Report
Material Shortage & Price Trend
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Executive Summary

Since last year, price increases and extended lead times have been witnessed across many electronic component manufacturing segments. This report provides a preview and analysis of some heated segments such as MLCC, inductor and resistor. A preliminary market overview was performed, and major players were analyzed in every segment to provide a whole picture.

Though MLCC and resistor prices have been increasing over the last two years, the reasons behind this price surge phenomenon are not all the same.

MLCC price increase is majorly driven by the significant demand from the automotive and smartphone industries. The current capacity is unable to keep up with a substantially higher demand. Adding to this, key players such as TDK and Kyocera exited the general MLCC market to focus on the more profitable electric automotive industry, further exacerbating the situation. Even worse, Murata decided to cut 50% of its production capacity for conventional MLCC lines in 2018. Prices of raw materials such as nickel, copper and palladium have also been climbing since the end of 2015, putting more cost pressure on MLCC manufacturers. Fortunately, Taiyo Yuden, Samsung Electro-Mechanics, Yageo and Fenghua Advanced Technology are all going to expand their capacity. The supply and demand imbalance should get better by the end of this year.

In January 2018, at least 7 resistor manufacturers announced price increases, and some have increased twice since the beginning of this year. The overall price of ruthenium, primarily used as a thick film paste in thick film chip resistors, has increased in value by 413.5% since April 2017. On a month-to-month basis, the price of ruthenium metal has skyrocketed to $215 USD per Troy ounce in April 2018. Current major manufacturers are very wary of expanding their capacity. The price increases and lead time extensions happening in the resistor manufacturing segment show no sign of turning around this year.

The largest manufacturers in these segments are Japanese, South Korean and Taiwanese companies and the depreciation of the U.S. dollar hurts their revenue, leading to growing pressure in costing.

In terms of inductors, so far only CHILISIN has announced a price increase of one of its inductors however it is seen as an early warning sign that a wave of inductor price increases will hit the market.

There is no clear indication as to when the shortage issue will be resolved nor when the price increases will end. Considering that some manufacturers have plans to expand the capacity, there is hope that the current shortage and price increase conditions will taper off by the end of this year.
I. Multilayer Ceramic Capacitors (MLCC)

Beginning last year, the signs of a solid upturn (extended lead times and more robust demand) for multilayer-ceramic capacitors became increasingly evident and the situation has grown in severity over the past year.

Market Overview of MLCC 2017

![Global MLCC Market Share](image)

Overview of Current Manufacturers

As far as competition is concerned, major global MLCC manufacturers are mainly from Japan, South Korea, and Taiwan and include Japan’s Murata, TDK, Taiyo Yuden and KYOCERA/AVX, South Korea’s Samsung Electromechanics and SAMWHA, and Taiwan’s Yageo and Walsin.

Tier 1: Murata, Kyocera, TDK, Samsung

Tier 2: Walsin, Yageo, Holy Stone

Tier 3: Guangdong Fenghua Advanced Technology, Eyang Technology Development, Chaozhou Three-Circle Group
MLCC Supply Chain

The chart below shows the upper and lower stream supply chains within MLCC manufacturing and applications. The predominant application of MLCC is in areas such as consumer electronics, industrial, telecommunication, automotive and data transmission. Almost all areas have strong growth momentum, driving up the demand for MLCC.

MLCC Cost Structure

As far as the cost structure is concerned, due to differences in the use of raw materials, the cost composition of low/high-capacitance products are quite different. This is mainly reflected in ceramic powder and packaging materials.

<table>
<thead>
<tr>
<th>Cost Structure</th>
<th>% of Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low Capacitance</td>
</tr>
<tr>
<td>Labour Cost</td>
<td>10% - 20%</td>
</tr>
<tr>
<td>Ceramic Powder</td>
<td>20% - 25%</td>
</tr>
<tr>
<td>Inner Electrode (Nickel, Palladium-Silver)</td>
<td>5%</td>
</tr>
<tr>
<td>Outer Electrode (Copper, Silver)</td>
<td>5%</td>
</tr>
<tr>
<td>Packaging</td>
<td>20% - 30%</td>
</tr>
<tr>
<td>Equipment Depreciation</td>
<td>20% - 35%</td>
</tr>
</tbody>
</table>

HCS Index *
The international MLCC electronic ceramic materials are monopolized by Japanese and American Ferro companies. Japanese manufacturers, including Sakai Chemicals, Japan Chemicals, and Fujitsu Titanium, together account for about 75% of the global market. The MLCC manufacturers don’t have negotiating power for better price.

