

## HV9910B PFC 40W LED Driver Demoboard

### General Description

The Supertex HV9910BDB7 demonstrates the use of an HV9910B control IC in an off-line, High Brightness LED driver application. The board incorporates power factor correction (PFC) and satisfies the limits for harmonic currents according to the EN61000-3-2 Class C standard having total harmonic distortion (THD) less than 20%. The board features a low component count and long life operation due to the absence of electrolytic capacitors. The board is designed to supply a string of LEDs with a current of 350mA and a voltage in the 65 to 105V range from a 220/230VAC line.

The conversion stage draws line current throughout the AC line cycle, partly using a charge pumping and partly using a boost conversion technique to charge the bulk energy storage capacitors. The LED current is provided with a continuous mode buck stage giving a DC current with about 30% peak-to-peak ripple. A patent for this conversion technique is pending. Please inquire with the Supertex applications department for design guidance, should change of input line voltage, output voltage, or output current be desired.

An effort was made to satisfy the requirements of CISPR 15 (EN55015), limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment.

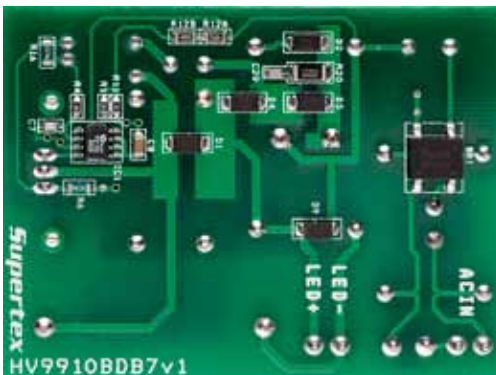
The connection diagram details the hookup of the board to the AC line. Note that the load is **NOT** galvanically isolated, and that measurements to the board require measurement techniques in common use with non-isolated off-line power supplies (isolation transformers, differential probes, etc).

### Specifications

| Parameter                       | Value                                      |
|---------------------------------|--------------------------------------------|
| Input voltage                   | 190~265VAC, 50Hz                           |
| Power factor                    | 0.95                                       |
| Total harmonic distortion       | <20%;<br>EN 61000-3-2 Class C              |
| EMI limits                      | CISPR 15                                   |
| Output voltage                  | 65~105V                                    |
| Output current                  | 350mA±10%                                  |
| Output power                    | 40W                                        |
| Efficiency                      | 90%                                        |
| Load regulation                 | <3%                                        |
| AC Line regulation              | <1.5%                                      |
| Output ripple                   | <30% peak-peak                             |
| Life time                       | Non-Electrolytic                           |
| Output short circuit protection | No                                         |
| Output open circuit protection  | Yes                                        |
| Dimensions                      | 3.0" x 2.3" x 1.1"<br>(76mm x 58mm x 28mm) |

### Board Layout

Top View

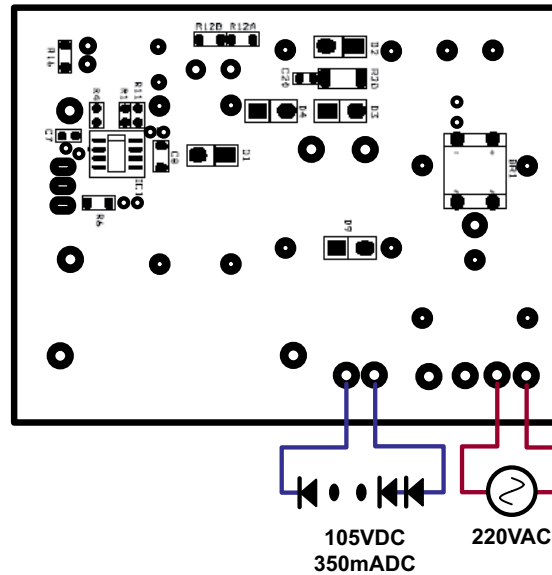


Bottom View



Actual Size: 3.0" x 2.3" x 1.1"

