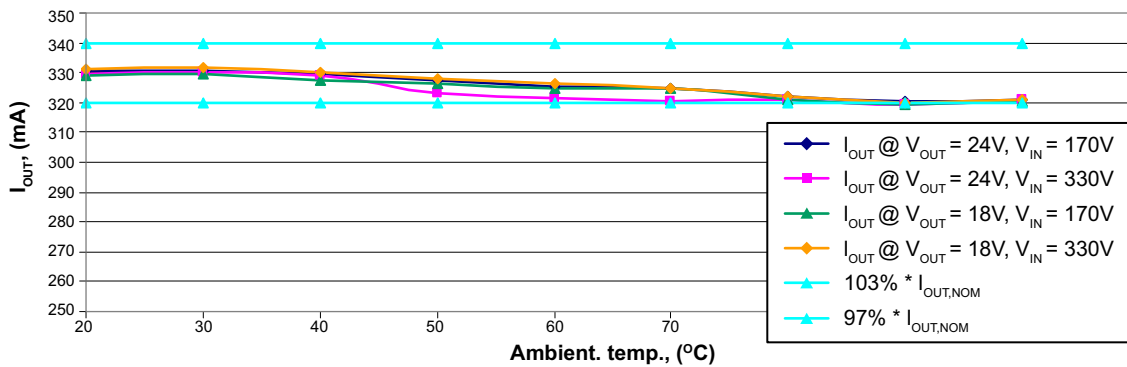


Figure 6. I_{OUT} Temperature Regulation

Typical Waveforms

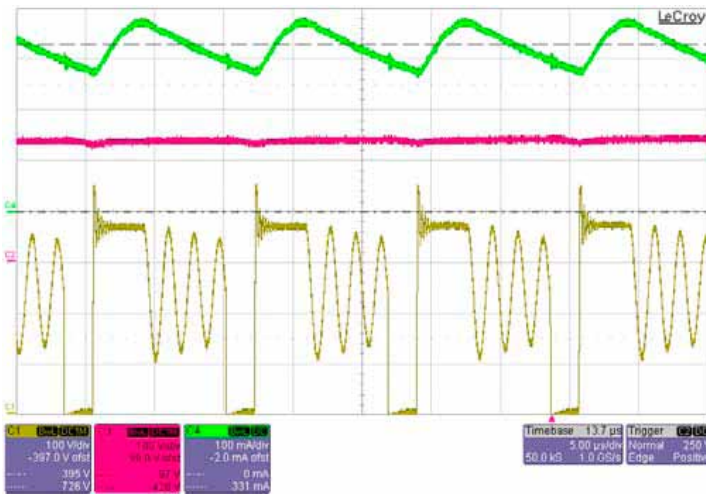


Figure 7. Output current (green trace, 100mA/div), drain voltage (yellow trace, 100V/div) and bus voltage (purple trace, 100V/div) @ $V_{LINE} = 230VAC$

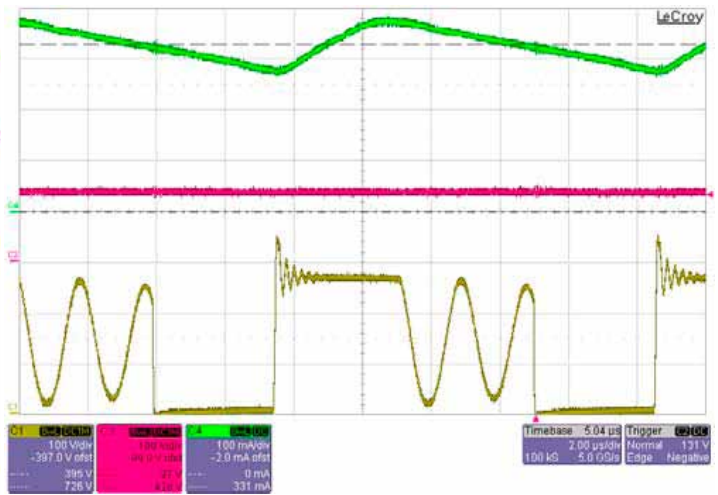


Figure 8. Output current (green trace, 100mA/div), drain voltage (yellow trace, 100V/div) and bus voltage (purple trace, 100V/div) @ $V_{LINE} = 230VAC$

