

# DI-202 Design Idea

## LinkSwitch-LP™

### 2.5 W Emergency Lighting Power Supply

Application	Device	Power Output	Input Voltage	Output Voltage	Topology
Emergency Lighting	LNK564PG	2.5 W	185 – 265 VAC	12 V	Flyback

#### Design Highlights

- Low cost, low component count
- Clampless™ flyback topology
- E-Shield™ transformer winding technique for reduced EMI
- Adjustable output voltage (8 V to 18 V) through single resistor selection
- Integrated input line low voltage monitor
- Active high signal for ballast triggering
- Easy compliance to IEC61000-3-2

#### Operation

The schematic in Figure 1 shows an off-line flyback converter using the LNK564PG. It operates over a line input voltage range of 185 VAC to 265 VAC and provides an isolated, 12 V, 210 mA output.

The AC input power is half-wave rectified, filtered and applied to one end of the transformer primary, the other end being connected to the DRAIN pin of the LNK564PG. Transformer T1 makes use of E-Shield™ techniques to reduce both conducted EMI generation and therefore the number of filtering components required.

The voltage generated by the secondary of T1 is rectified and filtered (by D2 and C2) to provide an isolated 12 V output. Resistor R2 provides a minimum load and ensures output regulation under no-load conditions.

Primary side regulation is achieved by sensing the bias winding output voltage across C3. This is fed into the FEEDBACK pin via divider R6 and R10. The transformer design is such that the output voltage can be configured between +8 V and +18 V by means of adjusting the value of R6, allowing the flexibility to provide 2.5 W of output power to different battery configurations.

The rectified mains voltage is sensed by the resistor divider formed by R1, R4, and R9, filtered by C5, and applied to the base of Q2. When the input voltage is greater than or equal to 195 VAC, Q2 is turned off and U1 regulates the output voltage. On the output, battery charging is sensed through series resistors R11 and R12. The voltage drop on R11 and R12 drives Q1 into saturation while charging, forcing output signal “Ballast Enable” low. When the input voltage drops below 180 VAC, Q2 turns on, increasing the current into the FEEDBACK (FB) pin and lowering the output voltage. The lower output voltage causes the battery current to fall and the signal “Ballast Enable” goes high (to +V<sub>BAT</sub>).

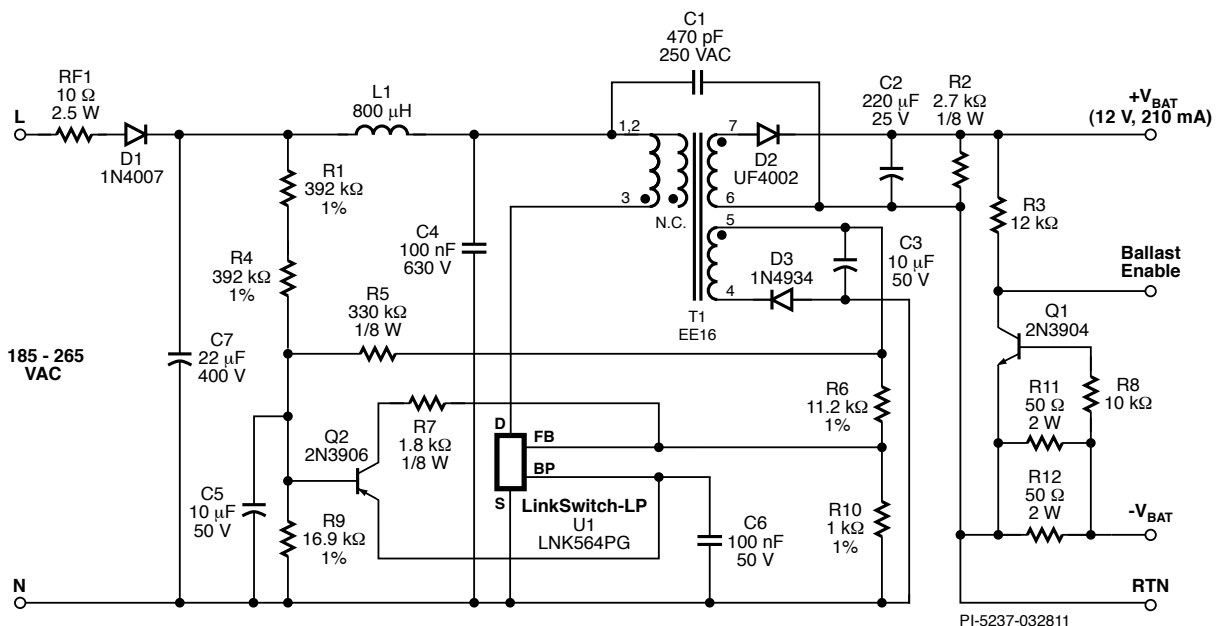


Figure 1. Schematic of a 2.5 W Lighting Power Supply Using LNK564PG.

