

# The Market Trend Analysis of the MLCC Industry

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**Abstract.** With the advancement of science and technology, multilayer ceramic capacitors are playing an increasingly important role in electronic products. In this article, we will analyze the market size and competitive landscape of MLCC, as well as their expected development. This article will analyze the growth of the MLCC market by collecting historical and forecast data and identify the major manufacturers and suppliers by surveying the competitive landscape. Finally, the technological innovation advantages of the industry are studied and discussed, and the application scenarios are analyzed. In the fourth part, four MLCC manufacturers will be listed, namely Fenghua Advanced Technology, Sanhuan Group, Murata, and Yageo. Finally, it can be seen that the competition among manufacturers in the MLCC industry is still fierce, and it is developing rapidly in emerging fields. In addition, MLCC products tend to be miniaturized, lightweight, high capacitance, high frequency, and high temperature resistance. Through research, it can help investors better formulate market strategies, provide government regulators with suggestions for the development of the MLCC industry, and serve product development and market expansion, to promote technological innovation and healthy and sustainable development of the industry.

**Keywords:** Muti-layer ceramic capacitors; Market competition; Trend; Electronic.

## 1. Introduction

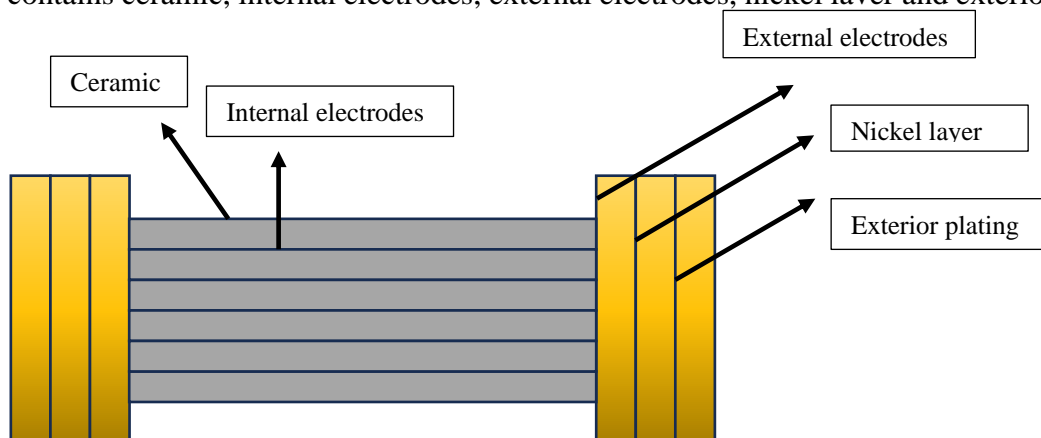
With the continuous advancement of science and technology, multilayer ceramic capacitors (MLCC) play an important role in electronic products. MLCC are a key electronic component that is widely used in power management, signal coupling, and filtering of electronic devices. As a basic passive component, ceramic capacitors occupy 56% of the capacitor market, of which MLCCs occupy more than ninety percent of the ceramic capacitor market due to their high temperature resistance, small size, and wide capacitance range [1]. As electronic products continue to become miniaturized and intelligent, the demand for MLCC is also increasing. Therefore, it is of great significance to conduct in-depth research on the development status and future trends of the MLCC industry.

This paper studies the growth trend of the market size of the MLCC industry, the competitive landscape, the direction and trend of technological innovation, and the application prospects in emerging technologies and application fields. This will help provide investors with market forecasts for the MLCC industry to better formulate strategies, provide policy recommendations for government regulators on the development of the MLCC industry, provide industry competitive intelligence to MLCC manufacturers, guide product development and market expansion, promote technological innovation in the MLCC industry, and promote the sustainable and healthy development of the industry.

This paper will analyze the market size and growth rate by collecting historical data and forecast data of the MLCC market. Second, analyzing the competitive landscape and key players in the MLCC industry, investigating the competitive landscape of the MLCC industry, and identifying major manufacturers and suppliers. Third, studying the trend of technological innovation and the latest technological progress in the field of MLCC. Then analyzing the application prospects, discussing the potential application prospects of MLCC in emerging technologies and application fields, such as 5G, Internet of Things, etc.

## 2. Historical Development

Before introducing the development history, let's learn about the MLCC structure through Figure 1, which contains ceramic, internal electrodes, external electrodes, nickel layer and exterior plating.



