US 20220354014A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2022/0354014 A1**

FEURTADO et al. (43) **Pub. Date: Nov. 3, 2022**

(54) **HIGH POWER MULTILAYER MODULE HAVING LOW INDUCTANCE AND FAST SWITCHING FOR PARALLELING POWER DEVICES**

(71) Applicant: **WOLFSPEED, INC.**, Durham, NC (US)

(72) Inventors: **Matthew FEURTADO**, Durham, NC (US); **Brice MCPHERSON**, Durham, NC (US); **Daniel MARTIN**, Durham, NC (US); **Alexander LOSTETTER**, Durham, NC (US)

(21) Appl. No.: **17/859,449**

(22) Filed: **Jul. 7, 2022**

Related U.S. Application Data

(63) Continuation of application No. 17/149,815, filed on Jan. 15, 2021, now Pat. No. 11,445,630, which is a continuation of application No. 16/658,630, filed on Oct. 21, 2019, now Pat. No. 10,917,992, which is a continuation-in-part of application No. 16/266,771, filed on Feb. 4, 2019, now Pat. No. 10,749,443, which is a continuation-in-part of application No. 15/405,520, filed on Jan. 13, 2017, now Pat. No. 10,212,838.

Publication Classification

(51) **Int. Cl.**

H05K 7/14	(2006.01)
H02M 1/088	(2006.01)
H02M 7/00	(2006.01)
H02M 7/537	(2006.01)
H05K 1/02	(2006.01)
H05K 1/18	(2006.01)
H05K 7/20	(2006.01)
H05K 5/00	(2006.01)
H05K 5/02	(2006.01)

(52) **U.S. Cl.**

CPC ***H05K 7/1432*** (2013.01); ***H02M 1/088*** (2013.01); ***H02M 7/003*** (2013.01); ***H02M 7/537*** (2013.01); ***H05K 1/0271*** (2013.01); ***H05K 1/181*** (2013.01); ***H05K 7/20909*** (2013.01); ***H05K 5/0069*** (2013.01); ***H05K 5/0247*** (2013.01); ***H05K 7/20509*** (2013.01); *H05K 2201/10272* (2013.01); *H05K 2201/064* (2013.01); *H05K 2201/10151* (2013.01); *H02M 1/0054* (2021.05)

(57) **ABSTRACT**

A power module including at least one substrate, a housing arranged on the at least one power substrate, a first terminal electrically connected to the at least one power substrate, a second terminal including a contact surface, a third terminal electrically connected to the at least one power substrate, a plurality of power devices arranged on and connected to the at least one power substrate, and the third terminal being electrically connected to at least one of the plurality of power devices. The power module further including a base plate and a plurality of pin fins arranged on the base plate and the plurality of pin fins configured to provide direct cooling for the power module.