DI-149 Design Idea
PeakSwitch®

Audio Amplifier Power Supply

Application	Device	Power Output	Input Voltage	Output Voltage	Topology
Audio	PKS607YN	70 W, 126 W peak	90 – 132 VAC, 180 – 265 VAC	32 V	Flyback

Design Highlights

- Delivers high peak power without amplifier distortion
- Dual range input voltage range operation allows a single design to be used worldwide
- High efficiency:
  - Efficiency 88% at 70 W
  - Meets CEC 2008, 86% average efficiency vs 85% requirement
  - Low no-load power consumption of <350 mW at 115/230 VAC
  - Latching open loop and output short circuit protection with fast AC reset
- Meets CISPR-22/EN55022 B conducted EMI limits with >10 dBμV margin (see Figure 3)
- Integrated safety/reliability features:
  - Internal current limit
  - Accurate, auto-recovering, hysteretic thermal shutdown function maintains safe PCB temperatures under all conditions
  - Auto-restart protects power supply during brown-out

Operation

The isolated flyback converter in Figure 1 shows a 32 V, 2.2 A (70 W) power supply, which is capable of delivering 126 W of peak power for short periods (thermally limited).

A voltage-doubler is configured for dual range operation at 115/230 VAC input (SW1, C4 and C5). Diodes D5 and C15 perform AC line sensing, which provides undervoltage (UV) lock-out to prevent power on/off glitches and fast AC reset.

After loss of regulation U1 determines if the cause was low AC input or a fault condition (short circuit, overload or open feedback) by checking for a UV condition. If there is not a UV condition, then the power supply latches off. To reset the latch, the AC must be removed such that U1 sense a UV condition. The AC line sensing reduces the time needed for reset to <5s by avoiding the need to wait for the main input capacitance to discharge (>1 minute).

The controller in U1 receives feedback from the secondary through the optocoupler (U2), and, based on that feedback, it enables or disables the switching (on-off control) of the integrated MOSFET to maintain output regulation.

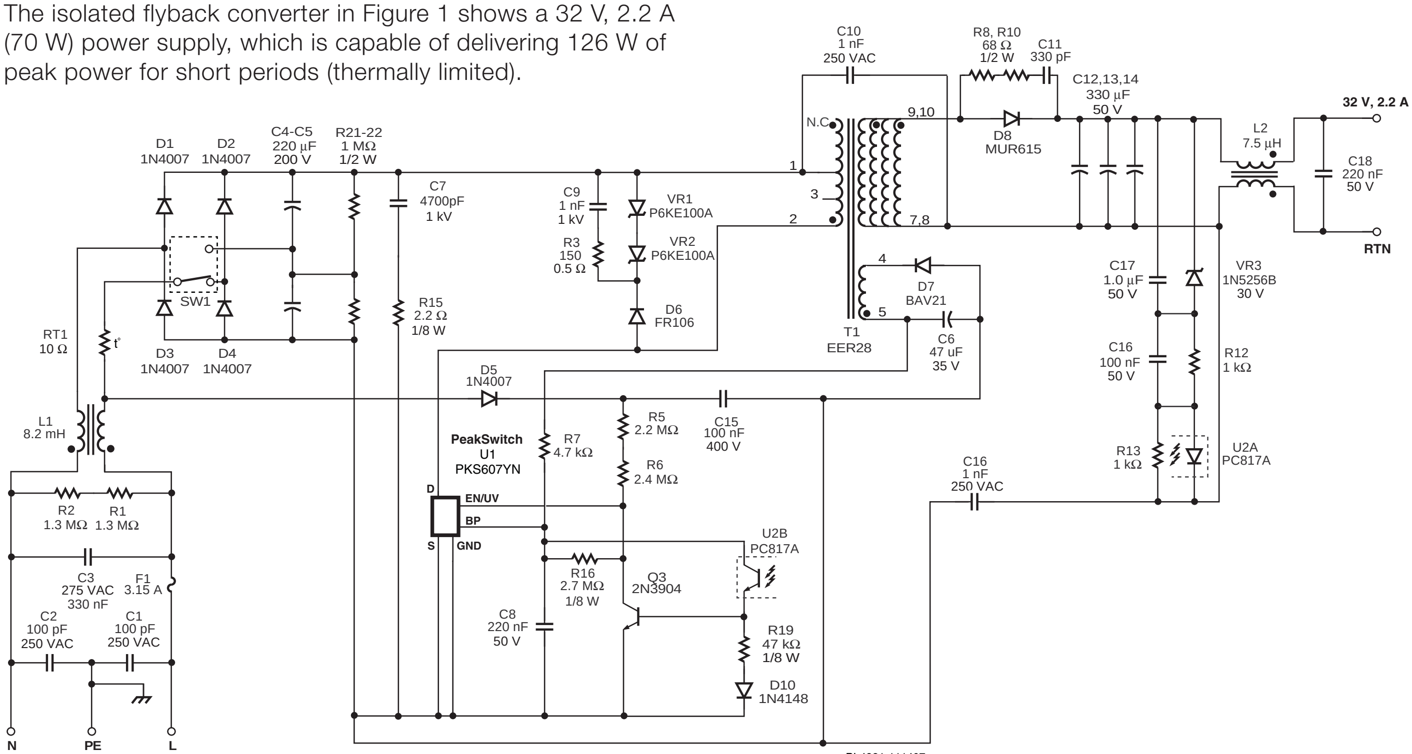

Figure 1. 70 W Continuous, 130 W Peak Audio Amplifier Power Supply, Designed Around a PKS607YN.