**Fig. 1.** MLCC structure (Photo credit: Original)

### 2.1. Initial Stage

The concept of MLCC first appeared in the late 50s and early 60s of the 20th century, which was initially used in the military and aerospace fields, and it was gradually used in consumer electronics.

### 2.2. 80s and 90s of the 20th Century

With the increasing popularity of electronic products and the increasing demand for portability, MLCC has begun to be widely used in various fields such as communication equipment, computers, and entertainment equipment. With the advancement of technology, R&D personnel began to study how to increase the capacity of MLCC while shrinking in size, which is also the development trend of MLCC themselves.

### 2.3. At the Beginning of the 21st Century

Due to the rapid development of mobile communication technology and the spread of smartphones, tablets, and various mobile devices, there is a surge in demand for small and high-capacity MLCC. As a result, the MLCC industry is expanding rapidly, and the competition among manufacturers is intensifying.

### 2.4. Recent Developments and Current Situation

The application of MLCC continues to expand to the fields of automotive electronics, medical equipment, industrial control, etc., especially in the field of automotive electronics, which drive the demand for high-temperature, high-voltage, and high-frequency MLCC in the entire MLCC market. In the current era of 5G technology development, MLCC, as the most important primitive component in electronic equipment, has ushered in a new development opportunity with higher operation quality requirements, which also shows that MLCC will develop in the direction of high frequency, low power consumption and small size [2].

### 2.5. Supply and Demand are Tight and Technological Advances

With the increase in the market demand for MLCC, the competition between suppliers has become more and more fierce, and the shortage of capacity and the lack of supply chain have become the focus of the industry. Meanwhile, with the continuous progress of manufacturing technology in the MLCC industry, such as the adoption of new materials, new processes, and 3D stacking technology, to improve its capacity density and performance. With the high integration and miniaturization of

integrated circuits, electronic components are also developing towards miniaturization, chip, and low cost [3].

## **2.6. Green Trends**

Because of the policy of promoting the construction of ecological civilization, people's awareness of environmental protection has been greatly improved, and the development of the MLCC industry has begun to focus on reducing the unfavourable impact on the ecological environment and exploring sustainable manufacturing and recycling solutions.

Simultaneously, with the continued sluggish demand for consumer electronics products and the outbreak of the new energy vehicle market, the demand for automotive-grade MLCC has grown rapidly, and several major Japanese MLCC manufacturers such as Murata Manufacturing Co., Ltd, TDK, and Murata Electronics, have accelerated the process of transformation to the automotive-grade market [4].

## **3. Factors that Influenced the MLCC Manufacturers**

The growth and development of the MLCC market is influenced by a variety of factors, including the proliferation of high-speed processors in high-end electronic devices, the expansion of 5G networks, and the increasing complexity and miniaturization of electronic circuits in smartphones and wearables. The development of the Internet of Things (IoT) is also key driver, with a significant increase in the number of IoT devices worldwide, requiring compact and efficient components like MLCC.

### **3.1. The Proliferation of High-speed Processors**

As a type of capacitor widely used in electronic devices, MLCC's main role is to provide capacitance in the circuit.

#### **3.1.1 Increased demand**

High-speed processors in high-end electronics often require more power stability and capacitance support. As a result, the demand for MLCC in these devices has increased substantially. This is a positive factor for the MLCC industry, as increased market demand is prompting manufacturers to expand capacity and increase production.

#### **3.1.2 Technology upgrades**

The popularity of high-speed processors has driven technological upgrades in electronic devices, including smaller, lighter, and higher-performance components. MLCC manufacturers must adapt to these new technical requirements and provide more advanced, higher-capacity, higher-frequency MLCC to meet the performance demands of high-speed processors.

#### **3.1.3 Material innovation**

To cope with the demands of high-speed processors, MLCC manufacturers may need to develop new materials and manufacturing processes. This may include the use of higher-grade ceramic materials, improved dielectric functionality, and increased temperature resistance of the capacitors. This innovation is critical to the long-term growth of the MLCC industry.

#### **3.1.4 Price fluctuations**

Due to the popularity of high-speed processors, the increase in demand for MLCC may lead to price fluctuations. The shortage of supply and demand may push up the price of MLCC, but as the market adapts, the price may stabilize. This requires industry players to be flexible in adapting their pricing strategies.