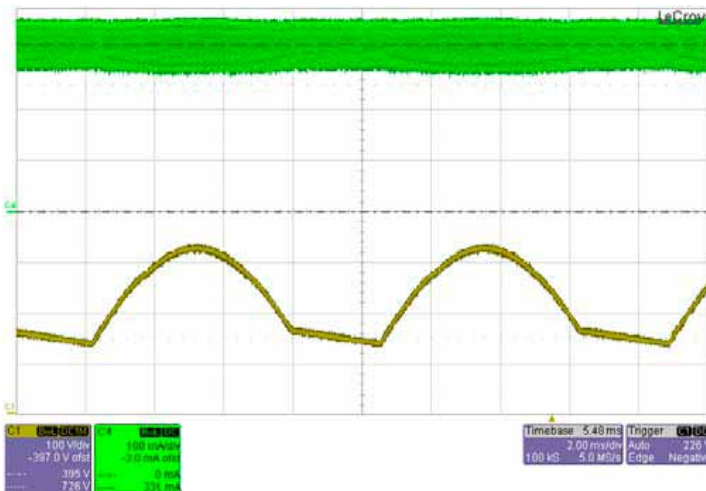


Figure 9. Output current (green trace, 100mA/div), and bus voltage (yellow trace, 100V/div) @ $V_{LINE} = 230VAC$

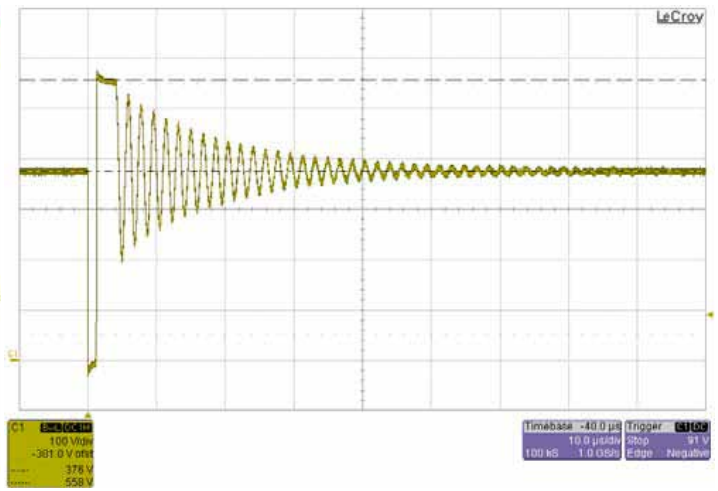


Figure 10. Drain voltage (yellow trace, 100V/div) @ $V_{IN} = 375VDC$ and LED open

Typical Waveforms (cont.)

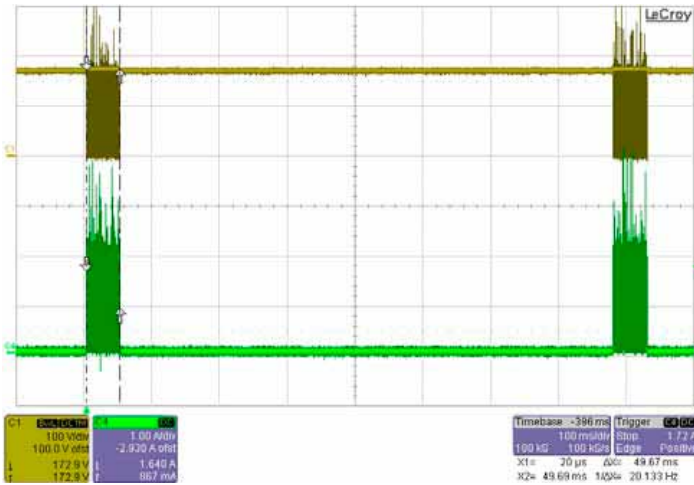


Figure 11. Output diode current (green trace, 1A/div), @ $V_{IN} = 170VDC$ and short across LED