## Connection Diagram

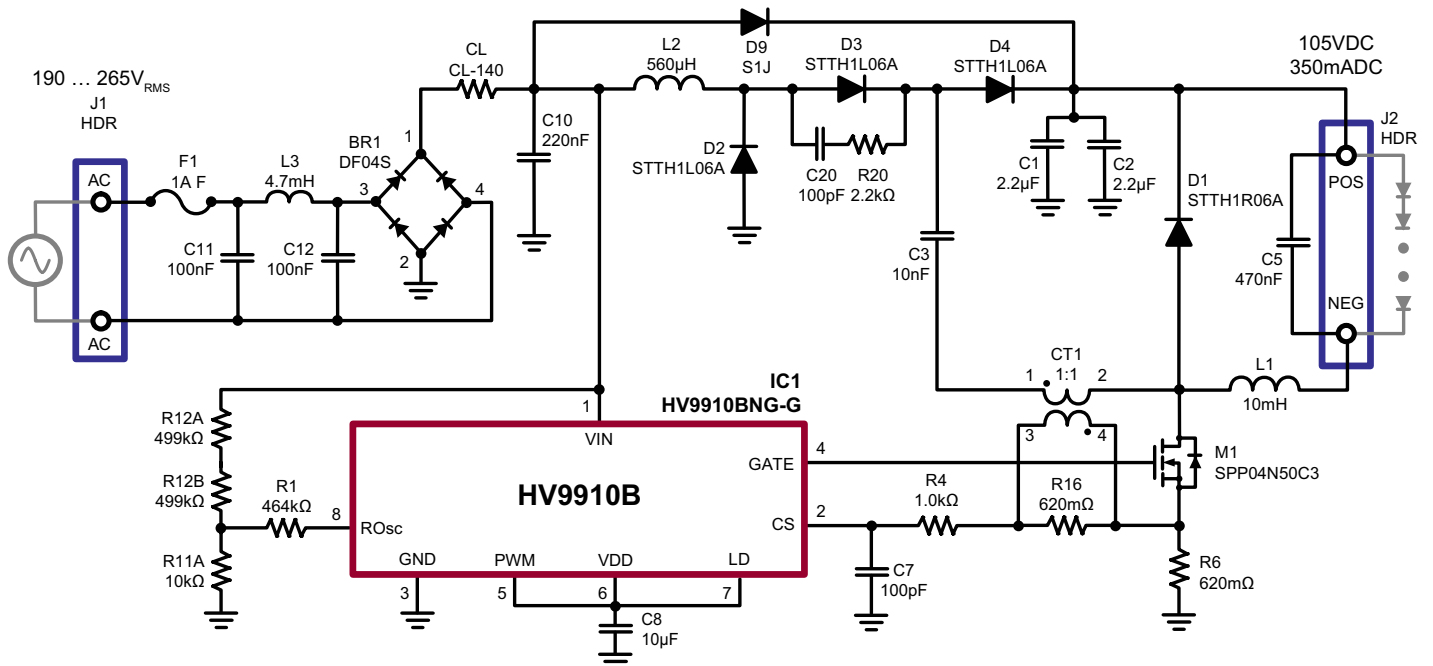


## Connections

**Input Voltage** - Connect the AC line input voltage to AC VIN as shown.

**LED String** - Connect the LED strings between LED+ and LED- as shown (anode of the string to LED+ and cathode to LED-).

## Schematic Diagram



## Typical Characteristics

Figure 1. Efficiency at full load.

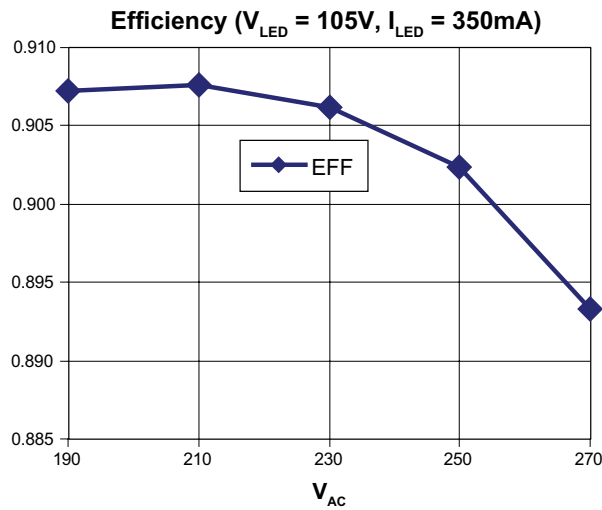


Figure 2. Efficiency at nominal AC line voltage.

