At high frequencies the material used for transformer cores is

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Please log in or register to add a comment. Page 10 asked Mar 19, 2018 by anonymous Please log in or register to add a comment. Page 11 asked Mar 19, 2018 by anonymous Please log in or register to add a comment. Page 12 In an actual transformer the iron loss remains practically constant from no load to full load because? Please log in or register to add a comment. Page 13 asked Mar 19, 2018 by anonymous Please log in or register to add a comment. Page 14 asked Mar 19, 2018 by anonymous Please log in or register to add a comment. Page 15 Negative voltage regulation is indicative that the load is? Please log in or register to add a comment. Page 16 asked Mar 19, 2018 by anonymous Please log in or register to add a comment. Page 17 When secondary of a current transformer is open-circuited its iron core will be? Please log in or register to add a comment. Page 18 asked Mar 19, 2018 by anonymous Please log in or register to add a comment. Page 19 asked Mar 19, 2018 by anonymous Please log in or register to add a comment. Page 20 During open circuit test of a transformer? asked Mar 19, 2018 by anonymous Please log in or register to add a comment. Page 21 asked Mar 19, 2018 by anonymous Please log in or register to add a comment. Page 22 asked Mar 19, 2018 by anonymous Please log in or register to add a comment. Page 23 asked Mar 19, 2018 by anonymous Please log in or register to add a comment. Page 24 The size of a transformer core will depend on? asked Mar 19, 2018 by anonymous Please log in or register to add a comment. Page 25 asked Mar 19, 2018 by anonymous Please log in or register to add a comment. Page 26 asked Mar 19, 2018 by anonymous Please log in or register to add a comment. Skip to Main Content Why High-frequency transformers aren't a new concept. In-fact they have been a staple in radio frequency circuits, amplifiers, antennas, and transmitters. However, in today's high-tech world of internet-connected mobile devices, renewable energy, and electric vehicles, the need for high-frequency transformers has grown exponentially over the past decade. Unlike low-frequency transformers, they come with additional design considerations. In your typical line-level transformer operating at 60hz (low frequency), it will generally use a laminated iron core as the waveform has no problem saturating through. However, as the frequency is increased, an iron core will start to experience an increase in hysteresis losses, also known as the "rubbing effect." Essentially, the "faster" you magnetize and demagnetize an iron core, the more heat is generated, which at a certain point becomes incredibly inefficient – this is where a different material such as a ferrite core begins to make sense. Ferrite losses are significantly less; however, it comes with a tradeoff. Ferrite cores offer less mechanical strength and become more brittle the larger they become. Therefore, the type of application, as well as the power levels required, will ultimately determine whether or not a ferrite core is viable. The good news is there are several other advanced materials other than ferrites that can be used as an alternative, but they too have their unique tradeoffs. That being said, there is no one-size-fits-all approach when it comes to high-frequency transformers – this is where our expertise comes into play. Our engineers have been designing high-frequency transformers for decades and know how to design a product that is efficient and highly reliable. In-fact, our high-frequency designs are used in mission-critical military and aerospace applications. The next time you are in need of a complex transformer, start with Pacific Transformer. RF transformers are excellent in many impedance-matching situations, and they make convenient baluns for using the LTC6400 differentially.From: Analog Circuit Design, 2013Cheng-Wei Pei, Adam Shou, in Analog Circuit Design, 2013RF transformers are excellent in many impedance-matching situations, and they make convenient baluns for using the LTC6400 differentially. However, their frequency response lower limit is largely determined by the size of the transformer, and there is no hope of achieving consistent frequency response all the way down to DC. Resistors used for impedance matching do not have this limitation. Resistors can yield a much more broadband impedance match than even the best RF transformers, and the frequency response of resistors extends down to DC. There is a penalty to pay in noise figure as compared to the transformer method, but using resistors also saves significant cost over transformers. Resistors can also be used to impedance match a single-ended input.The circuit shown in Figure 25.27 uses a resistor to terminate a differential 50Ω input source. Since the system is fully differential, the input impedance of the amplifier by itself is calculated by adding the two input resistances together (in this case 400Ω). The shunt input resistor matches this impedance to 50Ω, from DC to high frequency. Note that the 400Ω low frequency