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20 kW PFC 电感脱敏应用案例

日期：2026-04-13 状态：公开脱敏案例 用途：20 kW级 PFC 电感应用案例说明

2. 脱敏案例摘要

字段	内容
Case title	20 kW PFC Inductor Review for an EV DC Charger Power Module
Application	EV DC charging station PFC stage
Product type	Custom PFC boost flat wire inductor
Power level	20 kW module class
Customer identity	Redacted
Project stage	Engineering review and sample validation
Supporting files	Parameter table, product photo, process photo, test/check record

3. 脱敏案例说明

3.1 客户问题

某 20 kW 级电源模块项目需要对 PFC 电感方案进行评审。关注点不是单一电感值，而是高功率 PFC 工况下的综合约束：

- 输入电流纹波控制。
- DCR 与铜损。
- 磁芯损耗和饱和裕量。
- 温升与冷却条件。
- 800 V 等级平台下的绝缘和结构空间。
- 与客户拓扑、开关频率和机械安装条件匹配。

3.2 已知输入类别

客户需要提供以下输入。具体客户原始资料和项目身份不在公开版本中展示：

输入项	案例中可公开的写法
Power level	20 kW power module class
Circuit stage	PFC boost stage
Converter topology	Confirmed during project review
Input condition	Customer operating range reviewed
Output bus condition	High-voltage DC bus requirement reviewed
Switching frequency	Reviewed against inductance and loss targets
Ripple target	Reviewed before inductance selection
Cooling condition	Air or liquid cooling requirement confirmed by project
Mechanical envelope	Mounting and size limits reviewed

Qualification documents	Confirmed per project

3.3 主要设计约束

约束	为什么重要
电感量与纹波平衡	电感量不足会增加纹波压力，过大又会放大尺寸和成本
DCR	高电流场景下铜损和温升敏感
磁芯材料与饱和裕量	需要兼顾损耗、偏置条件和温度稳定性
绝缘结构	高压平台下需按项目要求复核
热路径	冷却方式会影响绕组、磁芯和结构方案
安装空间	端子、固定方式和散热布局会反过来限制电感结构

3.4 磁性器件方案思路

本案例采用以下工程评审路径：

1. 先根据拓扑、工作频率和纹波目标确定 PFC 电感设计窗口。
2. 再复核额定电流、峰值电流、DCR 和饱和裕量。
3. 对高电流绕组优先评估扁平线结构，以控制导体损耗、散热路径和结构一致性。
4. 根据客户冷却方式和安装边界确定结构方案。
5. 在样品阶段通过电气检查、结构检查和项目要求的验证项确认设计是否进入下一轮。

3.5 需要验证的项目

验证项	说明
电感量	按对应样品记录确认
DCR	按对应样品记录确认
绝缘/耐压相关检查	按项目资料确认
温升相关结果	按样品测试记录确认
结构尺寸与安装适配	按图纸或检查记录确认
客户系统级 THD / PF 结果	如无客户授权，不公开

3.6 结果说明

公开版本保留以下工程结论：

> The review narrowed the PFC inductor design around the customer's power stage inputs, ripple target, thermal path, insulation requirements, and mounting limits before sample validation.

如项目授权提供脱敏测试记录，可补充：

- 样品检查完成。
- 某些测量项满足该样品规格。
- 某轮验证已完成。

以下内容不作为通用结论：

- `temperature rise reduced by X%`
- `efficiency improved by X%`
- `passed all charger reliability tests`

- `meets all 20 kW EV charger applications`

4. 英文公开稿

Title

20 kW PFC Inductor Review for an EV DC Charger Power Module

Summary

A 20 kW-class EV charger power module required a PFC inductor review that balanced current ripple, conductor loss, thermal path, insulation requirements, and mechanical limits. ProMagTech reviewed a custom PFC boost flat wire inductor approach around the converter inputs and sample validation requirements rather than treating inductance as the only selection parameter.

Project Context

The project focused on the PFC boost stage of a high-power charging module. At this power level, the inductor decision affects ripple control, copper loss, magnetic loss, temperature rise risk, installation space, and the validation work needed before a custom magnetic component can be released for the target system.

Design Inputs Reviewed

The engineering review considered the project power level, PFC stage requirements, operating frequency window, ripple target, current stress, high-voltage insulation needs, cooling method, and mounting constraints. The exact customer topology, electrical limits, and qualification documents remain project-specific.

Inductor Approach

The review evaluated a custom PFC boost inductor structure using the customer's converter requirements as the starting point. For the high-current winding path, a flat wire approach was considered to support low-loss design review and practical thermal handling. The final magnetic structure, inductance target, current margin, insulation structure, and cooling details must be confirmed against the customer's electrical and mechanical inputs.

Validation Path

The next validation step is to check the sample against the approved project specification. Typical review items include inductance, DCR, electrical inspection items, mechanical fit, insulation-related requirements, and any thermal or system-level checks required by the customer application.

Result That Can Be Disclosed

This case shows the decision path for a 20 kW-class PFC inductor project: define the electrical inputs, control ripple and loss trade-offs, confirm thermal and insulation constraints, then move into sample validation with traceable checks. Final performance values are confirmed by the approved sample record and the target charger system.

What Remains Project-Specific

- Input and output operating range.
- Topology and switching frequency.
- Ripple target and current margin.
- Cooling method.
- Mechanical envelope and terminal structure.
- Qualification and compliance document requirements.

5. 官网页面短版

English Short Version

For a 20 kW-class EV charger PFC stage, ProMagTech reviewed a custom PFC boost flat wire inductor around ripple control, DCR, magnetic loss, thermal path, insulation requirements, and mounting limits. The case shows the engineering

path from converter inputs to sample validation rather than presenting inductance as a standalone selection value. Final electrical and thermal values are confirmed by the approved project specification and sample record.

中文短版

20 kW级 EV 充电模块 PFC 电感案例主要围绕纹波控制、DCR、磁损、热路径、绝缘要求和安装边界进行评审。最终电气和热性能结论以项目规格书、样品记录和客户确认文件为准。

6. 关联资料

资料	说明
20 kW PFC 电感产品照片	用于展示产品外观和结构方向
对应工序照片	用于展示相关制程能力
公开参数表	用于展示可分享的参数范围和评审项目
脱敏检查记录或样品测试记录	用于展示检验项目格式和样品验证路径

7. 与现有官网资料的一致性

当前案例与现有官网产品页和技术资料保持一致：

- PFC boost flat wire inductor 当前产品页覆盖 `3 kW – 60 kW` 功率范围。
- Charging station PFC inductor 当前产品页覆盖 `20 kW – 60 kW` 单模块级别。
- 20-60 kW PFC 设计指南已经把高功率 PFC 电感的关注点放在纹波、损耗、饱和、温升和绝缘设计上。

这些范围仍应以项目工程资料和对外参数表为准。

Product-specific numeric results and conclusions must be confirmed against the approved sample record and project specification.