Report

Material Shortage & Price Trend

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July 21, 2017

SiLECTA
Streamlining Progress

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Material Shortage & Price Trend

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Introduction

Since last year, price increase and extended lead time have been witnessed across many electronic component manufacturing segments. This report is to provide a preview and analysis of some heated segments in the electronics manufacturing industry such as MLCC, DRAM, Microcontroller Unit and NOR Flash. A preliminary market overview was performed and major players were analyzed in every segment to provide a whole picture.

Pervasive price increases and lead time extensions are happening in these segments with no sign of the trend turning around this year. An investigation of the reason behind these unprecedented changes determined that it mostly resulted from the current capacity being unable to keep up with a substantially higher demand. Strategy changes from major manufacturers further exacerbate the situation. A major player’s exit may lead to a huge imbalance between supply and demand, driving up price and prolonging the lead time. Additionally, current major manufacturers are very wary of expanding their capacity; the largest MLCC manufacturers are Japanese, South Korean and Taiwanese companies and the depreciation of U.S. dollar hurts their revenue, leading to growing pressure in costing.

This report includes a future trend probability which is provided to assist buying parties (e.g., EMS, OEM) in preparing their supply chain and production mitigation plans.
I. Multilayer Ceramic Capacitors (MLCC)

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

Market Overview of MLCC 2016

![Global MLCC Market Share Chart]

*Passive electronic components: World Market Outlook 2017-2022*

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 Electro-Mechanics 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

Price Increase

MLCC price has increased significantly this year. Take Yageo as an example, it has increased its MLCC prices approximately 40% this year alone.

Reason for Increase

The widening imbalance between supply and demand this year has driven prices higher; some contributing factors are:
1) TDK faded out of the general MLCC market mid-last year, which has worsened the imbalance.

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. Large MLCC manufacturers are currently preparing MLCC for the iPhone 8 but, considering the forecasted smartphone demand in coming years (see chart below) this gap will quickly become a crevasse if manufacturers do not expand their production capacity.

4) After the Galaxy Note 7 battery explosion saga last year, Samsung Group started initiatives to enhance quality management and improve product quality. This overhaul resulted in a Samsung MLCC material shortage and long lead time.

5) Capacity expansion is very slow. Annual expansion rates are around 5% to 8%, far less than the increasing demand.

6) Since the majority of MLCC manufacturers consist of Japanese, Taiwanese and Chinese companies, there is an 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.
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Currency exchange TWD to USD

Currency exchange JPY to USD
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**Exchange rate CNY to USD**

![Exchange rate CNY to USD graph](image)

*Google Finance*

**Lead Time**

Lead times continue to rise, especially for large case size and high capacitance capacitors.

![Lead Time graph](image)

*Passive electronic components: World Market Outlook 2017-2022*
**Future Trend**
Nearly all top manufacturers are currently running at 90%-95% of their capacity and most do not have plans to expand this year. Shortages will continue until the end of this year at least.

**II. DRAM**

**Market Overview of DRAM 2016**
The oligopolistic market situation continued with no plan for capacity expansion.

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*Source: Gartner, NTC*

**Overview of Current Manufacturers**
As shown the chart below, 3 top manufacturers dominate the whole DRAM market, taking up 93% of total global market share.

<table>
<thead>
<tr>
<th>Global Revenue Ranking of Branded DRAM Manufacturers (Million US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ranking</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>Others</td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
</tbody>
</table>

*DRAMeXchange February 2017*
**Reason for Increase**

1) These three companies want to maximize their profitability by maintaining the current situation rather than aggressively competing for market share through price reduction or capacity expansion. Into the 2\textsuperscript{nd} half 2017, the top 3 do not have any plans to expand their capacity.

2) As the largest supplier in the DRAM market, Samsung want to increase their profits from DRAM in order to compensate for the huge loss incurred from the Galaxy Note 7 faulty battery event.

3) While Samsung and Micron have begun work on the 18nm and the 17nm processes, they have encountered some bottlenecks. Samsung is planning to finish development of the 17nm DRAM by the end of 2017, with mass production to start in 2018 which implies that the market supply will be expanded. However, according to Avril Wu, Research Director of DRAMeXchange, “both Samsung and Micron have encountered setbacks related to sampling and yield, so the supply situation remains tight going into the second quarter and PC DRAM prices will continue to rise through this three-month period.”

