

Section 5 Inductor and Flyback Transformer Design

Filter inductors, boost inductors and flyback transformers are all members of the “power inductor” family. They all function by taking energy from the electrical circuit, storing it in a magnetic field, and subsequently returning this energy (minus losses) to the circuit. A flyback transformer is actually a multi-winding coupled inductor, unlike the true transformer discussed in Section 4, wherein energy storage is undesirable.

Application Considerations

Design considerations for this family of inductors vary widely, depending on the type of circuit application and such factors as operating frequency and ripple current.

Inductor applications in switching power supplies can be defined as follows (see Fig. 5-1):

- *Single winding inductors:*
 - Output filter inductor (buck-derived)
 - Boost inductor
 - Flyback (buck-derived) inductor
 - Input filter inductor
- *Multiple winding inductors:*
 - Coupled output filter inductor⁽¹⁾
 - Flyback transformer

Inductor design also depends greatly on the inductor current operating mode (Figure 5-2):

- *Discontinuous inductor current mode*, when the instantaneous instantaneous (instant) in all windings) dwell at zero for a portion of each switching period.
- *Continuous inductor current mode*, in which the total instantaneous does not dwell at zero (although the current may pass through zero).

In the continuous current mode, the ripple current is often small enough that no winding has and no wire has any significant, but in the discontinuous mode, no losses may dominate.

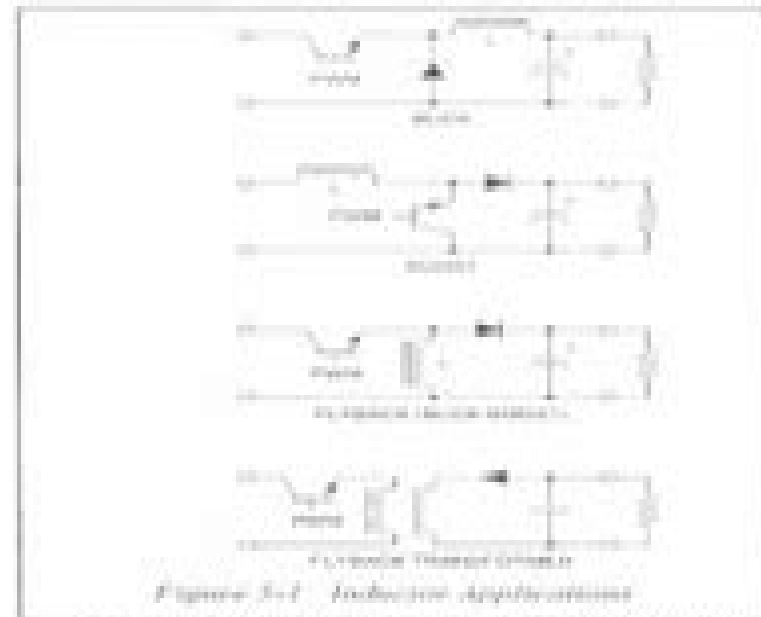


Figure 5-1 Inductor Applications

Design limitations: The most important limiting factors in inductor design are (a) temperature rise and efficiency considerations arising from wire losses and ac and dc winding losses, and (b) core saturation.

Output filter inductors (buck-derived)—single and multiple windings are seldom operated in the discontinuous current mode because of the added burden this places on the output filter capacitor, and because it results in poor cross-regulation in multiple output supplies. Typically operated in the continuous mode with peak peak ripple current much smaller than full load current, ac winding loss is usually not significant compared to dc loss.

Magnetics Design 5 Inductor And Flyback Transformer Design

Clifford Lane



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Fundamentals of Power Electronics Robert W. Erickson, Dragan Maksimović, 2020-07-14 Fundamentals of Power Electronics Third Edition is an up to date and authoritative text and reference book on power electronics This new edition retains the original objective and philosophy of focusing on the fundamental principles models and technical requirements needed for designing practical power electronic systems while adding a wealth of new material Improved features of this new edition include new material on switching loss mechanisms and their modeling wide bandgap semiconductor devices a more rigorous treatment of averaging explanation of the Nyquist stability criterion incorporation of the Tan and Middlebrook model for current programmed control a new chapter on digital control of switching converters major new chapters on advanced techniques of design oriented analysis including feedback and extra element theorems average current control new material on input filter design new treatment of averaged switch modeling simulation and indirect power and sampling effects in DCM CPM and digital control Fundamentals of Power Electronics Third Edition is intended for use in introductory power electronics courses and related fields for both senior undergraduates and first year graduate students interested in converter circuits and electronics control systems and magnetic and power systems It will also be an invaluable reference for professionals working in power electronics power conversion and analog and digital electronics Magnetic Components for Power Electronics Alex Goldman, 2012-12-06 Magnetic Components for Power Electronics concerns the important considerations necessary in the choice of the optimum magnetic component for power electronic applications These include the topology of the converter circuit the core material shape size and others such as cost and potential component suppliers These are all important for the design engineer due to the emergence of new materials changes in supplier management and the examples of several component choices Suppliers using this volume will also understand the needs of designers Highlights include Emphasis on recently introduced new ferrite materials such as those operating at megahertz frequencies and under higher DC drive conditions Discussion of amorphous and nanocrystalline metal materials New technologies such as resonance converters power factors correction PFC and soft switching Catalog information from over 40 magnetic component suppliers Examples of methods of component choice for ferrites amorphous nanocrystalline materials Information on suppliers management changes such as those occurring at Siemens Philips Thomson and Allied Signal Attention to the increasingly important concerns about EMI This book should be especially helpful for power electronic circuit designers technical executives and material science engineers involved with power electronic components CMOS Analog Circuit Design Phillip E. Allen, Douglas R. Holberg, 2011 A textbook for 4th year undergraduate first year graduate electrical engineering students Analog Circuit Design Bob Dobkin, Jim Williams, 2011-09-26 Analog circuit and system design today is more essential than ever before With the growth of digital systems wireless communications complex industrial and automotive systems designers are challenged to develop sophisticated analog solutions This comprehensive source book of

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