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Classification of additive manufacturing and 3D-printing processes for electronics

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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It is based on a document issued by Fachverband Elektronikdesign und -fertigung e. V. (FED) entitled *Classification of additive manufacturing and 3D-printing processes for electronics, White Paper Edition 2024*, and was submitted as a PAS document.

The text of this Publicly Available Specification is based on the following documents:

Draft	Report on voting
91/2105/DPAS	91/2114/RVDPAS

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

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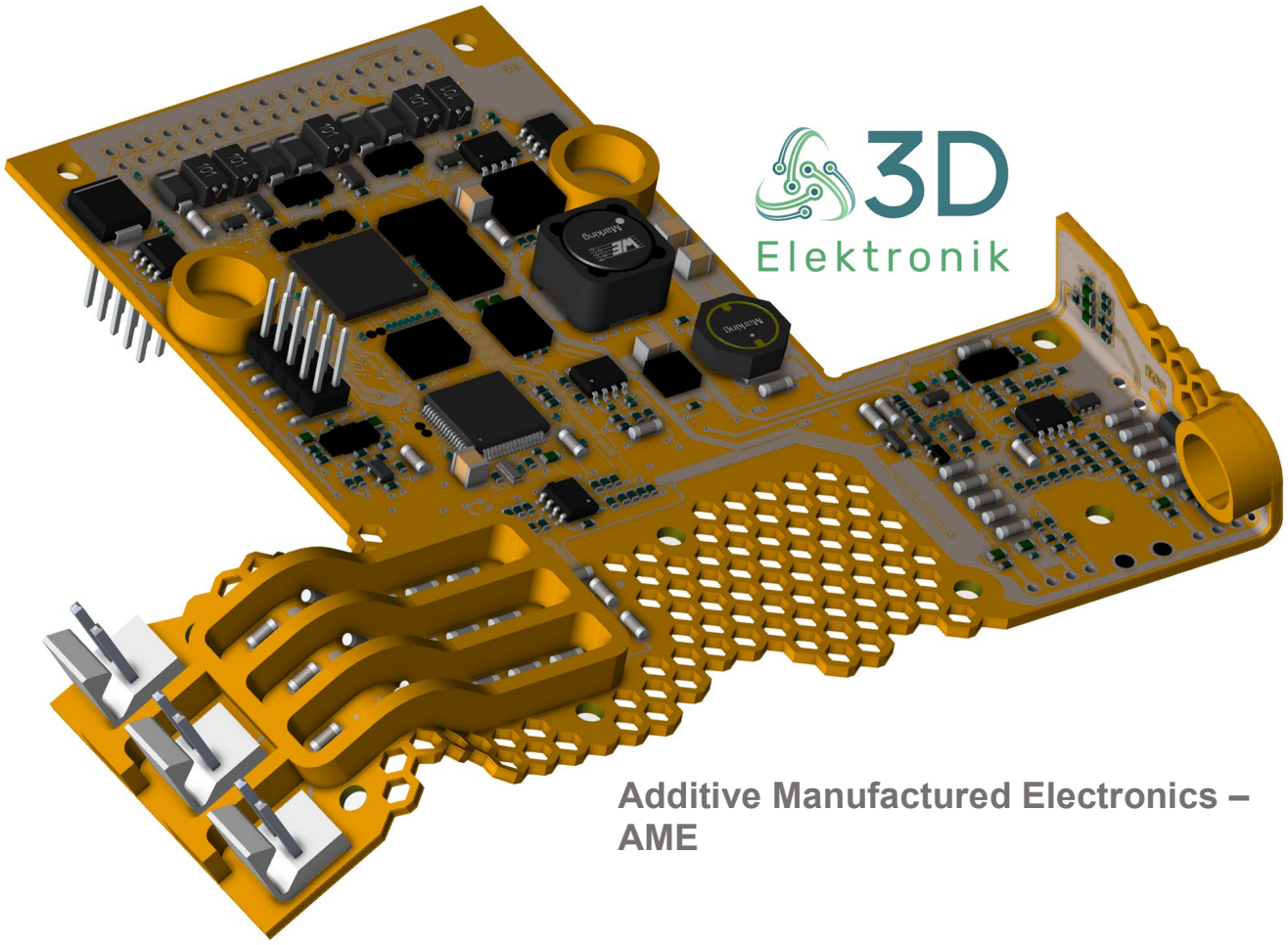
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FED

We connect

FED-Working group 3D-Elektronik

Classification of additive manufacturing and 3D-printing processes for electronics



3D Elektronik

Additive Manufactured Electronics – AME

Classification of Additive Manufacturing (AM) methods and processes and 3D printing processes for electronic

White Paper Edition 2024

1 Foreword



The growing demands for miniaturization and increased performance of electronic devices today go far beyond system integration, which is described as "More than Moore" and driving forces regarding Additive Manufacturing in the electrical and electronics industry.

AM is becoming increasingly important, especially for 3D electronics concepts. New 3D printing processes enable heterogeneous and functional integration through multi-hybrid and tool-free production. Both, physical and/or electrical functions, can be printed, additionally electronic components can be assembled within a single operation.

With the new 3D printing processes multidimensional substrates (components) and circuit carriers with integrated functions such as sensors, actuators, electro-optical or bionic properties can be realized, without the need for a carrier substrate or already manufactured Printed Circuit Board.

At the same time rapid progress due to material development is carried out. Nanomaterials in combination with new developed materials printed in one process enable advanced or new possibilities. As an additional positive effect material, energy and transportation costs can be saved in further production processes.

Given the large number of processes and applications it makes sense to classify the methods from the perspective of manufacturing. The FED 3D Electronics Working Group developed this classification in a two-year project and defined five classes of electronics integration using AM.

The classes differ in the used substrate material and the printing process. The different classes build on each other and the requirements for complexity and handling as well as printing technology and precision increase with each class.

The classification for Additive Manufacturing in electronics is intended to help manufacturers and users to find an easy way of the new and extensive possibilities of 3D electronics concepts. This creates a level playing field for discussion between the partners and lowers the entry threshold for the new technologies for users.

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