4) Tech research firm TrendForce mentioned in a report that a nitrogen gas dispensing system malfunction had led to the contamination of wafers and equipment in one of Micron's facilities near central Taiwan.

The incident reportedly occurred at the beginning of July and production was impacted through to the middle of the month; some output had to be scrapped.

According to TrendForce, Micron suspended the production line at one of its two plants from the start of the month – a move that could impact PCs, servers and mobile memory chips.

Their report indicated that, “The malfunctioning of the nitrogen gas dispensing system led to the contamination of wafers and equipment in the facility.”

This equates to a capacity loss of roughly 60,000 wafers that had been pumped out by the affected factory each month. TrendForce added, “This conservative estimate also amounts to a 5.5 per cent cut in the global DRAM production capacity for this July. The temporary shutdown of Fab-2 is expected to aggravate the current undersupply situation in the DRAM market and cause further price increases for memory products.”

![Monthly DRAM Average Selling Price](image)
Micron Technology Inc denied the report of a major malfunction at one of its plants, but said there had been a minor incident which had no impact on the business however, its equipment provider indicated that their N2 plant’s critical equipment - used to purify nitrogen - didn’t work. Unpurified nitrogen pollutes wafers.

**Future Trend**

According to market watcher DRAMeXchange, the average selling price (ASP) of DRAM chips is projected to increase by 5% from the second quarter to the end of the third quarter as tight supply persists.

“This situation is anticipated to last to 2018 since suppliers will not take on significant additional production capacity in the short term,” Wu (Research Director of DRAMeXchange) said in a press statement. "Meanwhile, ASPs of various DRAM products will remain high."

**III. Microcontroller Unit**

Global microcontroller market is estimated to be valued at USD 26.9 billion by 2020, as per a new research report by Radiant Insights, Inc. Global microcontroller unit shipments were estimated at 17,393.6 million units in 2013 and are expected to register 39,108.5 million units by 2020, growing at an estimated CAGR of 12.3% from 2014 to 2020.

This growth is primarily driven by following factors:

1) Demand surge in the Internet of Things market. The global IoT microcontroller market is estimated to growth with an approximate 16.06% CAGR during the years 2017-2024.
2) Increase adoption of touchscreen devices such as smartphones, laptops, monitors, large displays, music players, and gaming consoles
3) Adoption by the automotive industry as well as its demand in hybrid and electric vehicles

**Market Overview of MCU 2016**

<table>
<thead>
<tr>
<th>2016 Rank</th>
<th>Company</th>
<th>2015</th>
<th>2016</th>
<th>% Change</th>
<th>% Market Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NXP*</td>
<td>1,350</td>
<td>2,914</td>
<td>116%</td>
<td>19%</td>
</tr>
<tr>
<td>2</td>
<td>Renesas</td>
<td>2,560</td>
<td>2,458</td>
<td>-4%</td>
<td>16%</td>
</tr>
<tr>
<td>3</td>
<td>Microchip**</td>
<td>1,355</td>
<td>2,027</td>
<td>50%</td>
<td>14%</td>
</tr>
<tr>
<td>4</td>
<td>Samsung</td>
<td>2,170</td>
<td>1,866</td>
<td>-14%</td>
<td>12%</td>
</tr>
<tr>
<td>5</td>
<td>ST</td>
<td>1,514</td>
<td>1,573</td>
<td>4%</td>
<td>10%</td>
</tr>
<tr>
<td>6</td>
<td>Infineon</td>
<td>1,060</td>
<td>1,106</td>
<td>4%</td>
<td>7%</td>
</tr>
<tr>
<td>7</td>
<td>Texas Instruments</td>
<td>820</td>
<td>835</td>
<td>2%</td>
<td>6%</td>
</tr>
<tr>
<td>8</td>
<td>Cypress***</td>
<td>540</td>
<td>622</td>
<td>15%</td>
<td>4%</td>
</tr>
<tr>
<td>9</td>
<td>Other</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>12%</td>
</tr>
</tbody>
</table>

* Acquired Freescale in December 2015
** Purchased Atmel in April 2016
*** Includes full year of sales from Spansion acquisition in March 2015.
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Overview of Current Manufacturers
As shown above, the top 8 manufacturers take up 88% of the whole MCU market. NXP owns about 20% of the market share.

Lead Time
*Cypress:* some 8 bit MCU lead time increased from 8-10 weeks to 16 weeks.
*Microchip:* lead time increased to 12-16 weeks.
*Renesas:* lead time increased to 25 weeks.
*ST Micro:* lead time for automotive MCU increased by 3 weeks.

