



A key aspect of TDK's approach to making products is "courage." The courage to challenge a difficult task without fear of failure, in order to meet the needs of society and create something new. As a case in point, let us introduce the members of the development team who received the "CHO (Super)" MONODZUKURI Innovative Components Awards in 2008 for their work on a noise filter for high-speed signals.

Know-how and technology concentrated in a miniature package: TCM2010H measuring a mere 2.0 x 1.0 x 0.8 mm

## Development of Miniature Noise Filter Using Thin-Film Technology

With the rapid shift of TV and other electronic devices towards digital formats and higher performance, the requirements placed on components used in such equipment also are undergoing a drastic change. The common mode filters produced by TDK are a case in point. Noise filters used in the input and output circuitry of TV sets, computers, and many other devices serve to remove noise generated during the transmission of audio, video and other data. They are indispensable elements for ensuring high data quality. In recent years, the highperformance HDMI interface enabling reliable transmission of large amounts of data at high speed has become widespread, bringing with it the need for noise filtering capable of handling very high signal speeds.

To meet these needs, TDK released the TCM2010H miniature noise filter array for high-speed signal lines in 2007. "As a matter of fact, there were already filters on the

market for use with high-speed signal lines, both from TDK and from other manufacturers." says one of the developers, Tomokazu Ito who works at the TDK Shonai. "However, they all were coil types which require quite a bit of space. The TCM2010H was drastically different, because it is a thin-film type smallsized product capable of handling high signal speeds. This was made possible by applying our technology for forming films with micrometer-level precision."

The small dimensions of course enhance the usefulness of the product and its application scope, but that is not all. They also mean that fewer raw materials and less energy are consumed during the manufacturing process, and that the Print-circuit board and the final dimensions of the product in which it is used can also be smaller, thereby reducing the environmental load.

The engineers working on this project were aiming not only to create a product to fit an immediate need but also one that takes the wider context of the environment into consideration. This kind of attitude formed the background of the development of the TCM2010H.

## Perseverance Through Trial and Error Is the Key

TDK has a proud and successful history of technological breakthroughs, for example in the field of thin-film magnetic heads for recording media applications. Why not apply the thin-film technology and know-how gained in this process to the field of electronic components as well? That was one of the ideas that inspired Mr. Ito and his colleagues to develop a thin-film type noise filter.

But of course, it was not a matter of simply using the same technology as for magnetic heads. Developing the filter required first building various prototypes based on design specifications, and then evaluating and analyzing their actual performance. Where are the problems, why are the targeted results not achieved? The team identifies possible causes, and a new, improved prototype is built. This process must be repeated not once or twice but numerous times.

The common view at the time held that it would be virtually impossible to adapt thin-film type noise filters to high-speed signal transmission applications. And of course, no manual or primer existed to which one could turn when trying to find out why the prototypes didn't deliver the desired functions and performance. The only way for the development team to forge ahead was to keep on brainstorming, discussing the various aspects over and over, and persevering with the test runs. "The fact that we were expected to produce results within a fairly short time frame considerably added to the pressure that we felt. After all, our research, even if on an important topic, is not an end in itself, it only has meaning if it leads to a usable product within a reasonable period of time" remarks Mr. Ito as he looks back on this difficult time. Because the team was in novel territory, of course nobody expected them to succeed right away, but at times they did not even see a possible avenue for progress, and were left wondering where the light at the end of the tunnel might be coming from. It certainly was a trying time. Remarkably, however, nobody ever suggested to give up. The spirit of craftsmanship and of challenging a difficult task in the face of adversity is very strong in the entire TDK organization, and it naturally applies to the research and development staff working at the forefront of new product development as well.



Some of the team members who worked towards a common goal



"The cooperation among departments is what makes TDK special" says Mr. Ito.

After overcoming innumerable failures, the noise filter TCM2010H finally became a reality in June 2007, featuring a footprint that was about one half that of a conventional coil-type product. About one year had elapsed since the first prototype was built, and the efforts of the R&D team had now resulted in a breakthrough success.

## Collaboration and Cooperation Lead to Success

In the year following its introduction, the TCM2010H series, which successfully combined small dimensions with high performance, attracted considerable interest and received a lot of praise for the advanced technology it represents. The Nikkan Kogyo Shimbun awarded it the "CHO (Super)" MONODZUKURI Innovative Components Awards in the electric and electronic component category. "Of course, gaining recognition from a wider audience is a great joy and it provides the motivation for our work. But when hearing of the prize, even stronger was the feeling of gratitude to all the staff members in the various departments who had taken part in the development" reminisces Takeshi Okumura who worked with Mr. Ito on the project.

As indicated by this comment, the TCM2010H indeed was not solely the brainchild of the designers around Mr. Ito. The cooperation of many people in various sections of the organization, such as the evaluation and manufacturing department, employees from the magnetic heads department who worked on thin-film head development, and many others was vital during the process. "All of these people worked towards the same goal and shared the same concerns. That is what made the development possible. And we were keenly aware of their efforts, so we felt even more that we couldn't just fail or give up. The success of the TCM2010H demonstrates how important it is to strengthen the collaboration between different departments in our company when developing new products, something that not necessarily was a given in the past" says Mr. Ito.

Both Mr. Ito and Mr. Okumura agree: "Our first thoughts after the TCM2010H was released went along the lines of 'What comes next?' and 'How can we create something that's even better?'" The courageous spirit of many people working together sustains the TDK tradition of creating products in a craftsmanlike manner. This is the drive that is alive today and is carrying us into the future.