Market Transformation Programme

Programme Bulletin
External Power Supplies
March/2012

Issue Number 1

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### Bulletin Summary

#### Impact on EPS Market of Technology Trends:

There are three significant technological trends that will impact adversely on the use of AC – DC EPS (External Power Supplies) in the next five years:

- **The growing use of USB power (Universal Serial Bus) in the consumer electronics market to power or charge E-books, Cell phones, and MP3/MP4 players etc. has the potential to seriously reduce the market share for lower wattage EPS. Power interface leads allowing the connection of products to USB (micro and standard) have catalysed a trend to a multi application EPS. This device can power a wide range of products from a given manufacturer with the connected product tailoring the output characteristics of the EPS through a power management interface (e.g. Apple 10W iPad charger which will correctly and safely power many other Apple devices).**

- **The establishment of an IEEE (Institute of Electrical and Electronic Engineers) working group in the USA, WG / P1823, whose objective is the development of a specification and protocols for a “smart” Universal Power Adapter for Mobile Devices (UPAMD is the already registered trade mark). UPAMD enabled devices would be able to communicate with and correctly power portable products and various office and ICT products that currently use a product specific EPS.**

- **PoE (Power over Ethernet) interface devices for office and domestic wired LAN and new standardised DC distribution systems with “smart” interface potential would allow the distribution of DC at low to medium powers for charging and powering purposes. This device will likely replace a wide range of small to medium AC-DC EPS.**

The impact of the above developments on small to medium EPS production and sales will be offset by the rapid trend to LED lighting, particularly in domestic décor lighting and in the replacement of Neon in channel LED letter systems for commercial signage. This lighting trend will sustain the AC-DC EPS market although there will be a dramatic downturn in AC-AC EPS as low voltage halogen décor lights are displaced from the market.

#### Improvements in EPS Technical Performance

EPS and standby criteria from regulation or voluntary agreements have impacted procurers of EPS required to power the products they distribute in major world markets. The criteria has driven specialist power supply IC (Integrated Circuit) producers to facilitate EPS designs capable of delivering power at high efficiency over a wide load range. EPS’s have good power factor (typically 0.9) and provide extremely low, no-load (standby) power wastage. Benchmark EPS designs for premium products are now capable of converting the AC input power to DC output power at an average efficiency of 86%. This average efficiency applies to a wide range of DC output power to the connected product (the load) from 10% to 100% of the peak rated output power of the EPS and a no-load standby (EPS disconnected from product but still connected to the mains) of 0.01W. Even very cost-sensitive small EPS designs (e.g. 3.5W Standard Voltage EPS) will deliver 75% average efficiency across a range of DC output power of 25% - 100% of the peak rated output power of the
EPS and 0.03W no-load standby. This is compared to current ErP EPS criteria for a 3.5W supply of 70% average efficiency with a no-load standby of 0.3W.

**Status of Regulation and Voluntary Agreements Impacting on EPS**

From December 31<sup>st</sup> 2010 the EPA (U.S. Environmental Protection Agency) dictated that the EPS market should not use the Energy Star Label to qualify its products (“Sunset on EPS”). The first catalyst for this dictate was the success of the EPA EPS programme. Within three years of its inception, this programme had transformed the market for EPS guaranteeing that 50% of all EPS sold in US markets were compliant with Energy Star criteria. The second catalyst was the additional pressure on compliance introduced by the 2008 U.S. federal minimum efficiency standard for EPS using the Energy Star criteria for its mandate. Even with the final tier of Energy Star criteria, current at the “sunset” statement of December 2010, 50% of EPS were compliant. Currently it is the EPA’s requirement that version 2.0 EPS criteria (equivalent to level 5 - “V”, of the International Efficiency Marking Protocol) be the minimum requirement for EPS supplied with Energy Star compliant products.

The US DoE (Department of Energy) has published a NOPR (Notice of Proposed Rule Making) covering EPS and battery chargers. They are proposing higher EPS efficiency levels than Energy Star version 2.0 and than Tier 2 (current since 2011) of the EU ErP EPS Ecodesign regulation. Stakeholder comment gathering on the NOPR will close in May 2012.

