

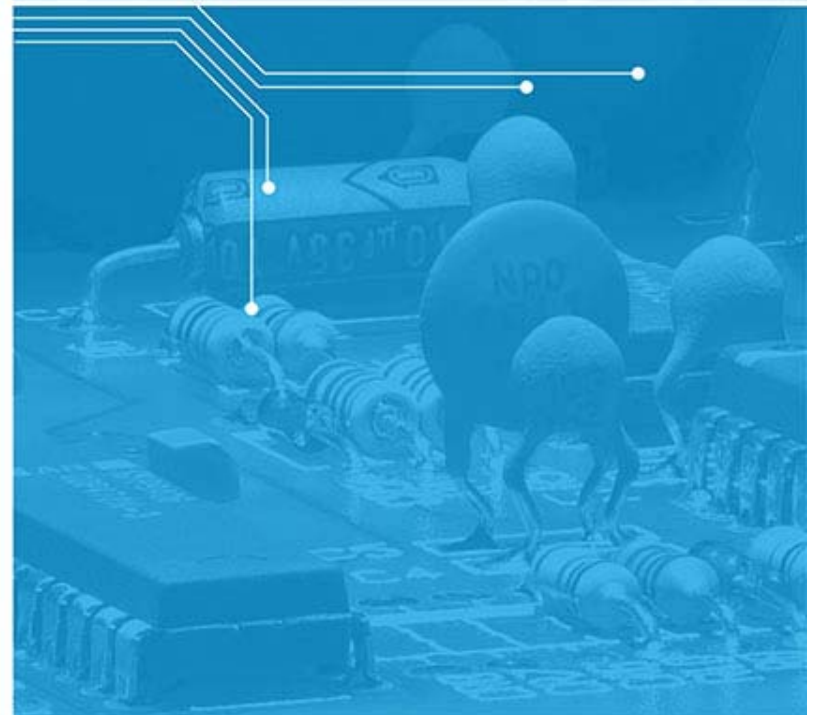


**TTI, Inc.**

The Specialist in Electronic  
Component Distribution

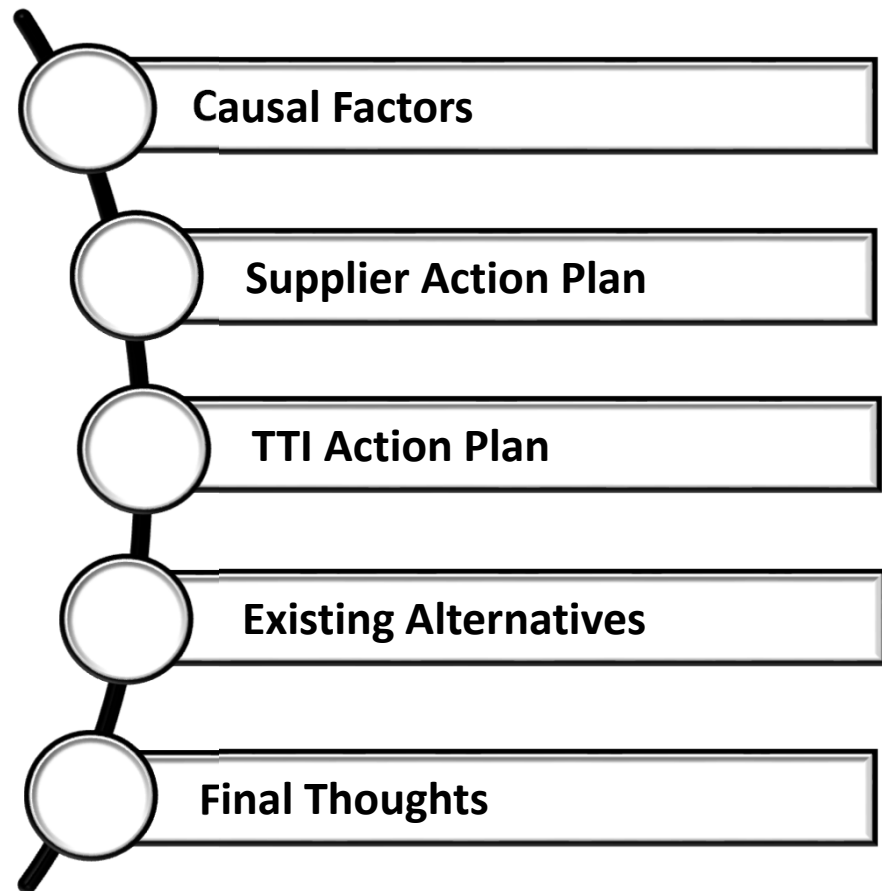
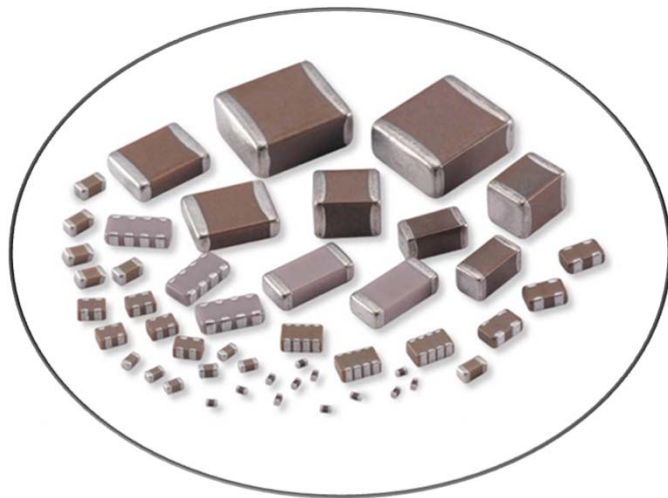
# MLCC Market Update

