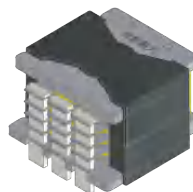


骠骑将军系列

新一代自动化制造

PQ型变压器

A new generation of automated manufacturing
PQ type transformer



- 标准化、自动化生产结构设计

Standardized and automated production structure design

- 低EMI电磁干扰绕组组合

Low EMI EMI winding combination

- 优秀的绝缘设计、自动制造

Excellent insulation design, automatic manufacturing

- 适配各种LLC半桥全桥拓扑

Adapt to various LLC half-bridge full-bridge topologies

唐山尚新融大电子产品有限公司

TANGSHAN CREATIVEMIX ELECTRONICS CO.LTD



公司简介

COMPANY INTRODUCTION

唐山尚新融大电子产品有限公司成立于2008年，是一家专注于磁性元器件开发、生产和销售的民营高新技术企业。尚新融大致力于为特种电源电路、智能电网、新能源汽车、轨道交通、云计算AI、石油勘探、5G通信等行业提供磁性元器件系统化解决方案及高可靠性、高品质产品。公司具备金属磁粉心、非晶纳米晶磁芯、平面变压器、电感器、高频电抗器、MIL-STD-1553B总线变压器、网络变压器、平面磁集成滤波器的研制、生产能力。公司通过ISO9001:2015标准质量管理体系认证及GJB9001C-2017武器装备质量管理体系认证等资质。

公司总部位于唐山市滦南县，具备两个自有土地加工基地、两个市级研发中心，拥有满足国军标要求的可靠性实验中心，先进的磁性元器件自动化设备、SMT电装生产线。公司在北京、天津、合肥设有研发中心及客户服务中心，以便于为不同地域的客户就近提供高效、优质服务！



生产环境、设备

PRODUCTION ENVIRONMENT, EQUIPMENT



SMT生产线



生产车间



自动化车间



扁平线圈绕线机



套管机



全自动套管机



多轴绕线机



环形自动绕线机

试验设备

TEST EQUIPMENT



温度冲击箱



稳态湿热箱



盐雾试验箱



高低温老化箱



拉力试验机



机械冲击台



机械振动台



低气压试验箱

骠骑将军系列变压器与传统系列变压器对比表

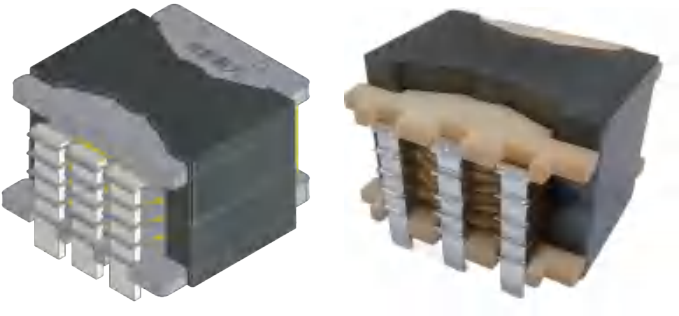
PiaoQi general Series transformer and Traditional series transformer correlation table

项目 project	骠骑将军系列变压器 PiaoQi general Series transformer	传统类型系列变压器 Traditional series transformer
图片 picture		
骨架 bobbin	有 Yes	无 No
产品高度 Product height	43mm	48mm
横向尺寸 Transverse dimension	50*51	50*52
EMI	绕制结构紧凑，分布参数小抗电磁干扰能力强 Compact winding structure and small distribution parameters. Strong anti-electromagnetic interference	分布参数大，抗电磁干扰能力弱 Large distribution parameters, Weak anti-electromagnetic interference
自动化 automation	可实现全自动化生产 Fully automatic production can be realized.	可实现半自动化生产 Can realize semi-automatic production.
系列化、标准化 Serialization and standardization	可系列化 骨架分体式结构，系列化，标准化 Serializable Keywords skeleton split structure, serialization, standardization	可定制 无固定结构，未形成标准化 Customizable No fixed structure, no standardization.
绝缘耐压 Insulation withstand voltage	骨架结构直接隔离绝缘耐压性能好 Direct isolation of skeleton structure Good insulation and pressure resistance.	环氧板，绝缘胶带隔离绝缘耐压性能低 Epoxy board, insulation tape isolation Low insulation and withstand voltage performance
产品一致性 Product consistency	骨架标准化，自动化生产 产品一致性高 Standardization of skeleton, automatic production High product consistency	无骨架绕制，半自动化生产 产品一致性低 Skeleton-free winding, semi-automatic production Low product consistency
成本 cost	有骨架成本，可实现自动化生产，人工工时低，综合成本低 Has skeleton cost, can realize automatic production, Low man-hour and comprehensive cost.	无骨架成本，只能半自动化生产 人工工时高，综合成本高 No skeleton cost, only semi-automatic production. High man-hour and comprehensive cost.