input impedance is only true as long as the amplifier maintains its internal "virtual ground" node, and as the amplifier's loop gain decreases with frequency, the input impedance will also change. The LTC6400 data sheet contains graphs of input impedance versus frequency.Figure 25.27. Resistor Termination with a Differential Input Source. A Single Shunt Resistor Transforms the 400Ω Input Impedance into a 50Ω Input Impedance. The Benefit of Resistor Termination is Wideband Performance, from DC to the Maximum Bandwidth of the Amplifier. The Drawback is Power Attenuation and the Resultant Increase in Noise FigureThe two downsides of using a resistor for termination are power/signal attenuation and the resultant increase in noise figure (i.e., degradation in noise performance). For the same input power level, a 50Ω input impedance will result in less voltage swing than a 400Ω input impedance, thereby introducing an effective voltage attenuation. By using a transformer, the impedances are matched losslessly, and no attenuation occurs. Since the input noise power density of the LTC6400 remains the same and the input signal is smaller, the noise figure increases proportionally.Figure 25.28 shows resistor termination used with a single-ended input source. Notice the extra resistor RT2, which balances the source impedances seen by the two inputs. Balancing the input impedances is desirable because the distortion performance of the LTC6400 can be affected by imbalance in the source impedances. Also, the inequality of the feedback factors will also cause a portion of the LTC6400's common mode noise to become differential mode noise. The best practice is to always balance the source impedances when working with single-ended inputs.Figure 25.28. Single-Ended Input with Resistor Impedance Match and Balanced Input ImpedancesThe addition of RT1 and RT2 creates additional terms that are not covered in Equation (6). The value of RT2 is simply the parallel impedance value of RT1 together with Rs (the source impedance). The new values of termination resistors can be calculated as shown:(9)RT1=12RS•RSRF+2RSRI+RS2RF2+4RF2RI2+8RFRI3+4RI4RI2+RFRI-RS2In Equations (9) and (10), RI and RF are the values of the internal gain and feedback resistors, 200Ω and 500Ω respectively in Figure 25.28. Table 25. 8 lists the values for RT1 and RT2 that apply in the case of a single-ended 50Ω input source (RS = 50Ω), calculated using Equation (9) and Equation (10).Table 25.8. Termination and Balancing Resistors Used to Match the LTC6400 Family to a 50Ω Single-Ended Input Source. The Resistance Values are Rounded to the Nearest 1% Standard ValueTERMINATION RESISTOR (RT1)BALANCING RESISTOR (RT2)LTC640x-859.0Ω27.4ΩLTC640x-1468.1Ω28.7ΩLTC640x-2066.5Ω28.7ΩLTC640x-26150Ω37.4ΩThe extra source impedance added by RS and RT1/RT2 changes the feedback factor of the differential amplifier, and therefore alters the gain. The overall voltage gain from the ungrounded side of RT1 to the differential output can be calculated as follows:(11)Gain=2RFRT2+RF+RI2RI2+2RIRF+RT2+RFRT2Revised by, ... Richard C. Walker, in Reference Data for Engineers (Ninth Edition), 2002Carrier-frequency transformers often use cores of MnZn ferrite having material permeability (μ) in the 1000 to 20 000 range. High-frequency transformers sometimes use NiZn ferrite cores having material permeability as low as 15, especially when low core loss is important. Most high-frequency transformers operate at relatively low impedance levels. To obtain efective permeability above about 10 000, either toroidal cores or split cores having extremely small air gaps are needed. Highly polished, clean, and coplanar core mating surfaces can achieve air gaps as small as 0.2 μm. Even at such small air gaps, μe can be considerably reduced from μ and is given by:where,μe = effective permeability,μ = material permeability,le = effective core magnetic path length,lg = length of air gap.Electrical loss in ferrite material is usually expressed as a relative loss coefficient, tan δ/μ = ωLp/Rp. It has three components: hysteresis loss, eddy-current loss, and residual loss. The effect in transformer cores can be more conveniently expressed as a parallel resistance per turn squared in ohms (Rc/N2) and plotted as a function of frequency. Ferrite core loss is a frequency-dependent nonlinear resistance; hence it cannot be equalized easily by a simple reactive network, should its effects be significant.The Curie temperature of the core material can be a consideration when transformers are operated at high ambient temperatures. High-permeability materials tend to have lower Curie temperatures. Core temperature and disaccommodation factors are usually not as critical in wideband transformers as in stable filter-class inductors.S.K. MazumderSr., in Power Electronics Handbook (Third Edition), 2011The leakage inductance of the HF transformer enhances the ZVS range of the dc-ac converter but reduces the duty ratio of the converter, which increases the conduction loss. Thus, the leakage inductance of each transformer is designed to achieve the highest efficiency, as illustrated in Fig. 29.18. For the sinusoidally modulated dc-ac converter, the ZVS capability is lost twice in every line cycle. The extent of the loss of ZVS is a function of the output current. The available ZVS range (tzvs) as a percentage of the line cycle (tLineCycle) is given by [1]FIGURE 29.18. ZVS range of the dc-ac converter with variation in output power [1].