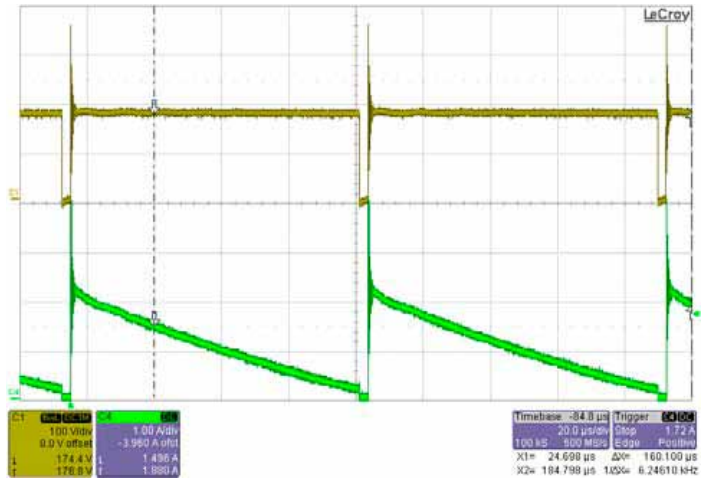


Figure 12. Output diode current (green trace, 1A/div), @ $V_{IN} = 170VDC$ and short across LED

