6 Selection of a DC/DC voltage converter (power module)

6.1 What makes the difference?

There are several factors to consider when selecting a power module. The requirements are essentially determined by the application, i.e. the supply side and load side, as well as the ambient conditions.

Crucial points for selection:

- Input voltage range
- Output voltage range
- Output current/power
- Ambient temperature
- Package type
- EMC
- Output ripple
- Switching frequency
- Efficiency
- Options (additional functions)

Thermal derating

The power modules from Würth Elektronik eiSos GmbH & Co KG can be used in almost every application, as they have a wide input and output voltage range. The efficiency is usually >85% and the power modules have hardly any thermal derating (Fig. 6.1), which is an attribute of the construction.

Ambient temperature

This means that the maximum output current can be provided at the maximum ambient temperature without an external heat sink.

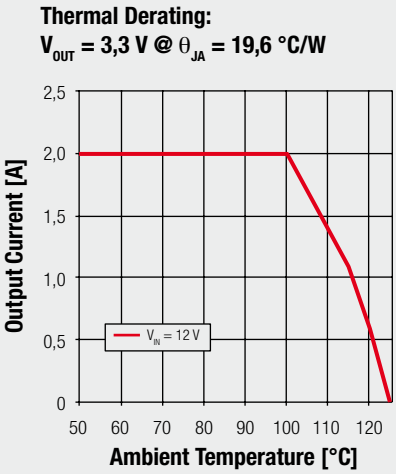

Fig. 6.1: Thermal derating taking the example of order code 171020601

High efficiency and low power losses are the most important considerations in the selection of a DC/DC converter. The efficiency curve, see datasheet, plays a major role and, as shown in the graph (Fig. 6.2), the optimum operating point is mostly found in the mid range area of the output current (red box). If too little power is taken from the power module, it works in the inefficient discontinuous mode. If the output power is too close to the performance limit, the efficiency drops, which impacts heat management (see chapter 3.4: Heat management).

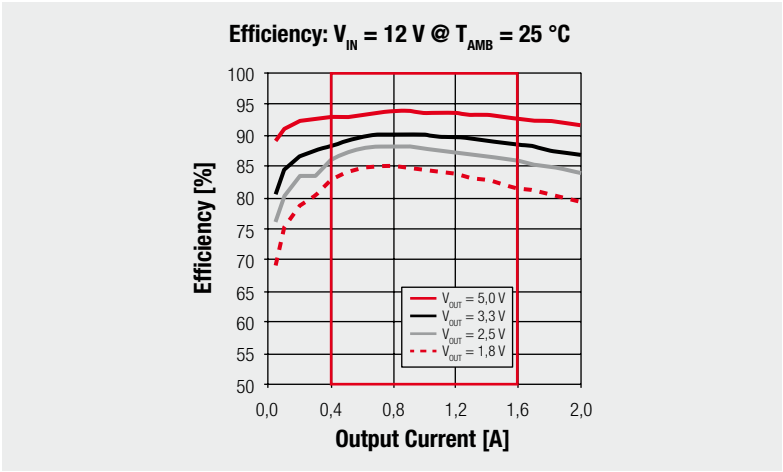

Fig. 6.2: Efficiency taking the example of order code 171020601

Ripple voltage

Output voltage ripple

In the definition of the output side of a DC/DC voltage converter, the ripple voltage, an AC voltage superimposed on the DC voltage, is a crucial parameter. A low ripple voltage is necessary, e.g. to supply sensitive loads, such as A/D converters, FPGAs & CPUs. For example, the output voltage ripple for the 2 A/5 V_{out} power module is <10 mVpp (Fig. 6.3).

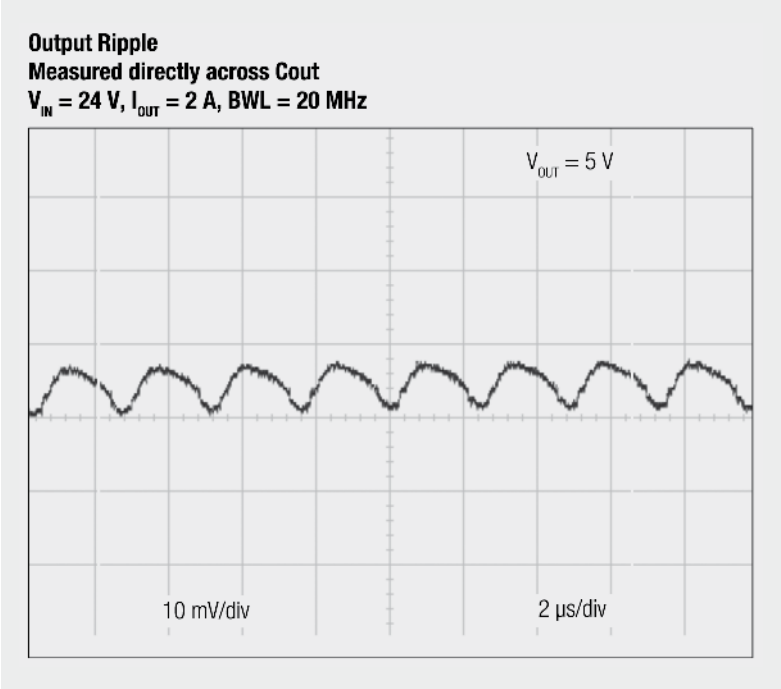

Fig. 6.3: Output voltage ripple @ 5 V taking the example of order code 171020601

EMC

A further important point that should be considered in module selection is EMC. Many DC/DC voltage converters do have interference-suppressing components integrated to reduce interference, but further, external filters may be necessary to comply with the relevant EMC standards.

Conducted noise, for instance, can soon be eliminated with an LC filter at the input. But what about the radiated interference?

Applications located in a shielded case will have no negative impacts, but as many applications are constructed in a plastic case, it is difficult to eliminate the radiated interference.

If the switching regulator module in its basic form emits little radiation, complex EMC measurement, trouble shooting and fix in the EMC lab can be avoided and thus time and money saved.

The example of the Würth Elektronik MagI³C power modules clearly shows the low level of non ionizing radiation (Fig. 6.4). The modules have been specified and tested in compliance with EN55022 Class B. (Measurements were performed on the Evalboard 178020601 V2.0).