Transformer parameters	
Core material	PC44, gapped for ALG of 139 nH/t^2
Bobbin	Horizontal, 10 pins, EE16
Winding details	Shield: 16T x 2, 32 AWG Primary: 100T, 33 AWG Feedback: 13T, 24 AWG Secondary: 14T, 24 TIW
Winding order	Shield (1-NC), Primary (4–1), Feedback (3–2), Secondary (10–6)
Primary inductance	1.545 mH, ±10%
Primary resonant frequency	500 kHz (minimum)
Leakage inductance	70 µH (maximum)
Transformer Parameters: (AWG = American Wire Gauge, TIW = Triple Insulated Wire, NC = No Connection)	

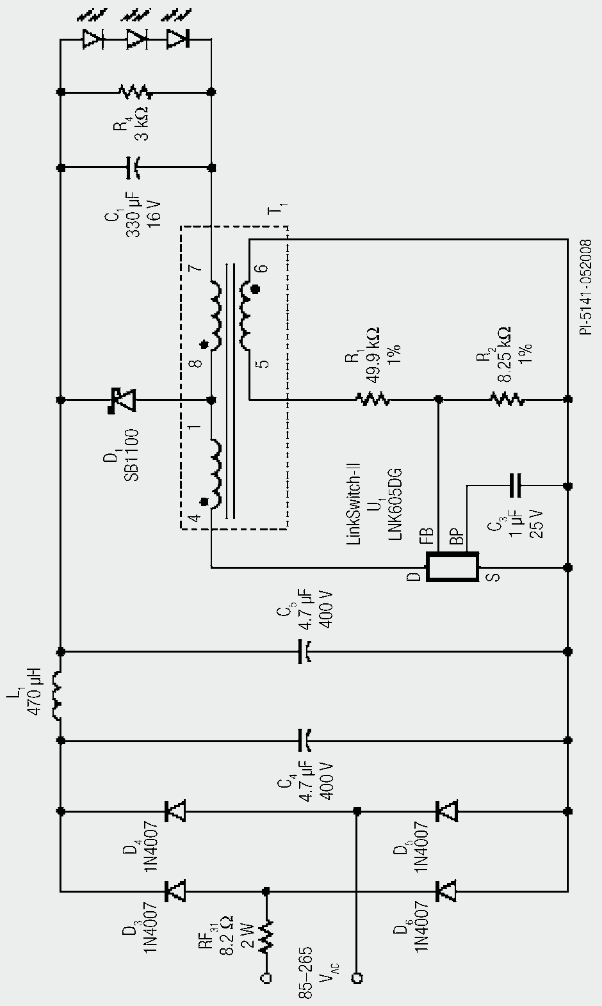
Tab. 3.20: Transformer parameters

9.2.5 LinkSwitch-II® non-isolated 350 mA, 12 V LED driver

Operation

Figure 3.272 shows the schematic for a universal input 12 V, 350 mA CV/CC power supply for LED driver applications using the LinkSwitch-II product LNK605DG in a tapped-inductor non-isolated buck converter configuration. A tapped buck topology is ideal for converters with a high ratio of voltage input to voltage output: It provides current multiplication on the output, making it possible to use this variant of a buck topology in applications requiring output currents greater than twice the device current limit. This topology lends itself to a smaller PCB size, a smaller inductor core size, and greater efficiency (80%, worst-case load) than an isolated flyback converter. EMI filtering is simpler due to less common-mode noise generation. This topology normally requires a clamp circuit on the primary side. However, by virtue of the 700 V MOSFET integrated to U1, the clamp circuitry is not necessary.

IC U1 consists of a power switching device (700 V MOSFET), an oscillator, a highly integrated CV/CC control engine, and startup and protection functions. The MOSFET gives sufficient voltage margin for universal input AC applications including line surges. Diodes D_3, D_4, D_5, and D_6 rectify the AC input; then bulk storage capacitors C_4 and C_5 filter the rectified AC. Inductor L_1 forms a pi (π) filter with capacitors C_4 and C_5 to attenuate differential-mode EMI noise. This configuration enables easy compliance to EMI standard EN55015 class B, with 10 dB of margin. Fusible, flameproof resistor RF1 provides catestrophic circuit failure protection.



L_1: 744 746 2471 (radial leaded wire wound inductor WE-TI)
T_1: 750 370 051 (coupled inductor)

Fig. 3.272: Schematic of a 4.2 W LED driver using LNK605DG

When the switch within U1 turns on, current ramps up and flows through the load and the inductor. Capacitor C_1 filters the load current, removing the switching component. Diode D_1 does not conduct since it is reverse-biased. The current continues to ramp up until it reaches U1's current limit. Once the current reaches this limit, the switch turns off. When the switch turns off, the energy stored in the inductor (T_1) induces a current to flow in the output section: (Pin 8–Pin 7). The current in the output winding steps up by a factor of 4.6 (the turns ratio), and flows from the output winding, through freewheeling diode D_1, and to the load. The low value of leakage inductance (between the two sections of the inductor) removes the need for a clamp network to limit the peak drain voltage. Normally this would dissipate the leakage energy but in this design the inductor intrawinding and MOSFET capacitance (discharged each switching cycle) is sufficient.