July 12, 2018



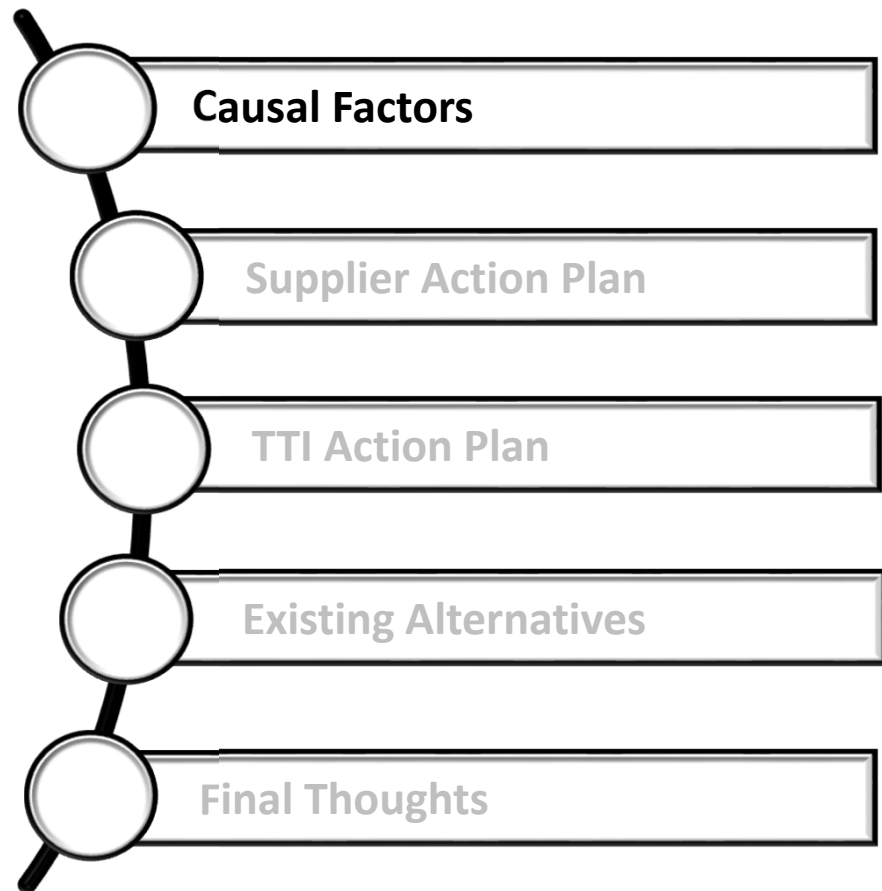


# MLCC Market Update





# MLCC Market Update





# Causal Factors

## Strong Economy + Technological Advancements

- MLCC market demand has risen dramatically over the past 18 months largely due to simultaneous growth in virtually all market segments
- Additionally, increased technology in the strong automotive, industrial and telecom markets have pushed demand beyond all anticipation