## Key Design Points

- Verify that the maximum drain voltage is <650 V at high-line.
- For the IC to limit the supply's output current past the point of peak power delivery, the voltage on FEEDBACK pin must begin to drop below 1.69 V as the load increases. Therefore, the value of R10 should be selected so the FEEDBACK pin voltage is 1.69 V at the peak power.

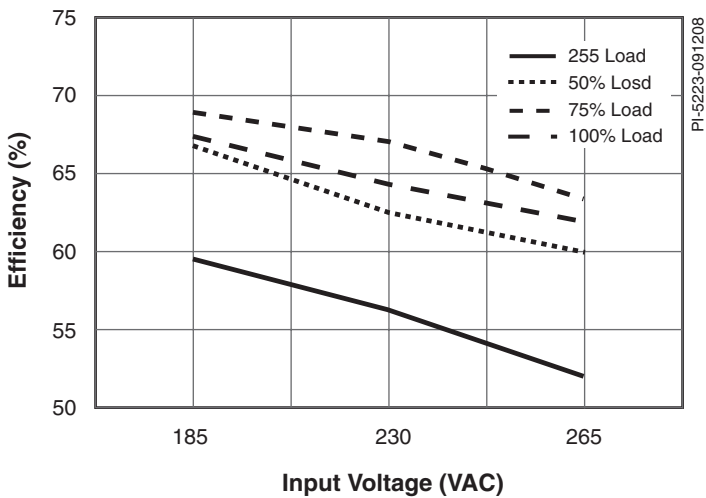


Figure 2. Efficiency vs. Input Voltage and Load.

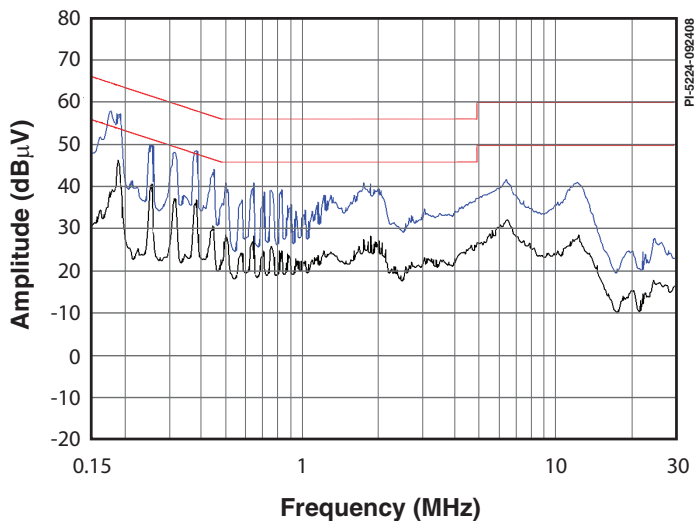


Figure 3. Figure 3: Conducted EMI, Maximum Steady-State Load, Line Input 230 VAC, 60 Hz, and EN55022 B Limits.

## Transformer Parameters

<b>Core Material</b>	EE16, NC-2H or equivalent, gapped for ALG of 101 nH/t <sup>2</sup>
<b>Bobbin</b>	Generic, 5 primary + 2 secondary
<b>Winding Details</b>	Cancellation Shield: 32T, 2 × #38 AWG Primary: 196T, #38 AWG Feedback/Bias: 33T, #36 AWG Secondary: 31T, #30 AWG TIW
<b>Winding Order</b>	Cancellation Shield (1,2-NC), Primary (3-1,2) Feedback/Bias, (5-4), Secondary (7-6)
<b>Primary Inductance</b>	4268 µH, ±10%
<b>Primary Resonant Frequency</b>	276 kHz (minimum)
<b>Leakage Inductance</b>	170 µH (maximum)

Table 1. Transformer Parameters. (TIW = Triple Insulated Wire, NC = No Connection)



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