(29.21)tZVStLineCycle=2πsin-1(14Vdc2(43Coss+12CT)iout2LlK)1/2,where Coss is the device output capacitance and CT is the interwinding capacitance of the transformer. When the dc-ac converter is not operating under ZVS condition, the devices are hard-switched. A numerical calculation of the total switching losses for the 1-kW inverter, as shown in Fig. 29.19, indicates that the optimal primary-side leakage inductance for the HF transformer should be between 0.2 and 0.7 μH. Clearly, as the leakage inductance of the HF transformer increases, the total switching loss decreases due to an increase in the range of ZVS, while the total conduction loss increases with increasing leakage inductance.FIGURE 29.19. Variation of the total switch loss of the dc-ac converter with the leakage inductance of the HF transformer [1].S.K. MazumderSr., in Alternative Energy in Power Electronics, 2011The leakage inductance of the HF transformer enhances the ZVS range of the dc–ac converter but reduces the duty ratio of the converter, which increases the conduction loss. Thus, the leakage inductance of each transformer is designed to achieve the highest efficiency, as illustrated in Fig. 5.18. For the sinusoidally modulated dc–ac converter, the ZVS capability is lost twice in every line cycle. The extent of the loss of ZVS is a function of the output current. The available ZVS range (tZVS) as a percentage of the line cycle (tLineCycle) is given by [1]Figure 5.18. ZVS range of the dc–ac converter with variation in output power [1].(5.21)tZVStLineCycle=2πsin−1(14Vdc2(43Coss+12CT)iout2Llk)1/2,where Coss is the device output capacitance and CT is the interwinding capacitance of the transformer. When the dc–ac converter is not operating under ZVS condition, the devices are hard-switched. A numerical calculation of the total switching losses for the 1-kW inverter, as shown in Fig. 5.19, indicates that the optimal primary-side leakage inductance for the HF transformer should be between 0.2 and 0.7 μH. Clearly, as the leakage inductance of the HF transformer increases, the total switching loss decreases due to an increase in the range of ZVS, while the total conduction loss increases with increasing leakage inductance.Figure 5.19. Variation of the total switch loss of the dc–ac converter with the leakage inductance of the HF transformer [1].Sanjeet Kumar Dwivedi, in Modeling and Control of Power Electronics Converter System for Power Quality Improvements, 2018Fig. 6.4 shows the circuit diagram of AC-DC Zeta converter. The design of components is given for the operation of Zeta converter in discontinuous conduction mode (DCM) of current operation. The Zeta converter is designed to operate in DCM as voltage follower for providing inherent PFC at the input AC mains to feed the VSI of vector-controlled PMSM drive. The output stage is referred to the primary side of the transformer and the resulting topology is shown in the equivalent circuit of Fig. 6.11. The equivalent DC-link voltage v′DC and the equivalent load "R" are the values referred to primary side of high frequency transformer isolation transformer. The value of output inductance Lo referred to the primary side is given as:Figure 6.11. Equivalent circuit of high frequency isolated AC-DC Zeta converter.where n is turns ratio of high frequency transformer.The value of secondary side capacitance C1 referred to the primary side is given as:The value of secondary side load resistance R referred to the primary side is given as:where R is equivalent load resistance (=vDC2/Pout).The value of output DC voltage vDC referred to the primary side is given as:The current flowing through inductor L′o is defined as:Operating modes of the high frequency transformer isolated AC-DC Zeta converter are shown in Fig. 6.12A (i–iii) and the resulting voltage and inductor current waveforms are given in Fig. 6.12B–D. These modes of operation are subdivided into three stages.Figure 6.12. (A) Three different operating stages (i), (ii), and (iii) of Zeta converter in DCM of operation and its (B) voltage waveforms (C) and (D) inductors current waveform.1.First Stage of Operation: The first stage is defined by the on time ton of the switch S1 and is shown in Fig. 6.12 A(i). In this stage the AC main feeds energy to the magnetizing inductance of high frequency transformer (Lm). This energy is subsequently transferred to the output inductor Lo through the intermediate capacitor C1. The current in the magnetizing inductance of the transformer (iLm) and the output inductor (iLo) increases linearly. The output DC-link capacitor voltage vDC and the intermediate capacitor voltage vC1 are considered constant in this stage and is equal to DC-link voltage vDC. In the first stage of Zeta converter operation, the current in inductors for, 0