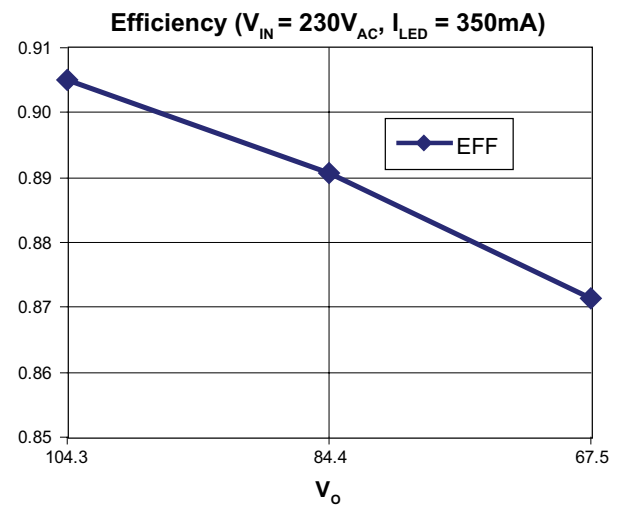


Figure 3. Load regulation.

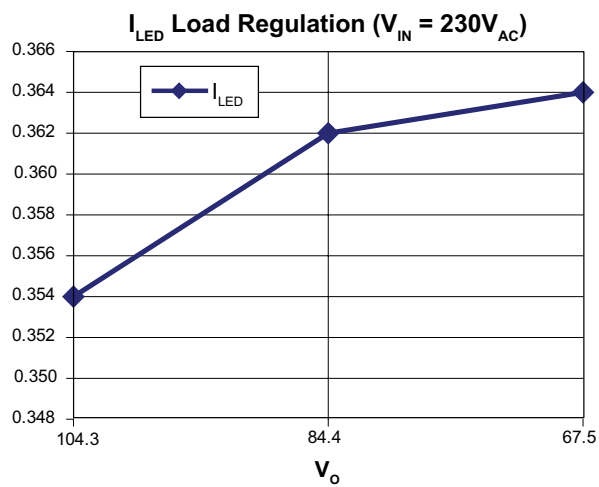


Figure 4. AC line regulation.

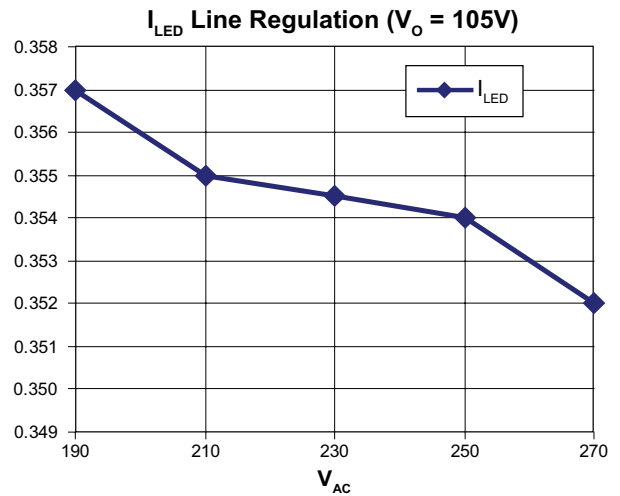


Figure 5. Harmonic Distortion vs. AC Line Voltage.

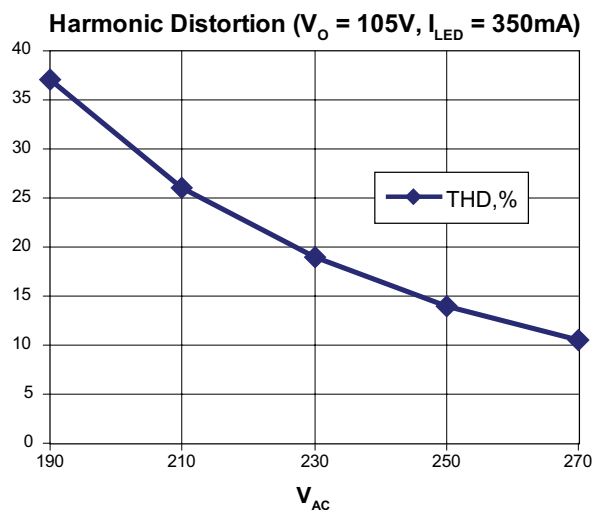


Figure 6. Power Factor vs. AC Line Voltage.