**Price Increase**

On March 7, 2018 Murata raised prices for its general-type multi-layer ceramic capacitors at the same time cutting back production capacity for its conventional product lines. Murata plans to cut 50% of production capacity for its conventional MLCC line in 2018 and will continue to reduce output for these general-type products while increasing their focus on advanced, small-size and high-performance MLCCs.

Prior to Murata’s announcement, Japanese manufacturer Kyocera decided to cut back production of certain MLCC products, such as size 0402 and 0603 by the end of February. Unfortunately, these products are in high demand and suffer from the most serious shortage issues.

Also, in March, Walsin Technology decided to raise the price on all MLCC product items with effective date of March 12, 2018.

Taiwan’s giant MLCC manufacturer Yageo will implement new price as of April 1, 2018. For the size 0201-1206 series, the average unit price became 2-5 times higher than what it was in February of this year, while pricing for some 0201 MLCC increased 200 times. Additionally, pricing will no longer be applied according to the contract but instead by the date of shipment; pre-existing contracts will all be subject to these increases.

On April 4, 2018 Samsung Electro-Mechanics (SEMCO) released a price increase notice to its distributors stating that SEMCO will be adjusting their MLCC pricing starting May 1st. The range of price increases is not yet published.

**Reason for Increase**

The widening imbalance between supply and demand over the past year has driven prices higher; some contributing factors are:

1) TDK faded out of the general MLCC market mid-last year, which worsened the imbalance. In 2018, Kyocera decided to stop production of some size 0402 and 0603 MLCCs. Murata plans to cut 50% of production capacity for its conventional MLCC line in 2018.

2) Top tier manufacturers have allocated resources to the more profitable automotive industry; Tier 1 manufacturers have shifted focus to this small size, high capacitance, high-end market. It is estimated that each car needs 3000 MLCCs compared to the 700 required for a smartphone.
3) High demand driven by smartphones, including those from Samsung and Apple, increases the gap between need and availability.

![Global smartphone shipments forecast from 2010 to 2021 (in million units)](image)

*Statista* ³

4) Strong demand from the automotive industry.

![MLCC Demand from Automotive Industry (10B pc)](image)

*Zhiyan Consulting* ⁴
5) Since the majority of MLCC manufacturers consist of Japanese, Taiwanese and Chinese companies, there is added pressure from currency appreciation. The exchange rate of these local currencies to USD has been climbing since last year. When revenues in USD are converted back to local currencies, the manufacturers end up with far less. In turn, they have less local currencies to cover their manufacturing expense.

*Currency exchange TWD to USD*

*Currency exchange JPY to USD*
6) At the end of last year, China had shut down up to 40% of its factories in an unprecedented stand against pollution. The raw material suppliers of MLCC were impacted by this initiative of environmental policy enforcement, leading to tighter supply in the upstream.

7) The price of key metals used for MLCC production also drives up MLCC price. Prices of raw materials for all key metals consumed in the MLCC increased in 2017 and continue to do so in 2018; nickel, copper and palladium show the greatest increase in price and impact on MLCC.
### Future Trend

The good news is that all major MLCC manufacturers have started to expand their production capacity however the construction period is very long. The huge supply and demand imbalance will only start to get better by the end of 2018.

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Expansion Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Taiyo Yuden</strong></td>
<td>TOKYO, November 8, 2017 - NIIGATA TAIYO YUDEN CO., LTD, a subsidiary of TAIYO YUDEN CO., LTD., announced that it will construct a new plant, Building No. 3, at their Niigata site. The plant will be completed in December 2018 and will meet increasing demand for multilayer ceramic capacitors.</td>
</tr>
<tr>
<td><strong>Samsung Electro-Mechanics</strong></td>
<td>Samsung Electro-Mechanics will concentrate on expanding manufacturing capacity for MLCC for automobiles and industrial use. It will also expand MLCC production lines in Tiajin, China and the Philippines for the consumer electronic industry.</td>
</tr>
<tr>
<td><strong>Yageo</strong></td>
<td>Yageo will invest US$170,550,000 to expand 10% capacity. Monthly MLCC output will be 41B pieces.</td>
</tr>
</tbody>
</table>
II. Inductor

Market Overview of Inductor 2017
In the inductor market, the top 3 manufacturers are Murata, TDK and Taiyo Yuden, all Japanese companies. They take up 40% of the total inductor market. In 2018, CHILISIN (Taiwanese company) acquired Mag Layers, thus increasing its market share to 11%.

