Feature
MCOIL™

Developed and commercialized by TAIYO YUDEN, the metal power inductor “MCOIL™” is attracting interest for its outstanding product competitiveness and future prospects for market expansion.

Awards Won by “MCOIL™”

MCOIL™ won the “2012 Product of the Year” award bestowed by the U.S. technology magazine “Electronic Products.”

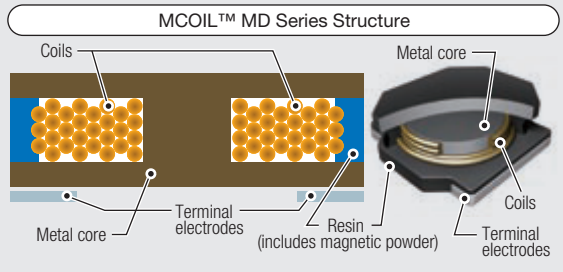
MCOIL™ won the “New Product & Novel Technology Award” at the 11th International Conference on Ferrites.

TAIYO YUDEN Paves the Way for a New Wave of Innovation in Inductors

Inductors, which generally take the shape of a conducting coil wrapped around a core, are basic components used in electronic circuits. Power inductors (also known as “choke coils”) are a type of inductor used in power circuits, and serve to stabilize circuit voltages.

To address the market demand created by increasingly stronger user needs for the lengthening of the battery operating time of compact digital devices such as smartphones and tablets and also in response to advances and increases in the functionality of these devices, there is a greater need for power inductors to be embedded in the internal circuitry of these devices to support larger currents. There are also strong calls for miniaturized and thinner power inductors that will make devices flatter and conserve more circuit space.

TAIYO YUDEN has developed a power inductor, called MCOIL™, that is attracting interest for satisfying these market needs. This power inductor is made of metallic magnetic materials (hereafter “metallic materials”) developed by TAIYO YUDEN. MCOIL™’s most significant feature is that it allows for the passage of large currents. This, coupled with a miniaturized and low-profile form, has caused an evolutionary development in the market in comparison to conventional power inductors made of ferrite (a ceramic material consisting primarily of iron oxide), which has been the main raw material until now. Power inductors using metallic materials can pass a current about 1.5 times larger than a ferrite inductor of the same size.



TAIYO YUDEN’s Newly Developed Metallic Material Our Competitive Advantages: High Strength, High Insulation, and High Magnetic Permeability

The main advantage of the metallic material developed by TAIYO YUDEN is that the new material does not contain organic binders*1. This is a significant product improvement in comparison with conventional metallic inductor materials.

TAIYO YUDEN ensures the insulation and strength of the metallic material by forming a highly crystalline and thin oxide layer on the surface of the metallic magnetic particles in the material. This achieves properties superior to conventional materials that use organic binders. This new metallic material allows TAIYO YUDEN to make extensive use of its proprietary manufacturing processes and related expertise, which have been cultivated through our vast experience with ferrite inductors. As a result, TAIYO YUDEN can achieve a consistently high level of product quality as well as being able to shorten development times and reduce costs.

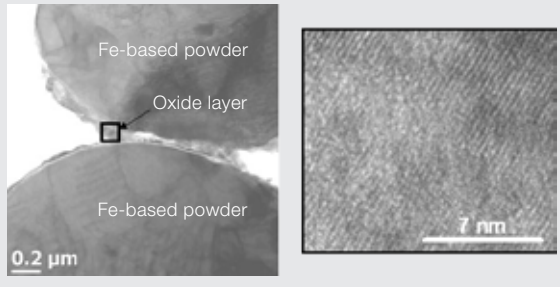
TAIYO YUDEN has successfully raised the magnetic permeability*2 of the new metallic material to roughly twice that of metallic materials containing organic binders.

In this manner, the metallic material developed by TAIYO YUDEN offers distinctive features, providing high magnetic permeability, along with both high insulation and high strength.

*1 Made from resins and other such materials, organic binders serve to bind metallic magnetic particles together and provide insulation.

*2 The magnetic permeability is a measure of the inductor core’s ability to concentrate magnetic force lines. The higher the core’s magnetic permeability, the stronger the magnetic flux, enabling direct current resistance to be held lower.

Electron microscope images of the metallic magnetic pressed powder material used in the metal power inductor MCOIL™



The right image is an enlargement of the square in the left image.

Another Feature of MCOIL™: The Device is More Resistant to Being Heated Up

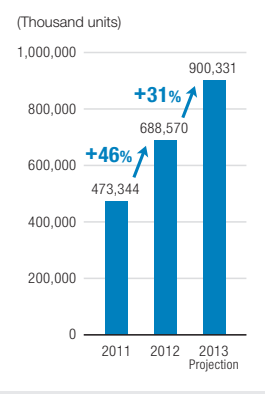
MCOIL™ possesses superior DC superimposition characteristics*3 compared to inductors using ferrite materials. Furthermore, because MCOIL™ possesses a higher magnetic permeability than metallic materials using organic binders, the direct current resistance can be lowered by reducing the amount of coil used in the inductor.