特点

Characteristics

- 结构简单、效率高
Simple structure and high efficiency
- 宽范围输入电压
Wide range of input voltage
- 噪声低、稳定性高
Low noise, high stability
- 系统性能优化
Optimize system performance



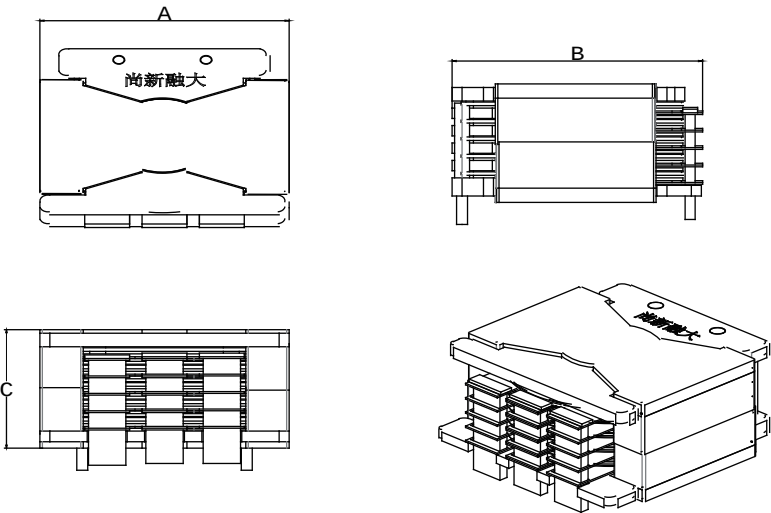
系列产品参数

Series product parameters

序号	型号	封装尺寸			电参数	
		A	B	C	适用频率	功率范围
1	RDPQH35-1	36.5max	38max	37max	100KHz-500KHz	1000W-1500W
2	RDPQH40-1	41.5max	42max	32max	100KHz-500KHz	1500W-2500W
3	RDPQH45-1	46.5max	47max	47max	100KHz-500KHz	2000W-3000W
4	RDPQH50-1	51.5max	52max	52max	100KHz-500KHz	3500W-5500W
5	RDPQH60-1	61.5max	62max	62max	100KHz-500KHz	6000W以上

封装图

Package drawing



■ 产品特性

Product characteristics

为了满足现代工业、信息技术、通讯、工业自动化等高要求的电源和优质电源的需求。我公司开发了PQ系列LLC谐振变压器，相较于传统的谐振变压器，具备更高的效率、更强的适应性、较小的空间占用、更好的稳定性和更强的EMI抗干扰能力。

In order to meet the requirements of modern industry, information technology, communication, industrial automation and other high-demand power supplies and high-quality power supplies. Our company has developed PQ series LLC resonant transformer. Compared with the traditional resonant transformer, it has higher efficiency, stronger adaptability, smaller space occupation, better stability and stronger EMI anti-interference ability.

在设计PQ型LLC变压器时，需要精确计算磁路参数，优化线圈布局，并选择合适的磁性材料，以实现预期的性能指标。此外，还需考虑散热设计，确保变压器在高负载条件下的稳定运行。

When designing PQ LLC transformer, it is necessary to accurately calculate the magnetic circuit parameters, optimize the coil layout, and select appropriate magnetic materials to achieve the expected performance indicators. In addition, the heat dissipation design should be considered to ensure the stable operation of the transformer under high load conditions.

PQ型LLC变压器是一种高性能的电子变压器，它结合了PQ型变压器的结构特点和LLC谐振变换器的工作原理。LLC谐振变换器因其软开关特性，在高频应用中能够实现高效率 and 低电磁干扰。PQ型LLC变压器通常用于电力转换、可再生能源系统（如太阳能和风力发电）以及电动汽车充电设施。具有以下特点：

PQ LLC transformer is a high-performance electronic transformer, which combines the structural characteristics of PQ transformer and the working principle of LLC resonant converter. LLC resonant converter can achieve high efficiency and low electromagnetic interference in high frequency applications because of its soft switching characteristics. PQ LLC transformer is usually used in power conversion, renewable energy systems (such as solar energy and wind power generation) and electric vehicle charging facilities. Has the following characteristics:

（1）结构简单、紧凑 Simple and compact structure

PQ型变压器的设计注重空间利用效率，其紧凑的结构适合在有限空间内安装和操作。由开关网路、谐振槽路、理想变压器、低通滤波器组成。属于斜率变压器，由频率控制。研发了系列骨架模具，骨架可以直接绕制次级线包，初级大电流铜片绕组效率高：全负载范围内MOSFET的ZVS和整流器的ZCS，高频化、体积小、功率密度高。输入电压范围宽：便于磁集成：磁化电感+漏感+谐振电容就构成了谐振变压器。The design of PQ transformer pays attention to space utilization efficiency, and its compact structure is suitable for installation and operation in limited space. It consists of switching network, resonant tank, ideal transformer and low-pass filter. It belongs to slope transformer and is controlled by frequency. A series of skeleton dies have been developed, in which the skeleton can be directly wound with secondary windings, and the winding efficiency of primary high-current copper sheet is high: ZVS of MOSFET and ZCS of rectifier are high-frequency, small in size and high in power density. Wide input voltage range: convenient for magnetic integration: magnetizing inductance+leakage inductance+resonant capacitance constitute a resonant transformer.

