Powering change

The challenges of the EuP Directive and some potential solutions. By **Ralf Keggenhoff**.

On 6 July 2005, the president of the European Union signed Directive 2005/32/EU, establishing a framework for the environmentally friendly design of Energy using Products (EuP).

The first important question is 'what are the targets of this Directive?'. These include:

- Harmonisation of national laws to ensure the free movement of those products within the internal market
- Reduction of the environmental impact caused by EuP
- Optimised environmental performance of products
- Energy efficiency improvements to reduce the emission of greenhouse gases
- Establishing a framework for the ecodesign requirements, and
- Minimising potential environmental impact

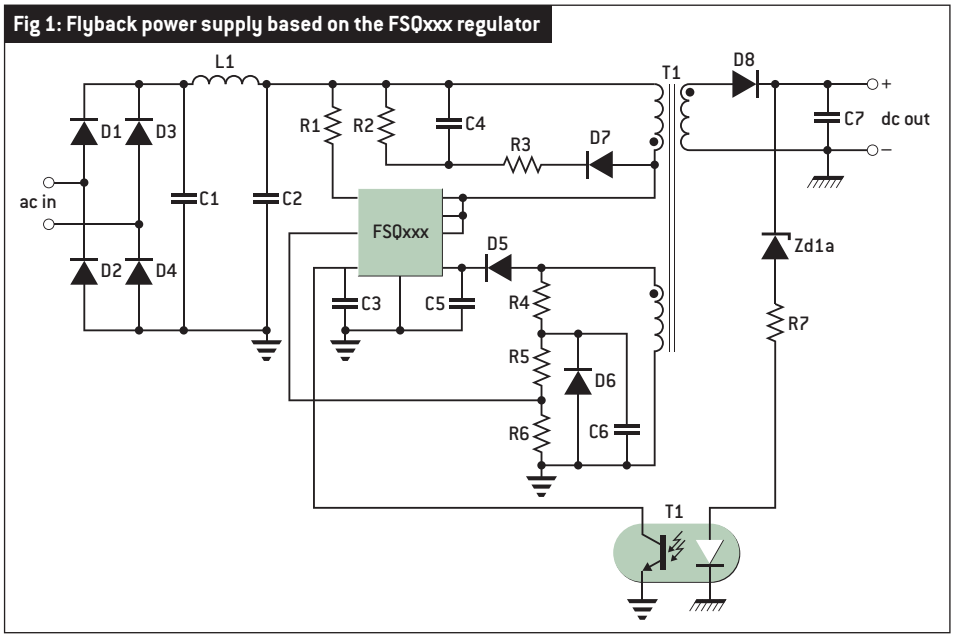
Article 3 of the Directive says member states shall take all appropriate measures to ensure that EuPs are only placed on the market if they comply with these measures and bear the CE marking. Non compliance of the regulations will result in penalties and the affected products have to be removed from the market.

A list of 600 products to which the Directive should be applied first has been compiled. This comprises 57 product groups, of which 34 have been prioritised. These 34 groups have been further divided into priority A (25 products) and priority B (9 products).

One product group for which stand by regulation is already effective is set top boxes and this is an exception because not only are standby losses regulated, so too is power consumption in normal operation.

This is a significant challenge for product manufacturers and semiconductor companies. Manufacturers have been forced to adapt their products within a very short time frame and semiconductor companies have had to provide developers with innovative devices that meet the following requirements:

Fig 1: Flyback power supply based on the FSQxxx regulator



One year after the regulation has come into force, the power consumption in any off mode shall not exceed 1W. Four years later, the power consumption in any off mode is limited to 0.5W, or 1W if reactivation and an information status display is implemented. Additionally, a product shall offer a function that switches equipment, after the shortest possible period, automatically into standby, off mode or other condition that does not exceed the applicable power consumption requirements.

To help developers meet these requirements, Fairchild offers a broad product portfolio, including the FSQ series of power switches. This suite of products offers high efficiency during normal operation and very low power consumption in standby.

High efficiency can be achieved using the valley switching technique to minimise switch on losses. These losses, which are proportional to the voltage across the power switch during switch on event, are minimised and efficiency increased by switching at the voltage's minimum.

