

Title (en)

PLANAR WINDING STRUCTURE FOR POWER TRANSFORMER

Title (de)

PLANARE WICKLUNGSSTRUKTUR FÜR LEISTUNGSTRANSFORMATOR

Title (fr)

STRUCTURE D'ENROULEMENT PLANE POUR TRANSFORMATEUR DE PUISSANCE

Publication

**EP 4160631 A1 20230405 (EN)**

Application

**EP 22169666 A 20220425**

Priority

- US 202163179784 P 20210426
- US 202117471142 A 20210909

Abstract (en)

The present disclosure provides a printed circuit board (PCB) based planar winding structure (500) for a main power transformer and/or an auxiliary power need. The PCB-based planar winding structure (500) can confine electric field through magnetic core potential control and thus create partial discharge (PD) free design for medium voltage (MV) applications. Meanwhile, the winding structure can be formed in the PCB manufacturing process to create a more modular and reliable structure, thereby enhancing manufacturability. Techniques, such as termination treatment, primary and secondary winding arrangements, etc., can be used to control the electrical stress in the medium voltage applications.

IPC 8 full level

**H01F 27/28** (2006.01); **H01F 27/29** (2006.01); **H01F 27/32** (2006.01); **H01F 27/36** (2006.01)

CPC (source: EP)

**H01F 27/2804** (2013.01); **H01F 27/29** (2013.01); **H01F 27/327** (2013.01); **H01F 27/36** (2013.01); **H01F 2027/2809** (2013.01)

Citation (applicant)

- J. WANG. Q. HUANG. W. SUNGY. LIUB. J. BALIGA: "Smart grid technologies", IEEE INDUSTRIAL ELECTRONICS MAGAZINE, vol. 3, no. 2, June 2009 (2009-06-01), pages 16 - 23
- D. ROTHMUNDG. ORTIZT. GUILLIODJ. W. KOLAR: "IOkV SiC-based isolated DC-DC converter for medium voltage-connected Solid-State Transformers", 2015 IEEE APPLIED POWER ELECTRONICS CONFERENCE AND EXPOSITION (APEC), CHARLOTTE, NC, USA, 2015, pages 1096 - 1103, XP032775167, DOI: 10.1109/APEC.2015.7104485
- Q. CHEN: "High Frequency Transformer Insulation in Medium Voltage SiC enabled Air-cooled Solid-State Transformers", 2018 IEEE ENERGY CONVERSION CONGRESS AND EXPOSITION (ECCE), PORTLAND, OR, USA, 2018, pages 2436 - 2443, XP033463917, DOI: 10.1109/ECCE.2018.8557849
- S. ZHAOQ. LIF. C. LEEB. LI: "High-Frequency Transformer Design for Modular Power Conversion From Medium-Voltage AC to 400 VDC", IEEE TRANSACTIONS ON POWER ELECTRONICS, vol. 33, no. 9, September 2018 (2018-09-01), pages 7545 - 7557, XP011686292, DOI: 10.1109/TPEL.2017.2774440
- L. HEINEMANN: "An actively cooled high power, high frequency transformer with high insulation capability", APEC. SEVENTEENTH ANNUAL IEEE APPLIED POWER ELECTRONICS CONFERENCE AND EXPOSITION (CAT. NO.02CH37335), DALLAS, TX, USA, vol. 1, 2002, pages 352 - 357, XP010582944, DOI: 10.1109/APEC.2002.989270
- C. LOEFR. W. DE DONCKERB. ACKERMANN: "On high frequency high voltage generators with planar transformers", 2014 IEEE APPLIED POWER ELECTRONICS CONFERENCE AND EXPOSITION - APEC 2014, FORT WORTH, TX, USA, 2014, pages 1936 - 1940, XP032590947, DOI: 10.1109/APEC.2014.6803571

Citation (search report)

- [IA] CN 209804426 U 20191217 - DELTA ELECTRONIC ENTERPRISE MAN SHANGHAI CO LTD
- [A] CN 202713788 U 20130130 - YAN YUEJUN
- [A] US 2019221359 A1 20190718 - HUNG SHUEN-CHANG [TW], et al
- [A] KR 20200081195 A 20200707 - ATUM [KR]
- [A] WO 2012093052 A1 20120712 - SIEMENS AG [DE], et al

Designated contracting state (EPC)

AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

Designated extension state (EPC)

BA ME

Designated validation state (EPC)

KH MA MD TN

DOCDB simple family (publication)

**EP 4160631 A1 20230405**

DOCDB simple family (application)

**EP 22169666 A 20220425**