IEEE Educational Videos on
Power Electronics

Direct AC-DC Conversion using Monolithic Bidirectional Switch

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Publication Date: 25 August 2026

This PDF provides the scholarly description and references accompanying the educational video published under DOI: https://doi.org/10.17024/pelstube.2026.007.

Abstract:

This educational video introduces direct three-phase AC-to-DC power conversion and explains how gallium-nitride-based monolithic bidirectional switches may enable more practical single-stage converter architectures.

The video first reviews the conventional two-stage AC-to-DC approach, including the role of the PFC/rectifier stage and the isolated DC-DC stage. It then discusses the motivation for single-stage conversion, the need for four-quadrant switching in direct AC conversion, and the limitations of conventional multi-device switch implementations.

The second part of the video focuses on GaN monolithic bidirectional switches, highlighting their ability to provide bidirectional current conduction and bidirectional voltage blocking with more efficient semiconductor area utilization. Finally, the video connects these device-level concepts to a DAB-based single-stage cycloconverter example.

The goal of the video is to help viewers understand the relationship between device technology, converter topology, and system-level tradeoffs in emerging direct AC-to-DC power conversion architectures.

Keywords:

AC-DC power conversion, Wide-band-gap devices, Single-stage AC-DC conversion, Three-phase AC-DC converters, GaN MBDS, Electrolytic capacitor-less converters, Power semiconductor devices, Bidirectional Switch

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