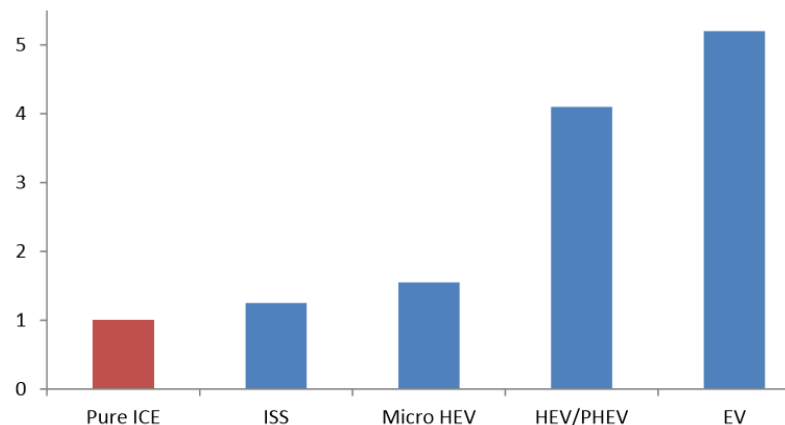
### Automotive

- Powertrain
- Safety & Comfort
- Body Electronics
- Infotainment & Telematics Systems

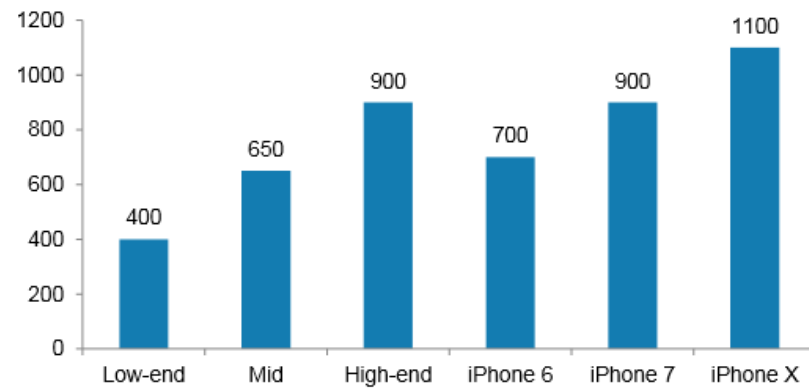
### Data

- Smart Phones
- Mobile Internet
- 5G

MLCC content by power train (number of Pure ICE=1)



MLCC content per phone increases along with the mobile phone upgrade



■ Number of MLCCs per phone



# Causal Factors

## Raw Material Cost Trends

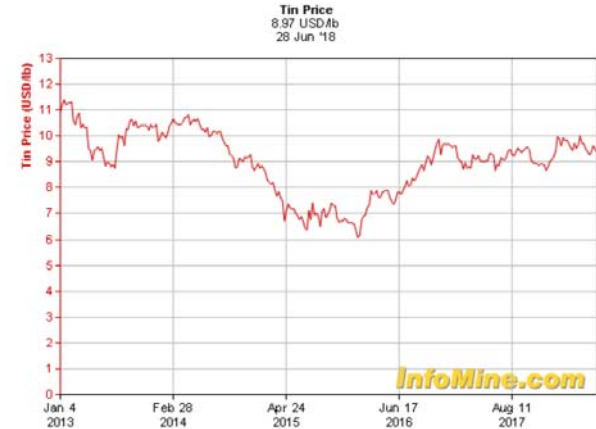
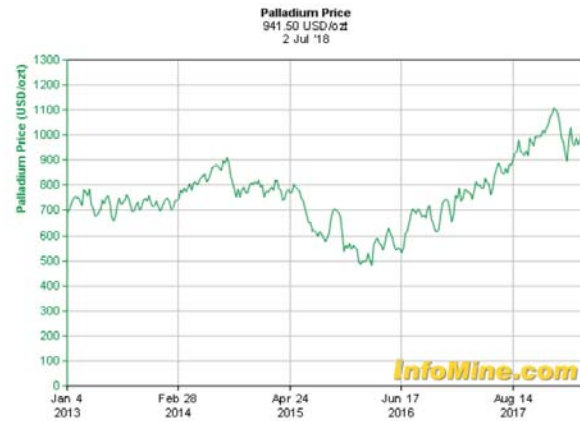
Impact of Raw Material Prices on the Cost of Capacitors