Price Increase
In response to the continuous cost increases in raw material and labor, CHILISIN’s operating costs have risen substantially. To continue to provide better products and services to its clients, on March 28, 2018 the company announced a price increase for CLH1608T series items; unit prices were raised by 45% to 68%. CLH1608T is one of CHILISIN’s multilayer high frequency inductor series.

Reason for Increase
1) Since April 2016, the price of copper has increased from nearly $2 USD per pound to $3.07 USD per pound, more than a 30% jump.
2) Strong demand from smart phones, smart devices and automotive
   The average number of inductors in traditional mobile phones was about 20-30. There are more than 200 inductors in an iPhone and their use in iPhone8 and iPhoneX will continue to increase. Inductors will continue to be an indispensable component in electronic products as well as in existing downstream applications such as PCs and smart phones. The continuous development of new applications such as automotive electronics, LED lighting, wearable devices and smart homes will also open new growth opportunities for inductors.

Future Trend
It is still unclear whether other companies will follow CHILISIN’s lead to increase their inductor prices. There are two divergent market options; one side believes it is an isolated event and the other side thinks it is an early sign of further price increases from other major players.
III. Resistor

Market Overview of Chip Resistor 2017

Overview of Current Manufacturers
As shown above, Yageo is the leader in the chip resistor market, accounting for 34% of the total market share. Among the top 5 manufacturers, Yageo is a Taiwanese company, KOA, Panasonic and Rohm are Japanese companies and Vishay is a US company; Asian companies take up more than half of the global market share.

Price Increase
The wave of price increases on resistors continues.

March 05, 2018: EVER OHMS announced an increase to the price of its resistors (sizes 0201, 0402, 0603, 0805, 1206, 022R and 024R) by 15% to 30%. New prices took effect on March 9th.

March 06, 2018: As the cost of raw materials continues to rise, and the inventory levels continue to drop, Ralec announced that the price of some thick film resistors would rise by more than 25% and that they would only accept purchase orders using the new unit prices. The price adjustment applies to 0402, 0603, 0805, 1206, 1210, 2010, 2512 series chip resistors as well as 0402 Array and 0603 Array series chip resistors. New prices took effect immediately. This was the second time this year that Ralec increased its prices; on January 2, 2018 they announced a price increase of 15% for chip resistor sizes 0402, 0603, 0805 and 1206 which was effective immediately.

March 20, 2018: Viking Tech issued a price increase notice, indicating that due to the substantial increase in the cost of thick film resistor materials (packages, pastes, plating materials, and ceramic substrates), the prices of some products must be adjusted. This adjustment applies to CR0201/0402/0603/0805/1206/1210/2010/2515/2512/CN-43J/CN-42J SMD chip resistors and array chip resistors.
**March 27, 2018:** RoyalOhm announced their second increase to the price of chip resistor sizes 0402-2512 and Array chip resistors; this increase of 25-30% took effect on April 1st. RoyalOhm had previously issued a public notice on January 18, 2018, stating that, due to the environmental protection requirements, the price of raw materials and the continually increasing operating cost of the company, product prices would be adjusted effective February 1, 2018. At that time, a 15-20% increase was applied to the current selling price of 0402 - 2512 chip resistors and Array chip resistors.

**April 8, 2018:** LIZ Electronics’ selling price increased by 20-30% on all of its thick film resistors. This follows a 15% increase that had taken effect on January 9, 2018.

**Reason for Increase**

1) Supply and demand imbalance
   
   At the end of December 2017, Yageo announced that they would no longer accept new orders for general products of thick film resistors because the demand is far greater than the existing production capacity. On February 21, 2018, Ralec stopped accepting new orders for thick film resistors. This news signals the market demand for resistance is in short supply.

2) Raw material price increase
   
   The price of ruthenium metal skyrocketed to $215 USD per Troy ounce in April on a month-to-month basis. The overall price of ruthenium, whose primary use is as a thick film paste in thick film chip resistors, has increased in value by 413.5% since April 2017.