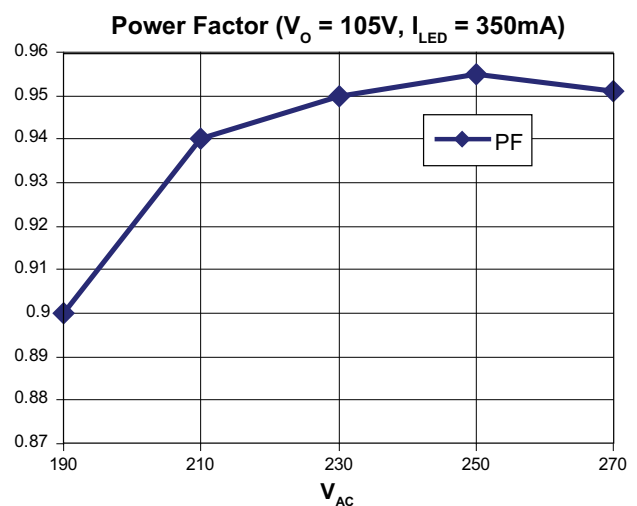


Figure 7. EMI Characterization - Conducted Emissions vs CISPR 15 Limits.

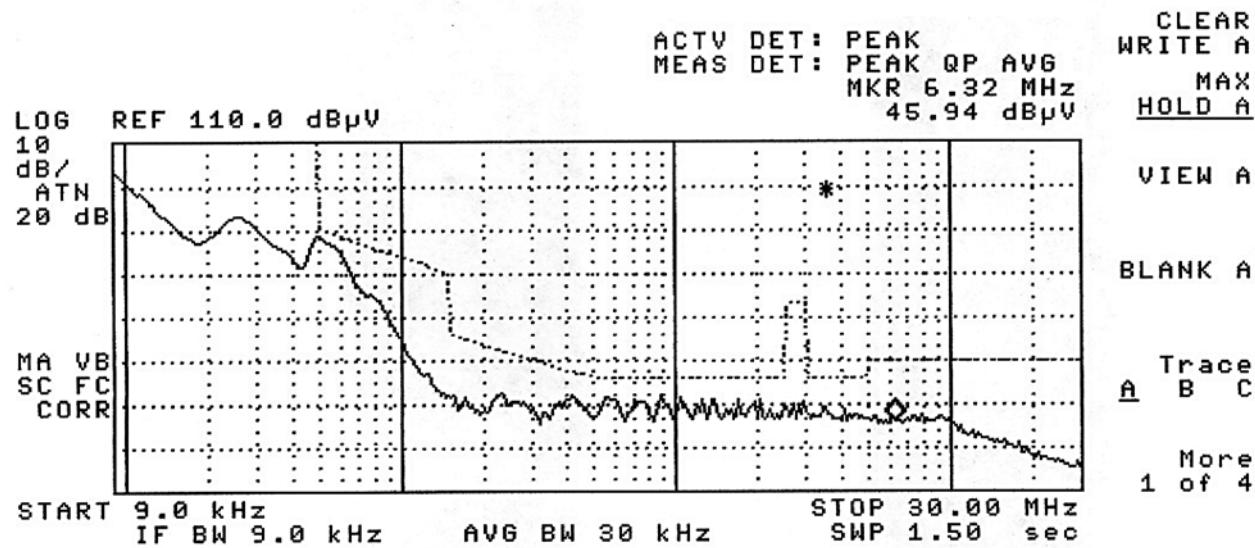
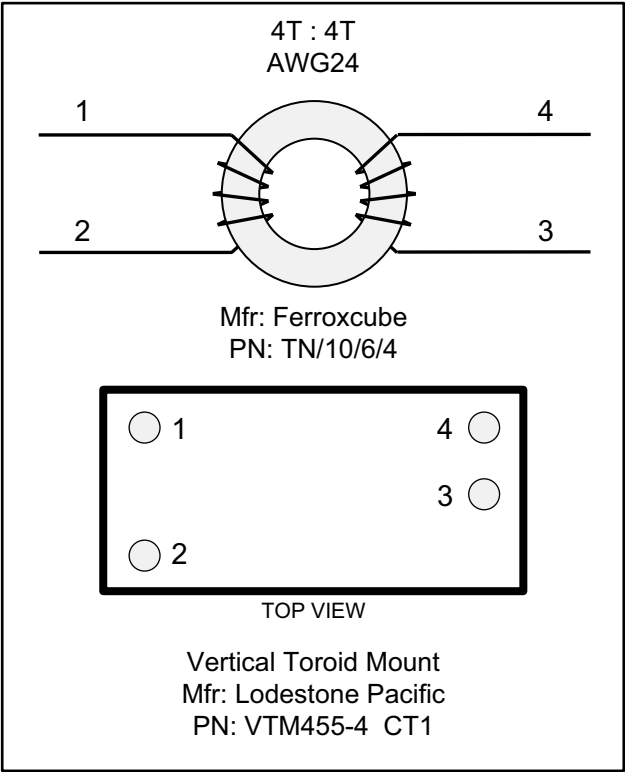


Figure 8. CT1 Construction Diagram.



