Power over Ethernet

Q&A

Q Does Infineon also have an offering for PoE-powered devices?

A Yes, Infineon does have an offering for Power over Ethernet – known as PoE – devices. In one of our recent webinars, we introduced Infineon's offering for power sourcing equipment (PSE). We also have dedicated power semiconductors for powered devices (PD), but we do not currently offer any PoE PSE or PD control ICs.

As an example, let us look at potential power semiconductors for a Wi-Fi access point or 5G pico/femto cell. For this use case, we have point of load (PoL) controllers or digital DC-DC controller products that can be used to implement advanced control schemes for DC-DC power conversion in the power stages. Moreover, we have matching discrete power MOSFETs for these powered devices. These include our OptiMOS™ device family, offering lowest switching losses with a sophisticated RF component for the RF stage.

Q How do you increase the power efficiency and reduce the power losses in an SMPS under light load conditions, e.g. at around 100 W for an SMPS with nominal 1200 W?

A That depends on the overall SMPS design and your preferred approach. As an example, you can select a MOSFET for your PFC stage and optimize the parameters for hard-switching typologies to enhance the performance of a single component within the overall system. However, to tweak and optimize SMPS system efficiency overall, a holistic system view and approach is required. This means you need to select the right topology for your system design and overall power requirements, along with the right control scheme including digital power controllers or matching power MOSFET designs on both the primary and secondary sides. Last but not least, interaction between the application-specific block and the SMPS itself can play a key role in optimizing efficiency under light load conditions. Here, for example, feedback channels between the application and the actual SMPS to communicate power demand can boost efficiency by enabling the SMPS to actively adapt its control scheme to light load conditions.

Q Why is the power design itself so essential for the new PoE standard, relative for instance to the importance of the actual PoE control IC?

A PoE functionality for detecting and managing connected powered devices is handled above all by the PoE control IC in power sourcing equipment. However, the overall power design for power sourcing equipment, including operation under light load conditions and power efficiency, is very much dependent on the overall SMPS design rather than the PoE control IC itself. The control IC manages the power from the main SMPS, but it does not manage how the power is provided to the PoE control IC, Ethernet ports included, or how the overall power budget is managed in terms of efficiency.

The new standard raises the maximum power per port up to 100 W. Hence adaptation and modification of power supply designs will play an important role in enabling power sourcing equipment like Ethernet switches to raise their power ratings from the current 30 W per port up to the 100 W per port provided for under the new standard.

Q Is there any fundamental difference in how data is transmitted between PoE and non-PoE devices?

A Yes. The difference lies in the abstraction layers in a network-enabled device. I'm talking specifically about the power layer and the data link layer. Within a PoE-powered application, the difference between PoE and non-PoE is mainly related to how the power is supplied to the network participants. Let me explain.

PoE uses the Ethernet cable to provide power, implementing full Ethernet functionality along with the power feature. From a data connectivity point of view, there is no fundamental difference between PoE devices and non-PoE – or just Ethernet-enabled – devices. The only difference is the way power is supplied to the devices. With PoE, no additional power cable is required, e.g. from the AC grid. A non-PoE Ethernet device requires an external power supply like an AC-DC wall adapter.

With the latest PoE standard, power management also uses the link layer discovery protocol (LLDP) as a control mechanism implemented in the data layer. This control mechanism manages the power level provided by PoE for more granular power management, but the underlying communication protocol remains Ethernet-based.

Q What benefits does a 600 V MOSFET offer compared with a 650 V MOSFET?

A Basically, the voltage rating of a MOSFET specifies the maximum breakdown voltage the MOSFET can withstand when the voltage is applied between source and drain. If you use the MOSFET in a switching application, this is the maximum voltage the MOSFET can switch and control without breaking down.

The right voltage rating for a MOSFET depends on different factors and their importance in your power design. These often include the main voltage and stability of the power grid in the target country of deployment and general system design considerations like your SMPS topology.

Choosing a 650 V product instead of a 600 V one gives you an additional safety margin of 50 V, which translates into more reliable and robust SMPS designs.

Q Are there isolation requirements for the PSE output voltage?

A Isolation requirements exist for PoE and they are specified in the IEEE standards along with isolation requirements for the actual Ethernet applications.

Isolation requirements and specifications for PoE and for Ethernet applications in general are quite complex due to the nature of the systems in question. As a rule, every device that is connected to any Ethernet jack has to implement isolation between the jack and the digital domain like the Ethernet controller. For PoE, isolation has also to be implemented between the data domain and the power supply that is connected to the jack. Typically, isolation is implemented by means of magnetics that separate the digital domain from the power domain.

Q What benefits does an SMPS design with a digital controller offer?

A Digital controllers offer you more flexibility as you can adjust and enable the SMPS design with digital control schemes including firmware configuration options. This gives you potential freedom for SMPS platform designs and you can quickly adapt existing designs to general changes in implementation requirements.

Moreover, digital controllers provide the flexibility of a potential feedback channel from the system to the SMPS for configuration updates on the fly and for reacting to different load conditions or general power requirements. This is especially important for PoE power sourcing equipment as the number of connected powered devices varies significantly depending on the system configuration. As an example, a switch with 12 PoE ports can either have one PoE-powered device connected (power requirement up to 100 W for PoE) or 12 powered devices (power requirement up to 1200 W for PoE). A digital SMPS controller allows you to react with flexibility to these changes in power demand and thus optimize the efficiency and operating conditions of the SMPS.

Q Why is the power density so important for PoE power sourcing equipment designs?

A Due to the new standard, the power level of the PoE solution overall increases as every port will be able to provide up to 100 W. However, the overall SMPS design of the power sourcing equipment in terms of housing and available space will not typically change.

If you have an existing PoE switch design and would like to upgrade it to the latest PoE standard, you have to increase the power density of your overall design to maintain the same form factor, e.g. due to external constraints such as a network equipment rack. Hence, the main challenge lies in providing higher power with the same physical space. Which is why you have to increase the power density (and also efficiency to maintain a similar cooling concept).

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