## **3.2. Expansion of 5G Networks**

### **3.2.1 Huge increase in demand**

The deployment of 5G networks requires many base stations and communication equipment, which have a huge demand for high-performance MLCC. The wide range of applications of MLCC in 5G devices includes RF filters, power amplifiers, antenna tuners, etc., so the popularity of 5G networks has directly led to a significant increase in the demand for MLCC.

### **3.2.2 High frequency and high-speed requirements**

5G communication networks require higher frequencies and faster data transmission speeds. This puts higher demands on the performance of MLCC, requiring higher frequency response and newer signal loss. Therefore, manufacturers should adapt to the new technical requirements and offer products suitable for high-frequency communication.

## **3.3. Changes in smart devices**

### **3.3.1 Miniaturization requirements**

The design of smartphones and wearables tends to be smaller and lighter. This means that components in electronic circuits, including MLCC, must have a smaller size. MLCC manufacturers need to offer smaller, lighter products to accommodate this trend while maintaining high performance and reliability.

### **3.3.2 High-density integration**

Increasingly complex electronic circuits require a higher level of integration to achieve more functionality and performance. The MLCC industry needs to provide high-density capacitors to meet the needs of device manufacturers to accommodate more electronic components in confined space.

### **3.3.3 Energy efficiency optimization**

Due to the limited capacity of batteries, device manufacturers are placing higher demands on the energy efficiency of electronic circuits. The energy efficiency optimization of MLCC has become critical to ensure reliability and performance in these devices.

### **3.3.4 Innovative materials and manufacturing processes**

To cope with the demand for miniaturization and high performance, MLCC manufacturers need to continuously innovate. For an example, the use of advanced ceramic materials and micro-manufacturing techniques is key to staying competitive.

## **3.4. The development of the IoT**

With the popularity of the IoT, the demand for MLCC for connectivity, sensing, and communication is increasing.

### **3.5.1 The number of devices has been proliferated**

With the rapid increase in the number of IoT devices, including sensors, embedded systems, etc., the demand for MLCC has also increased accordingly. IoT devices often require small, lightweight, high-performance capacitors to support their operation in different environments.

### **3.5.2 Sensor network requirements**

Sensor networks in the IoT have a particularly high demand for MLCC. Sensors are typically used for mobile phone environmental data and transmitted over the network to a central system. MLCC plays an important role in sensor networks to support stable operation and data transmission of sensors.

### **3.5.3 Long life requirements**

IoT devices are often placed in a variety of environmental conditions, such as outdoors, bad weather, etc. Therefore, MLCC needs to have good temperature resistance, moderate stability, and long life to ensure that the device can operate reliably under various conditions.

### **3.5.4 Communication requirements**

IoT devices need to communicate in a variety of networks, including wireless and low-power communications. As a key component of electronic circuits, MLCC is used to support the operation of communication modules and must adapt to differential communication standards and frequency requirements.

## **4. The Competitive Relationship and Advantages**

### **4.1. Fenghua Advanced Technology**

#### **4.1.1 The Introduction of Fenghua Advanced Technology**

Fenghua Advanced Technology is one of the leading MLCC manufacturers in China, focusing on the R&D and production of high-end MLCC products. Since its establishment, it has continued to promote resistors, capacitors, and inductors to become stronger and bigger, electronic materials to be more refined, and other products to be more professional. In 1985, Fenghua Advanced Technology took the lead in introducing an annual production line and technology of 100 million MLCC from the United States from the United States, laying the foundation for China's MLCC to catch up with the world's advanced level [5].

#### **4.1.2 Development Advantages**

Fenghua Advanced Technology has a large production scale and technology research and development capabilities, and has a certain market share in the fields of automotive electronics and communication equipment, and is committed to providing high-quality and high-performance MLCC products. However, at the same time, it is also facing fierce competition from Japanese and Korean companies, which need to continuously improve the products' quality and technological innovation.

### **4.2. Sanhuan Group**

#### **4.2.1 The Introduction of Sanhuan Group**

Sanhuan Group is also a well-known MLCC manufacturer in mainland China, with a long history of development and rich experience.

#### **4.2.2 Development Advantages**

Sanhuan Group focuses on providing MLCC products with a wide range of specifications, and has certain advantages in supply chain and cost control, focusing on product diversification and mass production capabilities. But at the same time, it is also necessary to improve the technical content and service level of products, so as to face the pressure from domestic and foreign competitors.