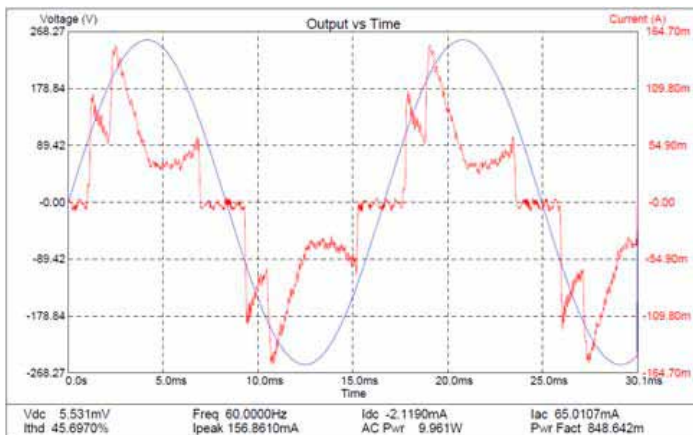


Figure 13. Line voltage and line current @ $VAC = 180V$

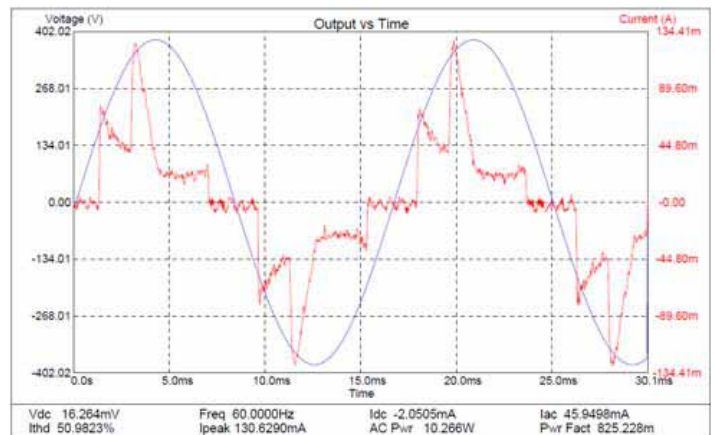


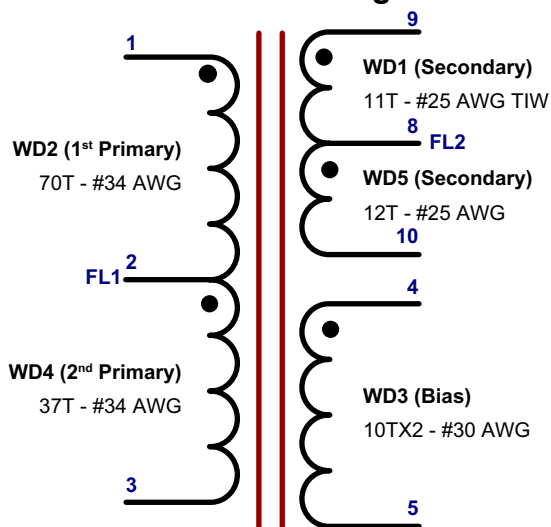
Figure 14. Line voltage and line current @ $VAC = 270V$

Bill of Materials

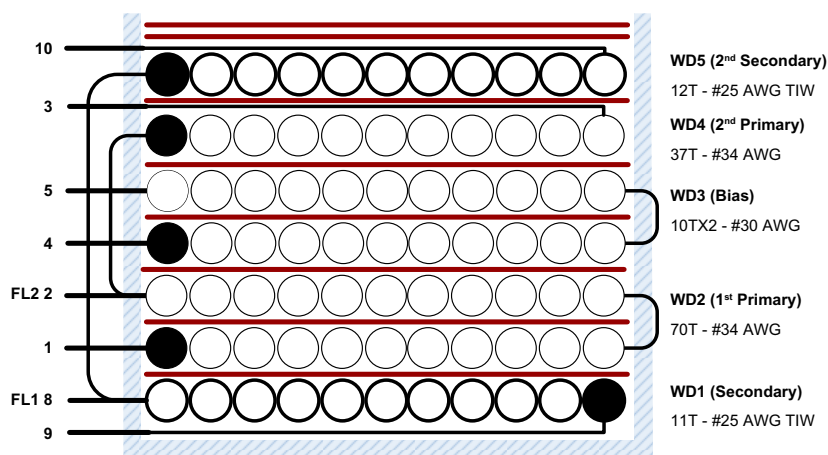
| # | Quan | Ref. Des. | Description | Package | Manufacturer | Manufacturer Part # |
|----|------|-------------------|--|----------------|---------------|---------------------|
| 1 | 1 | BR1 | Rect bridge GP 600V 0.8A | Mini-Dip | Diodes inc. | HD06-T |
| 2 | 1 | C1 | 0.1 μ F 400V radial capacitor | Thru-hole | Epcos | B32529E6104J000 |
| 3 | 2 | C2, C10 | 3.3 μ F 400V elect vy radial capacitor | Thru-hole | Nichicon | UVZ2G3R3MPD |
| 4 | 1 | C3 | 0.5pF 50V ceramic chip capacitor | SMT0603 | Yageo | CC0603CRNP09BNR50 |
| 5 | 1 | C4 | 22 μ F 16V alum elect capacitor | Thru-hole | Panasonic ECG | ECE-A1CKA220 |
| 6 | 1 | C5 | 10pF 50V ceramic chip capacitor | SMT0805 | Yageo | CC0805JRNP09BRN100 |
| 7 | 1 | C6 | 20pF 630V ceramic chip capacitor | SMT1206 | Kemet | C1206C200JBRACU |
| 8 | 1 | C7 | 680 pF 250VAC capacitor | Thru-hole | Murata | DE2B3KH681KA3B |
| 9 | 1 | C8 | 10 μ F 50V ceramic chip capacitor | SMT1210 | Taiyo Yuden | UMK325C7106MM-T |
| 10 | 2 | C9, C10 | 47nF 500 ceramic chip capacitor | SMT1206 | Vishay | VJ1206Y473KXEAT5Z |
| 11 | 1 | D1 | Diode ultra fast switch 600V 1A | SMA | Diodes inc. | US1J-13-F |
| 12 | 1 | D2 | Diode switch 75V 400mW | SOD123 | Diodes inc. | 1N4148W-7-F |
| 13 | 1 | D3 | Diode fast rec 200V 1A | SMA | Diodes inc. | ES1D-13-F |
| 14 | 3 | D4, D5, D6 | Diode fast rec 1000V 1A | SMA | Micro Comm | ES1M-TP |
| 15 | 2 | L1, L2 | 2.2mH 0.20A inductor | SMT | Murata | 13R225C |
| 16 | 1 | M1 | 600V 2A N-channel MOSFET | I-PAK | Vishay | IRFUC20PBF |
| 17 | 1 | R _{DD} | 374 Ω 1% resistor | 1/4W Thru-hole | Any | --- |
| 18 | 1 | R _{IN} | 953k Ω 1% resistor | SMT1206 | Any | --- |