## Bill of Materials

| Qty | Ref Des    | Description                              | Manufacturer          | Part Number        |
|-----|------------|------------------------------------------|-----------------------|--------------------|
| 1   | BR1        | Rect Bridge, DFS, 400V, 1.5A             | Fairchild Semi        | DF04S              |
| 2   | C1, C2     | Cap, MZPEF, 450VDC, 10%, 2.2UF           | Panasonic ECG         | ECQ-E2W225KH       |
| 1   | C3         | Cap, MZPEF, 630VDC, 5%, 10NF             | EPCOS Inc             | B32529C8103J       |
| 1   | C5         | Cap, MZPEF, 400V, 10%, .47UF             | EPCOS Inc             | B32522C6474K       |
| 1   | C7         | Cap, CER, NP0, 50V, 10%, 0805, 100PF     | Kemet                 | C0805C101K5GACTU   |
| 1   | C8         | Cap, CER, X7R, 10V, 10%, 1206, 10UF      | Murata                | GRM31CR71A106KA01L |
| 1   | C20        | Cap, CER, NP0, 1000V, 5%, 0805, 100PF    | Vishay/Vitramon       | VJ0805A101JXGAT5Z  |
| 1   | C10        | Cap, MKP, 220NF, 305VAC, X2, 125C, 20%   | EPCOS Inc             | B32922T2224M       |
| 2   | C11, C12   | Cap, MKP, 100NF, 305VAC, X2, 125C, 20%   | EPCOS Inc             | B32922A2104M       |
| 1   | CL1        | Inrush current limiter, 50/0.89Ω, 1.1A   | GE Sensing            | CL-140             |
| 1   | CT1        | Core, toroidal, TN10/6/4-3E25            | Yageo / Ferroxcube    | TN10/6/4-3E25      |
| 1   |            | Toroidal core mount, 0.455Dia, 4PIN      | Lodestone Pacific     | VTM455-4T          |
| AR  |            | Magnet wire, MW28C, SPN AWG24            | MWS Wire Industries   | SPN AWG24          |
| 1   | D1         | Diode, ultrafast, 600V, 1A, SMA          | STMicroelectronics    | STTH1R06A          |
| 3   | D2, D3, D4 | Diode fast, 600V, 1A ,SMA                | STMicroelectronics    | STTH1L06A          |
| 1   | D9         | Rectifier, GPP, 600V, 1A, SMA            | Diodes Inc            | S1J-13-F           |
| 1   | F1         | Fuse fast, 1.00A, IEC, Short, TR5        | Wickmann USA          | 37011000410        |
| 1   | HS1        | Heatsink, TO-220, Ver MNT W/Tab, H75 21K | Aavid Thermalloy      | 574502B03700G      |
| 1   | IC1        | IC, LED Driver, 8-Lead SOIC              | Supertex              | HV9910BLG-G        |
| 2   | J1, J2     | Header, 2POS, .156, VERT TIN             | Molex                 | 26-48-1021         |
| 1   | L1         | Choke AXL, 14mm, 10mH, 10%, 350mA        | Renco                 | RL-1292-10000      |
| 1   | L2         | Choke SH RAD, 16mm, 10%, 560μH, 1.1A     | Sumida                | RCR1616NP-561K     |
| 1   | L3         | Choke SH RAD, 13mm, 15%, 4.7mH, 370mA    | Sumida                | RCP1317NP-472L     |
| 1   | M1         | MOSFET, N-CH, 560V, 4.5A, TO-220AB       | Infineon Technologies | SPP04N50C3         |
| 1   | R1         | Resistor 1/8W, 1%, 0805, 464KΩ           | Panasonic ECG         | ERJ-6ENF4643V      |
| 1   | R4         | Resistor 1/8W, 1%, 0805, 1.00KΩ          | Panasonic ECG         | ERJ-6ENF1001V      |
| 1   | R11        | Resistor 1/8W, 1%, 0805, 10.0KΩ          | Panasonic ECG         | ERJ-6ENF1002V      |
| 2   | R12A, R12B | Resistor 1/4W, 1%, 1206, 499KΩ           | Panasonic ECG         | ERJ-8ENF4993V      |
| 1   | R20        | Resistor 1/2W, 5%, 2010, 2.2KΩ           | Panasonic ECG         | ERJ-12ZYJ222U      |
| 2   | R6, R16    | Resistor 1/2W, 1%, 1206, .62Ω            | Susumu Co Ltd         | RL1632R-R620-F     |

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