（2）输入电压宽范围 Wide range of input voltage

LLC谐振变压器具有宽范围的输入电压，可适应工业和商业应用的不同输入电压范围。传统谐振变压器的输入电压范围相对较窄，因此无法适应不同工业和商业应用的输入电压，局限性大。

LLC resonant transformer has a wide range of input voltage, which can adapt to different input voltage ranges of industrial and commercial applications. The input voltage range of traditional resonant transformer is relatively narrow, so it can not adapt to the input voltage of different industrial and commercial applications, and has great limitations.

（3）系统性能优化 System performance optimization

LLC谐振变压器具有很强的适应性，能够根据负载的变化来自动调整输出电压和电流，从而实现最优负载匹配，并提高系统的效率。其多种输出电压和电流的选择和调节方式，能更好地适应系统的需要，提供更加精准的电源应用控制。

LLC resonant transformer has strong adaptability, which can automatically adjust the output voltage and current according to the change of load, thus achieving the optimal load matching and improving the efficiency of the system. Its various output voltage and current selection and adjustment methods can better meet the needs of the system and provide more accurate power supply application control.

（4）效率高 High efficiency

通过优化磁路设计和减少能量损失，PQ型变压器能够提供较高的能量转换效率。LLC谐振变压器具有很高的转换效率，是因为该变压器采用了电感、电容、电阻等元器件的串联谐振电路。由于电路采用了谐振电路，极大地减少了开关管的开关损耗，使得功率器件的损耗大大降低，能够将输入电源的能量转换为输出功率的损耗大大减少，从而实现了高效率转换。此外，LLC谐振变压器的功率密度也相对较高，占用板子的空间相对较小。

PQ transformer can provide high energy conversion efficiency by optimizing magnetic circuit design and reducing energy loss. LLC resonant transformer has high conversion efficiency because it adopts series resonant circuit of inductance, capacitance, resistance and other components. Because the resonant circuit is adopted in the circuit, the switching loss of the switch tube is greatly reduced, so that the loss of the power device is greatly reduced, and the loss of converting the energy of the input power supply into the output power is greatly reduced, thus realizing high-efficiency conversion. In addition, the power density of LLC resonant transformer is relatively high, occupying relatively little space on the board.

（5）低噪声 Low noise

传统谐振变压器在工作时，由于存在开关损耗，其产生的噪声会影响输出电压的稳定性和质量，使用传统谐振变压器的时候，会存在一些噪声和干扰，需要使用额外的滤波器来进行滤波处理。但是，LLC谐振变压器采用谐振电路的方式，能够降低噪声的干扰，使得输出电压稳定性更好，能够更好地满足高精密度和高品质的应用需求。

When the traditional resonant transformer works, the noise generated by it will affect the stability and quality of the output voltage because of the switching loss. When the traditional resonant transformer is used, there will be some noise and interference, so it is necessary to use an additional filter for filtering. However, LLC resonant transformer adopts resonant circuit, which can reduce noise interference, make the output voltage more stable, and better meet the application requirements of high precision and high quality.

（6）高可靠性 High reliability

LLC谐振变压器的结构相较传统的谐振变压器更加紧凑，元器件的选择也更加灵活。主要是其采用了带有隔离变压器的电路设计方式，实现了高度的隔离性能和电压变换的功能，能够更好地适应不同种类的负载。另外，LLC谐振变压器实现了软切换技术，不仅能够在瞬时开关时减少电流和开关压力，还能够降低噪声和EMI干扰。同时，由于使用谐振电路可以降低开关频率，从而增加变压器的可靠性，降低维护成本。

The structure of LLC resonant transformer is more compact than the traditional resonant transformer, and the selection of components is more flexible. Mainly, it adopts the circuit design with isolation transformer, which realizes high isolation performance and voltage conversion function and can better adapt to different kinds of loads. In addition, LLC resonant transformer realizes soft switching technology, which can not only reduce current and switching pressure during instantaneous switching, but also reduce noise and EMI interference. At the same time, the resonant circuit can reduce the switching frequency, thus increasing the reliability of the transformer and reducing the maintenance cost.

（7）良好的电磁兼容性 Good electromagnetic compatibility

LLC谐振变压器的应用范围很广，可以广泛应用于车载、机床、电力、照明等领域，技术优越性和经济性均优于其他方案，所以是未来的绿色电源转换的主力军。软开关特性减少了电磁干扰，有利于在密集的电子设备环境中使用。

LLC resonant transformer has a wide range of applications, which can be widely used in vehicles, machine tools, electric power, lighting and other fields. Its technical superiority and economy are superior to other schemes, so it is the main force of green power conversion in the future. Soft-switching characteristics reduce electromagnetic interference, which is beneficial to use in dense electronic equipment environment.



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