From the perspective of MLCC production capacity, MLCC production capacity was once concentrated in Japanese and Korean companies, such as Taiyo Yuden, Murata, TDK, and Samsung Electro-Mechanics, and led in cutting-edge products, ceramic powder technology and production capacity [6].

### **4.3. Murata Manufacturing**

#### **4.3.1 The Introduction of Murata Manufacturing**

Murata is one of Japan's most well-known MLCC manufacturers, with the world-leading technology and market share. The company has been focusing on the production of MLCC for residential and automotive applications, offering MLCC in various sizes for different applications. Murata's MLCC business is the core of the company and accounts for a significant proportion of its total revenue.

Murata is the world's first company to mass-produce 008004-size MLCC, i.e., chip MLCC, with a global market share of nearly 31%, of which smartphones have a market share of 40% [7].

Over the years, Murata has continued to expand and strengthen its MLCC business through various acquisitions, including the acquisition of ROHM's MLCC business in 2007 and the acquisition of Panasonic's ceramic capacitor business and Showa Denko's functional polymer capacitor business in 2009.

#### 4.3.2 Development Advantages

Murata Manufacturing has an important position in the high-end MLCC market, and has led technological innovation capabilities and quality management capabilities. It is widely used in automobiles, smartphones, and other fields. However, it also faces market competition from China and other regions, and needs to continuously increase production capacity and innovative R&D technology to maintain its leading position in the global market.

#### 4.4. Yageo Corporation

##### 4.4.1 The Introduction of Yageo Corporation

Yageo Corporation is one of the leading manufacturers of passives components in Taiwan, and has a unique position in the industry. When high-frequency MLCC applications such as mobile communications, RF modules, and telecom networks require miniaturized capacitors due to more functionality, complexity, and portability in a limited space, Yageo CQ 01005 series is the best choice to make client processing more efficient [8].

##### 4.4.2 Development Advantages

Yageo Corporation attaches more attention to providing high-quality and high-performance MLCC products, which are widely used in the field of electronic products and have a certain brand influence, but it also needs to improve its market expansion capabilities.

### 5. Development Advantages of the MLCC Industry in Various Regions

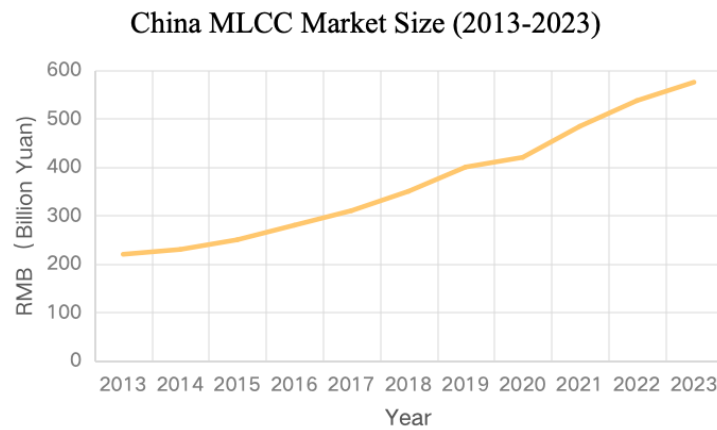
Competitive landscape. In the global MLCC market, major manufacturers are concentrated in Japan, South Korea, Taiwan, the United States, and China. China MLCC manufacturers account for about 7% of the global share.

#### 5.1. China

From 2013 to 2023, the market size of the MLCC industry in the Chinese market has the following data. At the same time, Table 1 and Figure 2 show that the market has been growing continuously over the past decade, with a clear upward trend, and the market is developing strongly (from China National Database).

**Table 1.** The Data of Chinese MLCC Marketing

	2013	2014	2015	2016	2017	2018
RMB (100 million yuan)	220	230	250	280	310	350
	2019	2020	2021	2022	2023	
RMB (100 million yuan)	400	420	484	537	575	



**Fig. 2.** China MLCC market size from 2013 to 2023 (Photo credit: Original)

In addition, as a global manufacturing hub, it has strong production and manufacturing capabilities to help meet the increasing demand for MLCC markets. At the same time, China is also one of the world's largest electronic product markets, and components such as MLCC have great potential in both domestic and export markets.

China MLCC enterprises actively participate in the global supply chain and have established extensive cooperative relations with international enterprises, including technical cooperation with multinational companies and cooperation with global electronic manufacturing service providers, which will help these domestic enterprises obtain advanced technology, improve product quality, and promote competitiveness in the international market. China MLCC companies provide global customers with competitive product prices through scale effect and relatively low cost.

