With Thermal and Noise Problems Entering a New Phase, High-function Management Devices Are Drawing Attention

Panasonic's PGS Graphite Sheet and Conductive Capacitor

Thermal and noise management is essential in the design of any electronic device. However, designers are now facing increasingly sophisticated and complex issues due to the progress in various fields such as automotive, mobile, industrial devices, and communication infrastructure as the information communication technology (ICT) develops, with the emergence of issues that cannot be solved with conventional methods. Here, I'd like to introduce some of the Panasonic devices that play a significant role in thermal and noise management in this new phase.

The constant progress of electronic devices has once again put the spotlight on thermal and noise issues. This is against the backdrop of the digital LSI mounting environment getting diverse while the number of systems containing high-speed digital LSI is increasing to meet the demand for higher functions. In other words, while thermal and noise issues due to digital LSIs are increasing, more application usages demand more stringent requirements than ever in terms of heat and noise. Electronic devices that offer advanced thermal and noise management solutions are finding greater need under such circumstances. Panasonic's PGS graphite sheet and conductive capacitor are one example.

Addressing Thermal Issues That Are More Sophisticated Than Ever

The PGS graphite sheet for thermal management is made by processing graphite, which has high thermal conductivity, into thin sheets of 10 µm to 100 µm in thickness (Fig. 1). Ordinary graphite sheets are made of natural graphite, whereas the PGS graphite sheet uses artificial graphite having a structure close to a single crystal, formed using Panasonic's unique process of treating polymer film at high temperatures. Its thermal conductivity is two to four times higher than natural graphite sheets and helps transfer or disperse heat while being in close contact with the heat source. It is already used in various devices including smartphones, notebook PCs, tablet terminals, digital still cameras, base stations, data centers, head up displays (HUD), and LED lamps, and is also being increasingly adopted in fields such as automotive, industrial devices, and communication infrastructure as an effective thermal management device.

Meanwhile, Panasonic proposes combined uses of the PGS graphite sheet, as its applications expand, to address newly emerging issues. Specifically, combined products include "Multilayer PGS", "Thermal Storage Sheet (TSS)", "Semi Sealing Material (SSM)," as well as the newly developed high-performance heat insulation sheet "NASBIS (NAno Silica Balloon InSulator)".

The multilayer PGS with an enhanced heat transport capacity is expanding its applications into motors and measuring instruments. The TSS, which starts storing heat at a predetermined temperature and continues to absorb heat up to its full heat capacity, is able to suppress rapid temperature rises. Using it for the heat dissipation of processors will extend the duration of high frequency operations, i.e. duration of crisp and smooth smartphone operations. The SSM, which consists of stacked elastomer and PGS graphite sheet, diffuses heat from its concavo-convex surface. The elastomer layer absorbs heat and the PGS graphite sheet diffuses the absorbed heat. This mechanism serves as thermal management for base stations and digital still cameras, .The NASBIS-combined products offer various benefits including thermal control and heat insulation. For example, it makes wearable terminals more energy-efficient. The PGS graphite sheet diffuses heat, while the NASBIS layer controls the heat dissipation direction, improving the heat utilization efficiency. They also help suppress local temperature rises, which are more likely to occur in devices that keep getting smaller and thinner.