3) Chinese Government launched an environment protection tax law
   
   On January 1, 2018, the environmental protection tax law of China was formally implemented. This burden on electronic component manufacturers pushes up the cost of manufacturing so they increase the sell price to compensate for the extra tax.
4) Currency appreciation
Most resistor companies are Taiwanese companies. In the past year, the US dollar has appreciated almost 5%. The resistor manufacturing industry is a low-margin industry and this 5% currency appreciation impacts the business bottom line significantly.

**Future Trend**
There has been no capacity expansion news from resistor manufacturers or their upstream ceramic substrate manufacturers. The price increase, long lead time and shortage will continue until the end of this year at least.
## APPENDIX

### MLCC Demand: Automotive Industry

<table>
<thead>
<tr>
<th></th>
<th>Electric</th>
<th>Hybrid/Plug in Hybrid</th>
<th>Mild Hybrid</th>
<th>Fuel-efficient</th>
<th>ICE (Internal combustion engine)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2016 Annual Usage</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Car Output</td>
<td>46</td>
<td>368</td>
<td>1474</td>
<td>737</td>
<td>6585</td>
</tr>
<tr>
<td>MLCC usage (10B PC)</td>
<td>83</td>
<td>442</td>
<td>707</td>
<td>287</td>
<td>1976</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3495</td>
</tr>
<tr>
<td><strong>2017 Annual Usage</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Car Output</td>
<td>94</td>
<td>514</td>
<td>1683</td>
<td>842</td>
<td>6218</td>
</tr>
<tr>
<td>MLCC usage (10B PC)</td>
<td>168</td>
<td>617</td>
<td>808</td>
<td>328</td>
<td>1865</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3787</td>
</tr>
<tr>
<td><strong>2018 Annual Usage</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Car Output</td>
<td>113</td>
<td>788</td>
<td>2363</td>
<td>1280</td>
<td>4922</td>
</tr>
<tr>
<td>MLCC usage (10B PC)</td>
<td>212</td>
<td>945</td>
<td>1134</td>
<td>499</td>
<td>1477</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4267</td>
</tr>
<tr>
<td><strong>2019 Annual Usage</strong></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Car Output</td>
<td>187</td>
<td>935</td>
<td>2619</td>
<td>1403</td>
<td>4396</td>
</tr>
<tr>
<td>MLCC usage (10B PC)</td>
<td>337</td>
<td>1122</td>
<td>1257</td>
<td>547</td>
<td>1319</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4582</td>
</tr>
</tbody>
</table>
Price Increase Notifications

CHILISIN

Translation:
To our respectful partners,

Due to the continuous cost increase in labor and raw material, our operating cost has been growing significantly. To sustainably provide better service and products, we decided to adjust price of our CLH1608T series. The price will increase 45%-68%.

The new price takes effect immediately.

Mar 28th, 2018
Translation:
To my respectful partners,

Considering that the raw material price continues to rise and the inventory level continues to drop, we decide to adjust the selling price of thick film resistor by more than 25%:

1) Series: 0402, 0603, 0805, 1206, 1210, 2010, 2512 SMD chip resistors
2) 0402 Array, 0603 Array resistors

We will provide new quotes to you and will only accept purchase orders according to new quotes. Thanks for your understanding and support.

Mar 05th, 2018
To my respectful customers and distributors,

Thanks very much for your long-term support and trust on LIZ.

To adjust the imbalance between supply and demand and the cost pressure because of raw material price increase, we decide to adjust the selling price as follows,

Thick film resistors: all series and Array resistors; price adjustment: 20%-30% increase

Diodes: 15% increase

Protective devices: 15% increase

We really appreciate your understanding and support. Millions of thanks!

Apr, 08th, 2018
Translation:

To my respectful partners and end users,

Thanks for your long-term support and trust. To solve the imbalance between supply and demand and the material shortage issue. We decide to adjust our product price.

- Price increase applied to: 0402~2512 chip resistors and all Array chip resistors
- The price will increase 25~30%
- New price takes effect on 1st, April 2018
- Brand impacted: ROYALHOM, UniOhm

Thanks. Mar 27th, 2018
Translation:

To respectful customers,

Because of the strong demand from our customers, our current capacity cannot meet customer’s demand. To guarantee the delivery, we decided to adjust the price for below products:

Products: 0201, 0402, 0603, 0805, 1206, 022R, 024R

Price increase range: 15%-30%

New price takes effect on March 9th, 2018.

We really appreciate your understanding and continuous support. Sorry for any inconvenience it brings to you.

Mar 5th, 2018
SOURCES