Capacitor C8 decouples the BYPASS (BP) pin of U1, which is the IC's internally regulated supply node. An integrated high-voltage current source provides initial operating power to U1. A bias winding on the transformer T1 (pins 4 and 5), D7, C6 and R7 is used to provide operating current to U1 after initial startup.

Optocoupler feedback using a simple low cost Zener reference diode (VR3) provides output regulation. A feedback current proportional to the output voltage flows through the optocoupler diode (U2A). On the primary side, phototransistor (U2B) drives a small signal transistor Q3, which in turn pulls current out of the EN/UV pin. Just before the start of each cycle, the PeakSwitch controller checks this EN/UV pin current. If this current exceeds 240 µA, switching is disabled for that cycle.

Key Design Points

- Transistor Q3 and associated circuitry (R19, D10) are used to increase high frequency gain and reduce grouping of consecutively enabled or disabled switching cycles.
- Use a fast blocking diode (D6), such as the FR106 or FR107, in the clamp circuit. Ensure that the diode has a reverse recovery time of 500 ns or less. These slower diodes can effectively recycle some of the clamp energy stored in C9, thus improving efficiency and no-load input power. Resistor R3 damps ringing caused by resonance between leakage inductance of T1 and C9.

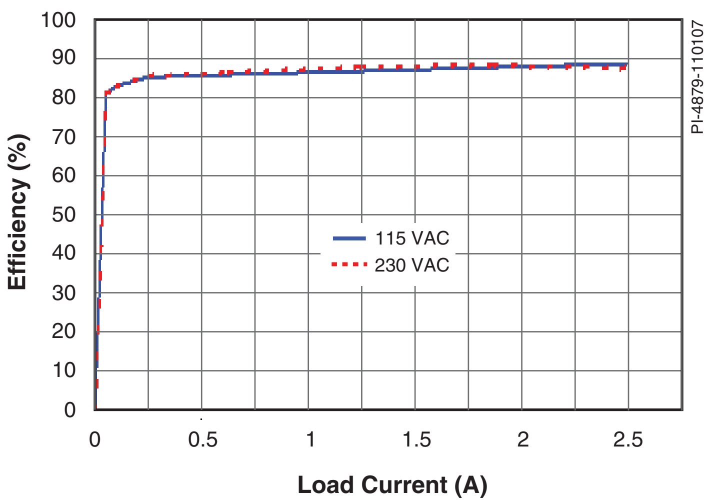

Figure 2. Efficiency vs Load at 115 and 230 VAC.

- To improve thermal performance, two series connected TVS Zeners (VR1 and VR2) were used to distribute clamp dissipation and avoid excessive heating.
- The core size and the winding wire diameter sizes (see Table 1) were chosen based on the average of the peak and the continuous output power.
- The number of turns in the primary and secondary windings and the primary inductance values (see Table 1) were chosen based on the peak output power.

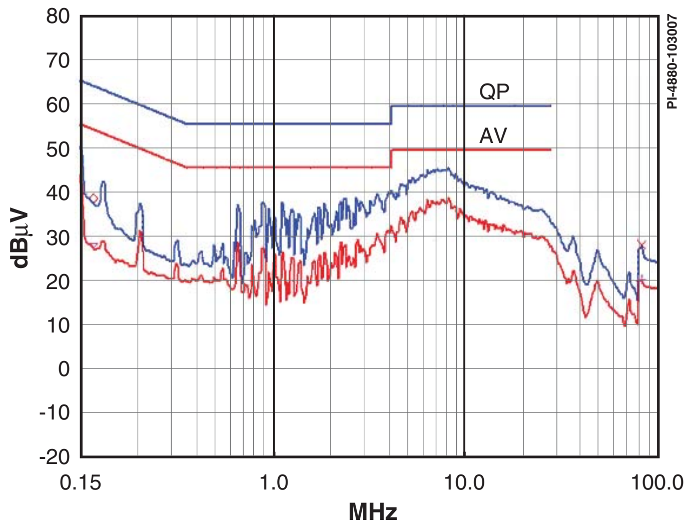

Figure 3. Worst Case Conducted EMI Measured at 230 VAC With Output Grounded.

Transformer Parameters

Core Material	EER28 NC-2H or equivalent, gapped for ALG of 226 nH/t²
Bobbin	EER28, 10 pin, Vertical
Winding Details	Use 3mm margin tape on the bottom side ½ Primary: 14T × 2, AWG26, tape Shield: 1T foil 2 mils thick, 3 layers, tape 32 V: 7T × 4, AWG25, TIW, 3 layers, tape Bias: 3T × 2, AWG26, tape ½ Primary: 14T × 2, AWG26, 3 layers tape
Winding Order	Primary (2–3), Shield (NC–1), 32 V (9,10–7,8), Bias (5–4), Primary (3–1)
Primary Inductance	172 µH, ±12%
Primary Resonant Frequency	1.5 MHz (minimum)
Leakage Inductance	2 µH (maximum)

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

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