Fig. 1. The PGS graphite, which diffuses heat efficiently

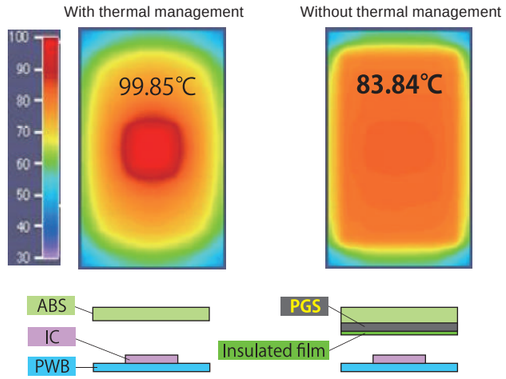


Fig. 2. Combined products for solving various thermal issues

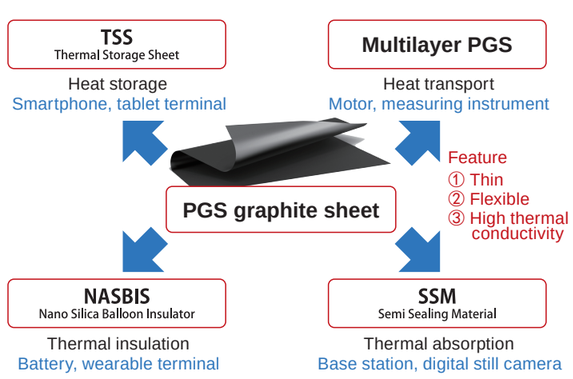
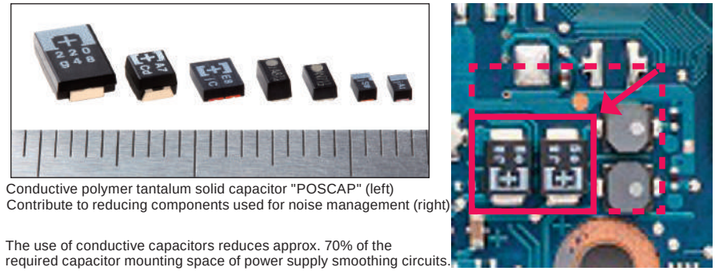


Fig. 3. Conductive capacitors that contribute to noise management and space saving



Conductive polymer tantalum solid capacitor "POSCAP" (left)
Contribute to reducing components used for noise management (right)

The use of conductive capacitors reduces approx. 70% of the required capacitor mounting space of power supply smoothing circuits.

Low-ESR Products Help Break the Downsizing Barriers

Conductive capacitors that use highly conductive polymer material for cathodes serve noise management (Fig. 3). They feature low equivalent series resistance (ESR) and equivalent series inductance (ESL). They play an active role in noise management for various devices such as mobile devices, network servers, storage, liquid crystal displays, and automotive devices and also contribute to reducing the number of components. This is because a full lineup of low-ESR, low-ESL, and large-capacity products allow a smaller number of conductive capacitors to replace components such as multilayer ceramic capacitors and electrolytic capacitors for noise management.

Panasonic is expanding its conductive capacitor models, anticipating the future need in, for example, automotive, mobile, industrial devices, and communication infrastructure fields. One example is a product developed for communication devices, which are increasingly smaller and more reliable with the widespread use of small cells, that guarantees 1000 operating hours at an ambient temperature of 125 °C (estimated service life of 10 years at 85 °C). Another example is ultra-small large-capacity products for mobile devices. The automotive lineup is expanding to meet the increasing need for conductive capacitors due to the trend toward electronically-driven vehicles.

Panasonic offers diverse solutions using its full lineup of thermal and noise management devices (See separate columns). Taking advantage of these edges, Panasonic intends to proactively respond to the demand for thermal and noise management in automotive, mobile, industrial devices, and communication infrastructure fields.

Multi-faceted Support for Thermal and Noise Management Using a Variety of Devices

Panasonic offers various types of thermal and noise management devices. Thermal management products include the PGS graphite sheet and NTC thermistor. Noise management products include capacitors, electromagnetic compatibility (EMC) management components such as common mode noise filters, EMI filters, and electromagnetic shield films, and circuit protection components such as ESD suppressors and chip varistors.

Many of these products have unique features. One example is a filter that removes common mode noise (Fig. 4). Its major feature is the adoption of a multilayer structure formed using Panasonic's unique process of stacking a ferrite sheet, a non-magnetic sheet, coils, etc., and baking them collectively to achieve downsizing. Combinations of the multilayer structure and coil patterns allow a product lineup that supports a wide frequency of high-speed signals.

Multilayer chip varistors including the 0402-sized small and tandem types also indicate Panasonic's excellent technologies (Fig. 5). Their uniquely developed varistor materials with different dielectric constants allow for a product lineup covering wide-ranging applications.

Panasonic provides various solutions based on suppression devices. Most of them are superior precisely because of Panasonic's wide variety of products.

Fig. 4. Common mode noise filter

Fig. 5. multilayer chip varistor

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