**Important Testing and other Standards for EPS**

For Europe the “Harmonised” standard EN 50563 was drafted and published in response to an EC mandate for the creation of a testing methodology in support of Commission Regulation EC 278/2009. This standard must be applied in all testing for the declaration of EPS compliance with this regulation.

European Standard EN62684 (mirroring International Standard IEC 62684:2011) specifies criteria for the Interoperability of small EPS for (data enabled) mobile phones. It supports the MoU (Memorandum of Understanding) between the EU and many major mobile phone manufacturers to introduce an EPS based on a micro-USB connector which could be used on a wide cross section of mobile phones. There is no evidence that this MoU has encouraged the reduction of mobile phone electronic waste since new phones are supplied with no option for users to purchase them without an EPS.
IC Controllers enabling highly efficient switch mode external power supplies are now available from many principal IC suppliers. These suppliers and principal EPS manufacturers adopting ICs and directly applying or refining suggested EPS topologies are listed in data sources at the end of the bulletin. The listed websites provide important EPS performance specifications across a wide range of EPS applications.

Achieving efficiencies across the EPS load curve over 90% is practicable even in small to medium power EPS through the use of:

- Larger MOSFET\(^1\) to reduce on-state losses
- Field effect transistors (FET’s) and Diodes made from exotic materials (compound semiconductors) to reduce switching and on-state losses. Materials include Silicon Carbide (SiC) and Gallium Nitride (GaN). Such devices are not usually commercially viable in competitive consumer products. Competitive, cost sensitive EPSs using less expensive components can still meet an average efficiency of 85% to 87% across a power load range of 25% to 100%. A Power Factor (PF) in current EPS topologies is typically 0.8 and often 0.9 or better. No-load power loss of 100mW or less is a typical specification insisted on by computer and mobile phone manufacturers when procuring EPS. Many commonly available low to medium power EPS’s can deliver no-load power loss of between 10mW and 30mW.

The development of the Universal Power Adaptor for Mobile Devices (UPAMD ™) currently being standardised by IEEE WG / P1823 in the USA will influence ESP modelling through 2015. This standard defines interconnection standards and communication protocols for a “smart” power adapter providing between 10W and 240W of power to the connected product. The standard will promote the universal reuse of power adaptors independently of the manufacturer of the supported product. The lifecycle costs of the EPS product could be positively reduced. An additional ecodesign benefit will be the ability of the adaptor to communicate with and qualify connected product power consumption to match available prime source power.

Rapid developments in PoE (Power-over Internet) interface and range expansion devices to allow the DC power required by ICT and some CE equipment to be provided by existing or new Ethernet data cable infrastructure, will, through the convenience of lower cost, installation flexibility and long term reliability, reduce the requirement of AC-DC EPS. For modelling purposes, detailed attention will need to be paid to power on data line resistive losses that will be inherent in transferring low voltage DC power through small conductors.

A longer term potential qualification of modelling the impact of AC-DC EPS products is the development of domestic and commercial DC grid power distribution systems. Such systems will integrate perfectly with DC storage replenished by solar and wind generated power or the DC power

\(^{1}\) Metal oxide semiconductor field-effect transistor
output of fuel cells. In the USA, DC output USB (“A” standard) outlet sockets are now installed with AC mains outlet sockets for the purpose of distributing DC stored power.

Policy Developments

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<tr>
<td>≤ 1 W.</td>
<td>≥ 0.5*Pno +0.16</td>
<td>≥ 0.480*Pno + 0.140</td>
<td>≥ 0.497*Pno + 0.067</td>
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<tr>
<td>≥ 1 W. and ≤ 49 W.</td>
<td>≥ 0.071<em>Ln (Pno) – 0.0014</em>Pno +0.67</td>
<td>≥ 0.0626*Ln (Pno) +0.622</td>
<td>≥[0.0750*Ln (Pno) +0.561]</td>
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<tr>
<td>&gt; 49 W.</td>
<td>≥ 0.870</td>
<td>≥ 0.870</td>
<td>≥ 0.860</td>
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<tr>
<td>No Load Power</td>
<td>0.100</td>
<td>0.3W.</td>
<td>0.3W.</td>
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<tr>
<td>≥ 50 W. and ≤ 250 W.</td>
<td>0.210</td>
<td>0.5W.</td>
<td>0.5W.</td>
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