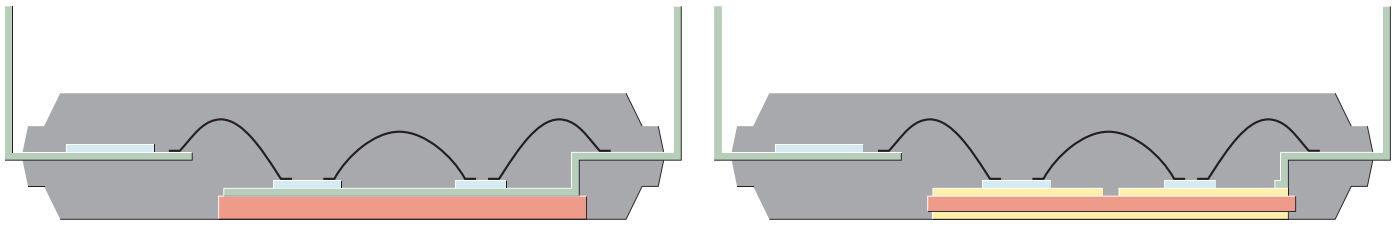
Additionally, a burst mode technique is used that minimises power consumption under light loads.

Even if a display is used that consumes 0.5W, an overall power consumption in stand by mode of less than 1W can be realised.

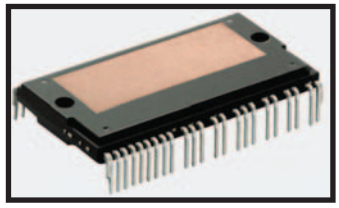
To access the valley switching (quasiresonant) function, the following devices need to be implemented: R4, R5, R6, D6 and C6 (see figure 1). By connecting this circuit to an additional secondary winding of the transformer and to the Sync-Pin of the regulator, valleys can be detected. With a fixed program, the regulator switches the integrated power switch in the valley of the drain voltage.

This burst mode operation is doing nothing

Fig 2: Mini DIP module cross section



else than switching the regulator sporadically at low loads. In this mode, output voltage ripple is slightly higher, but this is negligible in stand by modes. Usually, displays are connected so the standby mode can be visualised. The simplest method is an LED and, eventually, a remote control receiver.



The FSQ510 and FSQ510H only support burst mode operation. With these devices, standby losses of 60mW can be achieved. These regulators are designed for a maximum output power of 9W; switch on losses in this power range are very low and the additional benefits of valley switching would be small.

But the Directive also cover systems larger than set top boxes, including motors and water pumps used in heating, ventilation and air conditioning systems. Compact designs with fewer components are becoming more important here – and not just for energy efficiency.

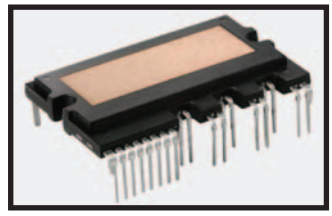
The water pressure depends on the distance between the heat-generating system and the radiators and on the head. Consequentially, pressure needs to be regulated individually. In larger buildings, each floor maybe connected to a separate pump.

In the past, pressure was regulated with simple triac based controls. The disadvantages of triac control, which can only work with universal motors, include:

- higher total harmonic distortion
- high input power
- inefficient regulation

Efficient and intelligent control of the heating system can be achieved with intelligent inverter based drives connected to modern brushless dc motors. In this way, primary energy requirements and greenhouse gas emissions are reduced.

Additional applications include solar energy and heat pumps. The requirements and power levels of these applications are similar to those of circulation pumps used in heating applications. To transport heat via water or hydraulic liquid, requires pressure to be controlled efficiently. The same applies in air conditioners, where even higher power levels are experienced. As a result of energy efficiency regulations and governmental restrictions, the trend is to develop and use inverter based solutions.



Fairchild offers a portfolio of Smart Power modules designed for use with devices rated at up to 120W. The TinySMD and TinyDIP families can replace nine discrete devices within a small footprint. To develop a space optimised pcb, only a few additional external components are needed, including a microcontroller.

Individual and step less regulation and control is a common requirement in building management systems. The power range of the devices used in these environments can reach several kW. Fairchild offers a portfolio of power modules for higher power ratings.

TinyDIP and TinySMD modules are pretested and optimised subsystems, which increases the reliability of the system by reducing FIT rates. This accelerates time to market and helps to create more compact designs compared to discrete solutions.

Fairchild offers a portfolio of modules for higher power ratings. These offer good thermal connection to the heat sink, which is usually needed at higher power ratings.

MiniDIP modules are available in three variants, all of which are pin to pin compatible. The main difference is the thermal connection to the heatsink. Two variants of DIP Module are available: ceramic and DBC based.

In the first variant, power devices are soldered directly to the lead frame, which is then attached to the ceramic. An isolation voltage of 2.5kV is provided, as well as a good thermal connectivity.

The DBC variant features a ceramic with copper attached from both sides. Outside the module, the copper area is homogeneous. The power devices are soldered on the inner structure of the copper area, which is similar in structure to a pcb. Both copper areas act as heat spreaders and, as a result, thermal resistance is lower than in the ceramic based solution.

The EuP Directive and its concomitant regulations are important ways to improve energy efficiency and present opportunities for semiconductor suppliers to develop highly integrated and efficient solutions.

Author profile:
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