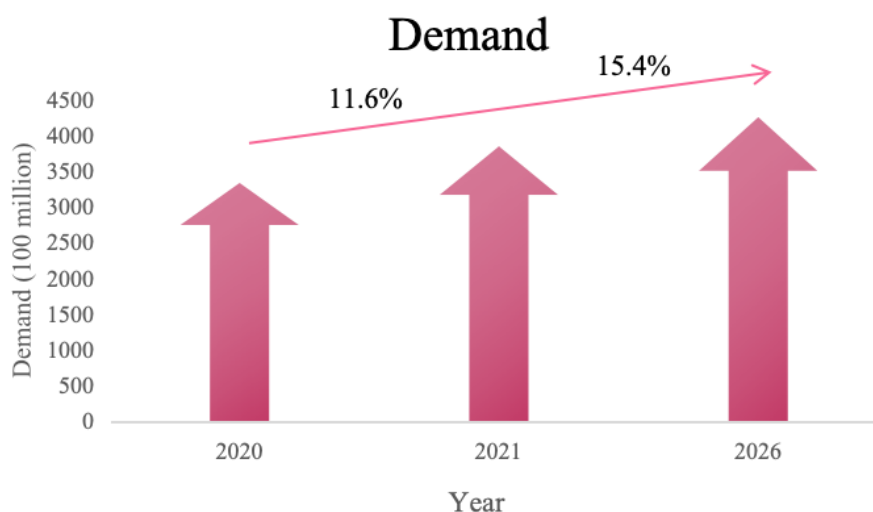
### 5.1.1 Market size

The size of China's MLCC market has continued to grow since 2017. The market size was 31 billion yuan in 2017 and will grow to 48.4 billion yuan in 2021, with a compound annual growth rate of 11.8%. By 2022, the market size is expected to reach 53.7 billion yuan, and it is expected to increase to 57.5 billion yuan in 2023.

China is a major importer of MLCC products, with an imbalance between supply and demand and a high degree of dependence on foreign countries. According to the China Electronic Components Industry Association, the global MLCC market size reached 101.7 billion yuan in 2020, a year-on-year increase of 11.1%, and it is expected that the global MLCC market will continue to grow to 114.8 billion yuan in 2021, a year-on-year increase of 12.9%, and will increase to 149 billion yuan by 2025, with a five-year compound growth rate of 7.9% (the data comes from the China Electronic Components Industry Association).

### 5.1.2 Demand

In 2020, the demand for MLCC in China increased to 3335 billion (see figure 3), a year-on-year increase of 11.6%. In 2021, the demand further increased to 3848 billion, a year-on-year increase of 15.4% (based on the China National Database). Based on a growth rate of 15.4%, the demand is expected to reach 4257 billion by 2026.



**Fig. 3.** China Market Demand (Photo credit: Original)

### 5.1.3 Imports and exports

According to 2021 data, China's MLCC import volume was 3.45 trillion units, a year-on-year increase of 12%, and the export volume was 2.02 trillion units, a year-on-year increase of 23.9% (the data comes from the China National Database).

### 5.1.4 Downstream demand

The mobile phone market is a major demander for MLCC. In 2021, China's mobile phone production exceeded 1.66 billion units. On ordinary, about 1,000 MLCC is needed per phone. The automotive industry is also important demand side, with the demand for MLCC increasing with the development of electric vehicles and smart cars.

However, it must be noted that some companies are facing the problem of insufficient brand awareness in the international market, and need to gain more customer trust by improving brand image and product quality.

## 5.2. Japan

Japan has achieved remarkable results in expanding into the international market through an active internationalization strategy. For example, they have expanded their market share globally by establishing global supply chains, opening overseas branches, and working with international partners. This global business model enables Japanese MLCC companies to better adapt to the needs of different countries and regions.

Murata Manufacturing, a Japanese industry giant, started its business, and its main product was titanium oxide ceramic capacitors, and later continued to develop and upgrade ceramic process technology. With the rapid development of the electronics industry in Japan and the world, Murata has gradually gained a place in the global market while rapidly occupying the domestic market [9].

The process of expansion can be divided into two periods: (1) From 1944 to 2005: Quickly occupy the market by using technology and scale advantages; (2) Since 2006, it has stabilized its market position, and it is also a period of M&A development. By expanding the coverage of production lines and multi-field layout, it will consolidate its leading position in the global market.