Future Trend

<table>
<thead>
<tr>
<th>Technology</th>
<th>Manufacturer</th>
<th>Pricing</th>
<th>Forward Looking Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Trend compared to previous Quarter</td>
<td>Current Lead-time</td>
</tr>
<tr>
<td>8 Bit MCU</td>
<td>Cypress</td>
<td>Stable</td>
<td>16-18</td>
</tr>
<tr>
<td></td>
<td>Microchip</td>
<td>Stable</td>
<td>12-16</td>
</tr>
<tr>
<td></td>
<td>NXP</td>
<td>Stable</td>
<td>14-16</td>
</tr>
<tr>
<td></td>
<td>Renesas</td>
<td>Stable</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>ST Micro</td>
<td>Stable</td>
<td>20</td>
</tr>
<tr>
<td>32 Bit MCU</td>
<td>Cypress</td>
<td>Stable</td>
<td>10-12</td>
</tr>
<tr>
<td></td>
<td>Microchip</td>
<td>Stable</td>
<td>12-16</td>
</tr>
<tr>
<td></td>
<td>NXP</td>
<td>Stable</td>
<td>12-14</td>
</tr>
<tr>
<td></td>
<td>Renesas</td>
<td>Stable</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>ST Micro</td>
<td>Stable</td>
<td>20</td>
</tr>
</tbody>
</table>

*Source: Market Conditions Report: Q3 -2017*

Whether the MCU market will have shortage or price increase issues is not clear at this time but, based on the information the above table, some manufacturers are demonstrating prolonged lead times.
IV. NOR Flash

Market Overview of NOR Flash 2016

As shown above, the top 4 manufacturers take up 74% of the NOR Flash market.

Price Increase

NOR Flash prices will rise by about 20% sequentially in this third quarter due to supply scarcity.

Reason for Increase

1) According to DRAMeXchange, a division of TrendForce, increasing demand for AMOLED panels from all smartphone brands and the rising production of ICs for Touch with Display Driver Integration (TDDI) have propelled the recent growth of the NOR Flash market. AMOLED panel penetration in the smartphone market is growing and, since NOR Flash is used to sustain AMOLED colour, its demand is also increasing.
2) NOR Flash supply remains tight because related components require a high level of customization and there are difficulties in ramping up production.
3) With their focus on DRAM and NAND Flash, Micron is reportedly planning to phase out and sell their NOR Flash business; Winbond and Chinese NOR Flash chipmaker GigaDevice Semiconductor (Beijing) Inc are on the short list of buyers. Micron’s exit from NOR Flash is going to worsen the already tight supply situation.
4) Cypress’ focus is on automotive and industrial segments instead of consumer electronics segments.
Future Trend

<table>
<thead>
<tr>
<th>Technology</th>
<th>Manufacturer</th>
<th>Pricing</th>
<th>Forward Looking Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOR FLASH</td>
<td>Cypress</td>
<td>Increasing</td>
<td>14-28</td>
</tr>
<tr>
<td></td>
<td>Macronix</td>
<td>Increasing</td>
<td>14-20</td>
</tr>
<tr>
<td></td>
<td>Microchip</td>
<td>Increasing</td>
<td>12-18</td>
</tr>
</tbody>
</table>


Some of the smaller NOR Flash suppliers have plans to expand their production capacity in response to the current market condition. Winbond for instance, will add another 6,000 wafer starts to its total monthly capacity by the year’s end, increasing from the current 44,000 pieces per month to 50,000. This additional 6,000 wafer capacity is wholly designated for NOR Flash production. Macronix also wants to gradually raise its NOR Flash production. Powerchip, which currently lacks in-house technology to produce its own, branded NOR Flash products is also expressing interest in entering the market by collaborating with other IC manufacturers.

Though there are initiatives to expand NOR Flash supply, much of the additional production capacity is not expected to become available until the second half of 2018 because time is needed to set up equipment and perform trial production. DRAMeXchange forecasts that the undersupply situation will persist over the next several quarters.

Memory demand suffers from a seasonality symptom with the 3rd quarter usually having the highest requirements. As a result, it is expected that the price will increase in Q3 and Q4.
Notice about price increase on R-Chip and MLCC parts

To my respectful customer and distributors,

Due to the continuous cost increase of raw and packaging materials, as well as the currency appreciation of TWD, leading to significant pressure on operating cost. So, we decide to adjust the prices for new orders from today. Our sales team will contact you and explain the changes in detail. The price increase ranges between 8% to 10%.

