

United  
States  
of  
America

To Promote the Progress



of Science and Useful Arts

The Director

of the United States Patent and Trademark Office has received  
an application for a patent for a new and useful invention. The title  
and description of the invention are enclosed. The requirements  
of law have been complied with, and it has been determined that  
a patent on the invention shall be granted under the law.

Therefore, this United States

Patent

grants to the person(s) having title to this patent the right to exclude others from making, using, offering for sale, or selling the invention throughout the United States of America or importing the invention into the United States of America, and if the invention is a process, of the right to exclude others from using, offering for sale or selling throughout the United States of America, products made by that process, for the term set forth in 35 U.S.C. 154(a)(2) or (c)(1), subject to the payment of maintenance fees as provided by 35 U.S.C. 41(b). See the Maintenance Fee Notice on the inside of the cover.

Andrew Kinn

DIRECTOR OF THE UNITED STATES PATENT AND TRADEMARK OFFICE



US010361619B2

(12) **United States Patent**  
Vangala et al.

(10) **Patent No.:** US 10,361,619 B2  
(45) **Date of Patent:** Jul. 23, 2019

(54) **REALIZING ZVS AND ZCS IN A CCM BOOST CONVERTER WITH BCM CONTROL WITH A SINGLE SWITCH**

(71) Applicants: Vignan Technology Business Incubator, Guntur (IN); Nagesh Vangala, Bangalore (IN); Rayudu Mannam, Bangalore (IN)

(72) Inventors: Nagesh Vangala, Bangalore (IN); Rayudu Mannam, Bangalore (IN); Srinivasa Rao Gorantla, Guntur (IN)

(73) Assignees: VIGNAN TECHNOLOGY BUSINESS INCUBATOR, Guntur (IN); Nagesh Vangala, Bangalore (IN); Rayudu Mannam, Bangalore (IN)

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: 16/281,824

(22) Filed: Feb. 21, 2019

(65) **Prior Publication Data**  
US 2019/0181743 A1 Jun. 13, 2019

(51) **Int. Cl.**  
H02M 3/156 (2006.01)  
H02M 1/08 (2006.01)  
H02M 3/335 (2006.01)  
H02M 1/34 (2007.01)  
H02M 1/00 (2006.01)

(52) **U.S. CL.**  
CPC ..... H02M 1/083 (2013.01); H02M 1/34 (2013.01); H02M 3/3523 (2013.01); H02M 2001/0058 (2013.01); H02M 2001/342 (2013.01)

(58) **Field of Classification Search**  
CPC ..... H02M 3/156; H02M 3/157  
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,281,824 B1 \* 8/2001 Masuda ..... H03K 17/0413 341/144  
2010/0308733 A1 \* 12/2010 Shao ..... H02M 1/4225 315/119

\* cited by examiner

Primary Examiner — Gary L Laxton

(74) Attorney, Agent, or Firm — Mannava & Kang, P.C.; Vinay Malik

(57) **ABSTRACT**

Realizing ZVS and ZCS in a CCM Boost Converter with BCM control with a single switch. Embodiments disclosed herein relate to continuous conduction mode (CCM) boost converters and more particularly to continuous conduction mode (CCM) boost converters with boundary control mode. The embodiments herein achieve a scheme to achieve complete soft switching of all the switching elements of a boost converter, without incorporating any additional auxiliary switch, wherein total soft switching is achieved by inserting a fly back transformer in series with a normal boost converter operating in a continuous conduction mode, and adopting boundary control mode.

1 Claim, 15 Drawing Sheets