The LEDs are driven with constant current so, U1 operates in CC mode during normal operation. In CC mode, the switching frequency is adjusted as a function of the output voltage (sensed across winding pins 5 and 6) to keep the load current constant. The CV feature provides inherent output over-voltage protection in case any LEDs fail open circuit or the load gets disconnected.

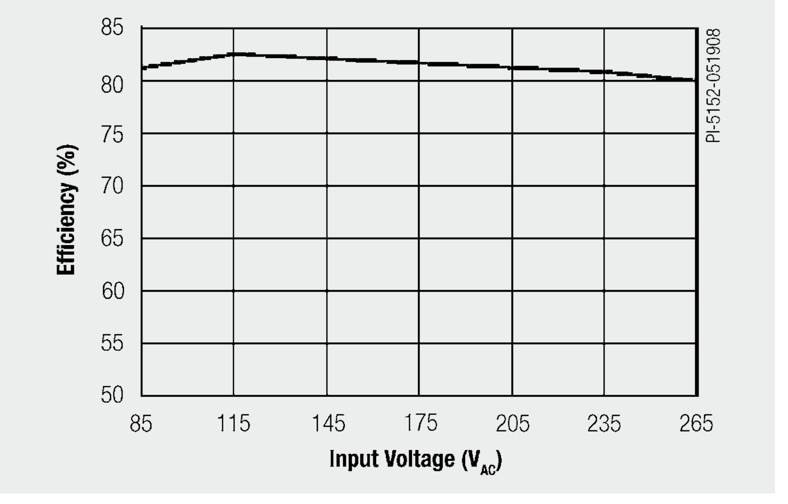


Fig. 3.273: Full load efficiency over input voltage

Key Design Points

- T_1 has a turns ratio (4.6) to ensure this circuit operates in discontinuous mode (DCM) at low line (85 V_{AC}), and D_1 has a conduction time at least 4.5 µs.
- Feedback resistors R_1 and R_2 have 1% tolerance values for tightly centering both the nominal output voltage and the CC regulation threshold.
- RF1 acts as a fuse: Ensure it has a rating to withstand instantaneous dissipation when the supply is first connected to the AC. Use a wire wound or oversized metal-film resistor.
- Preload resistor R_4 maintains the output voltage under fault conditions such as a disconnected load.

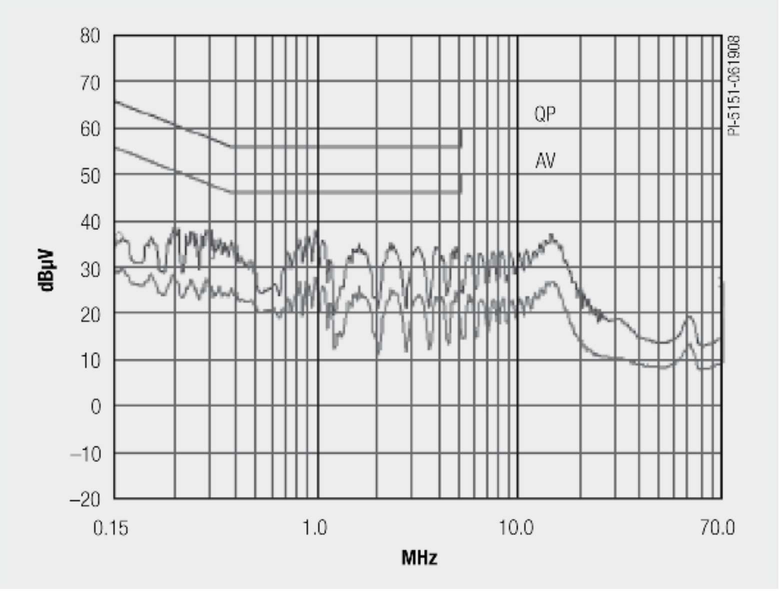


Fig. 3.274: Conducted EMI, 230 V_{AC} input, EN55015 B limits shown, output RTN floating

Inductor parameters	
Core material	PC44, gapped for AL of 86.3 nH/t²
Bobbin	Horizontal, 8 pins, EE10
Winding details	Main Inductor: 97T, 34 AWG Tap Inductor: 27T, 27 AWG Feedback: 27T, 33 AWG
Winding order	Main Inductor (4–1), Tap Inductor (8–7), Feedback (6–5)
Total inductance	1.32 mH, ±10%
Resonant frequency	1.1 MHz (minimum)
Leakage inductance	–
Transformer Parameters. (AWG = American Wire Gauge, TIW = Triple Insulated Wire)	

Tab. 3.21: Inductor parameters

9.2.6 25 W quasi-resonant power supply

This section describes a solution for a 25 W power supply using the Green Mode FPS™ FSQ0365RL Fairchild Power Switch. The input voltage range is 160 V_{RMS}–265 V_{RMS} and there is one DC output with 12 V/2.1 A. The power supply uses a quasi-resonant converter.