| 19 | 1 | R _D | 95.3k Ω 1% resistor | SMT1206 | Any | --- |
| 20 | 1 | R _{BIAS} | 13.3k Ω 1% resistor | SMT0805 | Any | --- |
| 21 | 1 | R _{S-A} | 3.48 Ω 1% resistor | SMT1206 | Any | (3.48//15) = 2.825 |
| 22 | 1 | R _{S-B} | 15.0 Ω 1% resistor | SMT1206 | Any | (3.48//15) = 2.825 |
| 23 | 1 | R _{F1} | 10 Ω 5% 2W MF fusible resistor | 1/4W Thru-hole | Vishay | --- |
| 24 | 2 | R1, R2 | Not Installed | SMT1206 | Any | --- |
| 25 | 1 | R3 | 10 Ω 1% resistor | SMT0805 | Any | --- |
| 26 | 1 | R4 | 1.91k Ω 1% resistor | SMT0805 | Any | --- |
| 27 | 1 | R5 | 1.1k Ω 1% resistor | 1/4W Thru-hole | Any | --- |
| 28 | 1 | R6 | 0 Ω | Jumper Wire | - | --- |
| 29 | 1 | T1 | Custom transformer | Thru-hole | Any | --- |
| 30 | 1 | U1 | LED Driver IC | SOIC-8 | Supertex | HV9971LG-G |
| 31 | 1 | VR1 | Diode Zener 180V 600W 5% | SMA | Vishay | BZG03C180TR |

Flyback Transformer Specifications

Transformer Electrical Diagram



Transformer Build Diagram



Transformer Electrical Specifications

| | | |
|----------------------------|--|---------------|
| Electrical strength | From pins 1-3 to pins 8-10 1second, AC 60Hz | 3000VAC |
| Primary inductance | Pins 1, 3 all other windings open, at 100kHz | 916μH, ±10% |
| Resonant frequency | Pins 1, 3 all other windings open | 750KHz (min.) |
| Primary leakage inductance | Pins 1, 3, leads 9, 10 shorted | 18μH (max.) |

Transformer Bill of Materials

| Item | Description |
|------|---|
| 1 | Core: RENCO E16/8/5 (or equivalent), Al = 80nH/T ² |
| 2 | Bobbin: E/16/8/5 vertical, 10pin or equivalent |
| 3 | Triple insulated wire: #25 AWG |
| 4 | Magnet wire: #34 AWG |
| 5 | Magnet wire: #30 AWG |
| 6 | Tape: 3M 1298 Polyester Film, 8mm wide, 2.0mils thick or equivalent |
| 7 | Tape: 3M 1298 Polyester Film, 4.7mm wide, 2.0mils thick or equivalent |
| 8 | Varnish: Dolph BC-359 or equivalent |

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