In the case of a power inductor that passes a large current, heat dissipation must also be suppressed as current passes through the inductor. Therefore, the capability of lowering the direct current resistance, which is a source of heat, provides a significant advantage. This means that MCOIL™ does not heat up easily—another key advantage of this device. A reduction of energy loss caused by heat dissipation will help to achieve a longer battery operating time as well. That this is a proven, important and key advantage for today's smartphones is beyond doubt.

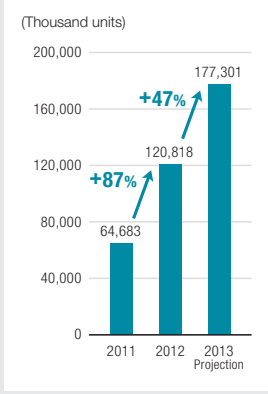
In addition, MCOIL™ is a composite material containing oxidation material, not organic binders. This makes MCOIL™ an excellent material for operation in high-temperature environments. MCOIL™ offers solutions for the development of applications in fields such as automobiles and industrial equipment, where higher reliability is strongly demanded under high-temperature conditions.

*3 The DC superimposition characteristics govern the amount direct current that can flow through the coil.

Global smartphone production volume



Global tablet devices production volume



Source: "World-wide Production of Major Electronics 2011—2013," Japan Electronics and Information Technology Industries Association (JEITA)

Outlook for MCOIL™: Continued Expansion Supported by Additional Applications Beyond Smartphones and Tablet Devices Markets

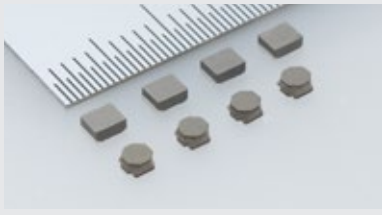
Smartphone and tablet shipments are projected to continue growing in the coming years and the number of ICs built into these devices is increasing in line with the higher functionality provided. For these reasons, demand for MCOIL™ is projected to continue to expand further.

Since the start of mass production in 2012, TAIYO YUDEN has upgraded and expanded the MCOIL™ lineup in order to meet a variety of needs arising from the smaller size of the final products in which MCOIL™ is installed. These needs include handling larger currents, fitting into smaller spaces, and suppressing heat dissipation. To meet these market demands, we are developing MCOIL™ products with an emphasis on them being smaller and thinner models.

Furthermore, MCOIL™ products have potential uses in fields other than smartphones and tablet devices, such as automobiles, industrial equipment and medical devices. For example, one particularly crucial requirement for automotive electronic components is for high reliability under stringent temperature conditions. As stated above, MCOIL™ does not use organic binders and offers strong advantages in terms of heat resistance and other temperature performance characteristics.

We will grow the market for MCOIL™ by expanding and upgrading the product lineup to suit a variety of applications.

MCOIL™ lineup



(Top) MA Series (EIA1008 size)
(Bottom) MD Series (2 mm square)

Thin products (Thickness: 1 mm)

MCOIL™ harbors the potential to become a game-changing product.

Toshiyuki Yagasaki

Product Development Department, Ferrite Application Product Division

When we started developing MCOIL™, the size of metal power inductors was generally around 8—10 mm square. The products were used mainly in laptops, such as ultra-books. In these circumstances and with an eye on the future evolution of digital mobile devices, we set out to develop an even smaller metal power inductor in order to differentiate ourselves from our competitors.

From the initial stage of selecting raw materials, the search for effective raw materials proved elusive, but we pressed on by repeating a process of trial and error. As we did so, we identified the possibilities of new materials that we would never have considered based on our previous line of thought. We studied the new materials extensively and finally succeeded in developing a new metallic material free of organic binders.

This discovery proved to be an exciting moment for our team. We set out to develop the world's best-performing inductor exclusively within the TAIYO YUDEN Group. With this strong determination, we rose to the challenge of meeting and exceeding the requirements defined by the extremely tough competitive environment we operate in, with the aim of supplying the market with the best-in-their-class product that we would be able to launch with confidence. With a high level of motivation, which permeates throughout TAIYO YUDEN's corporate culture, we did not give up on these goals and we energetically tackled this task. I believe that these factors were the driving forces behind the successful development of MCOIL™. As the next step, we intend to develop a variety of production applications that incorporate the features of MCOIL™.

MCOIL™ Production Sites

TAIYO YUDEN CO., LTD. Nakanojo Plant

The Nakanojo Plant is an inductor production headquarters responsible for operations ranging from product development to mass production.

Location: Nakanojo-machi, Agatsuma-gun, Gunma Prefecture

Chuki Seiki Co., Ltd.

Aiming to be a cutting-edge plant conducting world-class manufacturing, Chuki Seiki Co., Ltd. also manufactures products that are difficult to produce and require advanced production technology.

Location: Inami-cho, Hidaka-gun, Wakayama Prefecture

TAIYO YUDEN (PHILIPPINES), INC.

TAIYO YUDEN (PHILIPPINES), INC. is the TAIYO YUDEN Group's mass production base for inductors. The company commenced full-fledged mass production of MCOIL™ in 2013.

Location: Cebu, Philippines