

Using AI and Big Data based algorithms to mitigate the effects on component shortage when designing highly efficient power electronic converters

by Angel Marinov | Svilen Simionov | Technical University of Varna | Technical University of Varna

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The high rate of technological development of electronics and their global market diffusion, has led to an extraordinary demand in almost all aspects of human life. Development and production of electronic devices is naturally highly dependent on the availability of electronic components and more specifically of integrated semiconductor circuits with variable complexity - commonly referred as chips. Various global events - most prevalently geopolitical crisis such as the war in Ukraine, tensions between China, Taiwan and US and the COVID-19 epidemic has led to an unprecedented chip shortage. This shortage is most tangible when referred to: (1) Consumer electronics - relevant to high performance/high complexity microprocessor and microcontrollers for computer electronics and smart mobile devices; (2) Automotive electronics - relevant to specialized integrated circuitry and microcontrollers. Although those areas are of critical importance, the chip shortage is also strongly felt in other fields as well such as industrial electronics and energy generation. The shortage affects both large and small enterprises, where the means and tools to deal with it are more limited for the latter. Smaller companies that deal with research and development (R&D) and production of smaller batches and limited quantities lack the levers or means to directly negotiate with semiconductor producers or stock larger quantities of components. Smaller enterprises usually procure their electronic components from large internationally trading retailers.

The aforementioned chip shortage has also strongly affected and felt in the field of power electronics as well, where there is a lack of semiconductor switches, specialized controller ICs and microcontrollers. This to some extent effects functionality and more importantly the efficiency of new power electronic converters and systems.

In response to the this the current paper aims at: (1) Providing a short introduction on how the chip shortage effects small enterprises working in the field of power electronics; (2) Discussing how the chip shortage effects power electronic converters produced by small enterprises and more specifically their efficiency; (3) Present several AI and Big data based algorithms and tools that can aid engineers in producing a more sustainable designs and products, somewhat negating the shortage effects, without the need of overstocking which can further drive the shortage.