Thank you for your understanding and please support our products.

Edgar Chen, GM of Great China
Notice about price increase and lead time adjustment

To my respectful customer and distributors,

Due to the continuous demand of MLCC, we are not able to deliver components on time though we’ve tried our best to serve our customers. So, we decide to extend the lead time and increase the prices of some items. The lead time will increase from 1.5 months to 6 months, depends on the current backorder. The price increase is approximately 15% to 30%, or even higher.

Our sales team will contact you and explain the changes in detail.

We are sorry about any inconveniences it brings to you.

Edgar Chen, GM of Great China

June.19th, 2017
Date: March 16th, 2017
To: All Key Customers and Partners

Subject: Price Adjustment MLCC & Chip Resistors 貼片電容 & 貼片電阻 價格調整

Dear customers and business partners,

With the fact that all raw material cost had been uptrend since Q4 2016 and continue till Q1 2017, our manufacturing sites improvement effort are no more possible to absorb those considerable impact.

On top of such, our local currency appreciation trend is factoring again negatively since early 2017.

Please be informed that our sales team will visit & discuss with you on new orders price adjustment step.

Appreciate your best understanding and continues supports. Should you need further information regarding this subject matter, please feel free to contact your sales representative at Walsin Technology Corporation.

Sincerely yours,

G S Yang 楊涵興

Vice President of Global Sales Marketing and Logistics SBU.

尊敬的客戶與合作夥伴:

由於所有原材料成本自 2016 年第 4 季度以來一直呈上升趨勢，並持續到 2017 年第一季度，我們的製造工廠全力改善但仍然無法負荷成本上揚並且已造成相當大的影響。除此之外，自 2017 年初台幣大幅升值趨勢以來，再次成為負面因素。

在此通知您，我們的業務團隊將訪問並與您討論新的訂單價格調整步驟。

感謝您的理解並繼續支持，如果您需要相關進一步信息，請隨時與相關的業務代表聯繫。

此致

G S Yang 楊涵興

副總經理
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RALEC

Translation:

To my respectful partners,

Thanks for your long-term support and trust and your effort of promoting RALEC brand. We would like to continuously work with you and achieve greater accomplishment.

Quality is of most importance to RALEC. Our major raw materials are from abroad (paid in USD). Since 2016, the exchange rate between TWD and USD has been climbing, leading to significant cost increase in our company. At the same time, price of packaging materials has been increasing. To maintain our business, we decide to adjust the selling price of below products:

1) SMD resistors with the size of 0603 (and above), price increases 10%.
2) New price takes effect on 15th, March

We are sorry about any inconveniences it brings to you.

March 10th, 2017
To my respectful partners and end users,

Thanks for your long-term support, which promotes the steady improvement in our cooperation relationship as well as the growth of UNI-ROYAL.

To respond to the high pressure from increasing price in raw material, manpower and operating cost, we decide to adjust our product selling price as below:

1) Resistors with the size of 0603 (and above), price increases 10%.
2) The price will increase 10%
3) New price takes effect on 1st, March
4) Brand impacted: ROYALHOM, UniOhm

Thanks.

February 25th, 2017
Dear Valued Customer,

Cypress' operations and business model has undergone an in-depth evaluation which resulted in a realignment of our organizational structure to better serve our customer's needs.

Cypress is experiencing a vendor supply allocation which necessitates immediate action. We determined that the price increases, while keeping the products available, would mitigate any negative impact on your projects.

NAND pricing for direct customers will take effect immediately. If there is a pricing agreement, please work with the pricing team. For NAND products via distribution, new pricing will take effect April 24, 2017. See below for details.

For Distribution:
Existing Debits:
- Existing Debits on NAND products, we will be expiring debits on April 24, 2017
- The new prices will be effective from April 25, 2017
- Any new debit (no debit history with Cypress) will be approved at the new price.

Distribution Book Cost (DBC):
- DBC will be increased for some of the memory part numbers. New DBCs will be reflected in the Q2 Price Book.
- Backlog/Inventory: We will follow our standard process for re-pricing, based on the DBC changes.

We are committed to delivering NAND products and we understand that you may have questions regarding the price increase. Your local Sales and Pricing teams are available to discuss your specific questions.

Regards,

Michael Balow
Executive Vice President,
SOURCES