## 6. Suggestions

Overall, the MLCC industry in Asia is characterized by fierce competition and high level of innovation. It has its own advantages in technological innovation, manufacturing capacity, and international market expansion. Competition from low-cost manufacturing countries is a common

challenge, as is the uncertainty of the international trade environment. In the face of the new situation, it is urgent to increase an investment in R&D and strengthen the self-sufficient and controllable and affluent innovation of the industrial chain [10].

### **6.1. Technological Innovation**

Firstly, the industry will continue to pursue MLCC products with higher capacity, smaller size, and higher performance to meet the needs of intelligent and miniaturized devices. Secondly, expand product lines to meet the needs of different industries and applications, and reduce the impact of single market fluctuations on enterprises. Thirdly, promote digital transformation, optimize production processes, improve production efficiency, and reduce production costs.

With the development of mobile devices, a domestic enterprise adjusted the research direction in a timely manner, vigorously promoted the innovation of advanced technology and materials, and shifted from the current mainstream micro 0402 and ultra-micro -1 generation 0201 sizes to the development and production of smaller ultra-micro - 2 generation 01005 and other sizes, and completed mass production technical reserves to meet market demand [11].

### **6.2. Emerging Application Areas**

The application of MLCC in emerging fields such as electric vehicles, 5G communications, and artificial intelligence will continue to grow, and enterprises and manufacturers in this industry need to pay more attention to the development trends in these fields, continue to increase an investment in R&D, improve the technical level, and gain a first-mover advantage. To meet the ultra-high requirements for capacity and transmission speed of 5G communication technology, MLCC materials need to be used more frequently in setting the microwave Q value. Since the Q value of the RF end will directly affect the broadband result, the high additional Q value and low resistance series connection can improve the application status of MLCC products in the communication industry [2].

### **6.3. Environmentally Friendly and Sustainable**

Increasing research on environmentally friendly materials to reduce the contrary impact of the production process on the environment is in line with the global trend of sustainable development. Emphasizing environmental protection and sustainable management, and enhancing corporate social responsibility by reducing waste and improving resource efficiency. As the demand for consumer electronics continues to be sluggish, the new energy vehicle market has exploded, and the demand for automotive-grade MLCC has grown rapidly. The moderate annual growth rate of car sales will exceed 30%, and the proportion of new energy vehicles in automobile sales will exceed 50% in 2025, which is five times the sales volume in 2021, and the resulting automotive MLCC market growth will reach 2 billion US dollars [4].

### **6.4. Supply Chain Management**

Enhancing supply chain transparency can ensure supply chain stability by reducing reliance on rare materials. Build a flexible supply chain management system to better adapt to fluctuations in market demand and changes in the global trade environment. Meanwhile, as an important role in the supply chain, agents should actively help manufacturers alleviate the problem of shortage of stock, including sharing this information with upstream suppliers according to changes in market demand, so as to help them effectively improve delivery time and stabilize supply. It can also do a good job in supplier resource planning, and continuously enrich and optimize the supplier resource pool [12].

## **7. Conclusion**

The purpose of this paper is to study the analysis of future development trends based on the current development status of MLCC. This paper analyzes its development history, factors affecting the MLCC industry, and regional manufacturers, and gives final suggestions based on the current

situation. The MLCC industry has undergone continuous expansion and technological innovation from the military field to consumer electronics, mobile devices, automotive electronics and other fields. What's more, it has become one of the indispensable and important components in dot and band electronics. In the future, with the new development of technologies such as the IoT, artificial intelligence, and 5G. The MLCC industry will continue to usher in new growth opportunities and challenges. Considering technology, market and environmental factors, MLCC companies need to maintain flexibility and innovation in the future to adapt to the rapidly changing market. It can be seen that the competition between manufacturers in the MLCC industry is still fierce and is developing rapidly in emerging fields. MLCC products tend to be miniaturized, lightweight, high-capacitive, high-frequency, and high-temperature resistant. Based on the current situation of the MLCC industry, it is recommended that manufacturers should continue to innovate products, always pay attention to new application fields, so that products can meet technological changes. Manufacturers should also adopt new manufacturing processes and mining new materials to achieve environmental protection goals, while doing a good job in supply chain management, improving transparency, ensuring sufficient inventory, and being flexible.

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