	Price	Ceramic
Base Metals		
Aluminum		Low
Copper		Med
Zinc		Low
Nickel		Med
Tin		Med
Steel		Low
Lead		Low
Precious Metals		
Gold		Low
Silver		Med
Platinum		Med
Palladium		High
Other		
Oil		Low

\*\* If non-RoHS compliant part

Direct materials like bonding wire, lead frame, lead wire, etc. are all affected by metals price increases. For more information, please see TTI MarketEYE

@ [www.ttiinc.com/content/ttiinc/en/resources/tools/material-costs.html](http://www.ttiinc.com/content/ttiinc/en/resources/tools/material-costs.html)



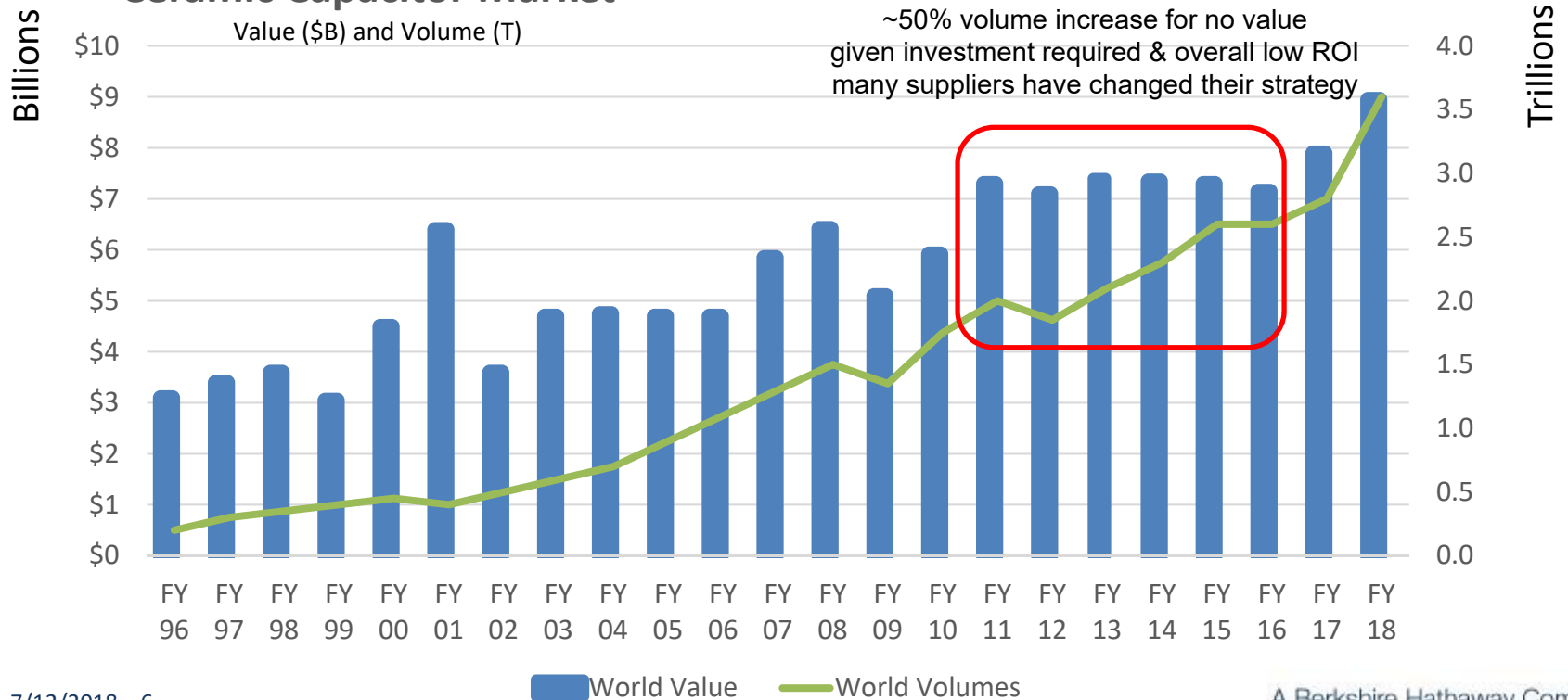


# Causal Factors

## Supplier Reluctance to Add Capacity

- MLCC unit output has increased every year while revenues remained flat
- Suppliers adding capacity with more balanced and/or measured objective
- Demand growing 25%-35% while capacity grows 10%-25%
- Forecasted to require a couple years to level out

### Ceramic Capacitor Market

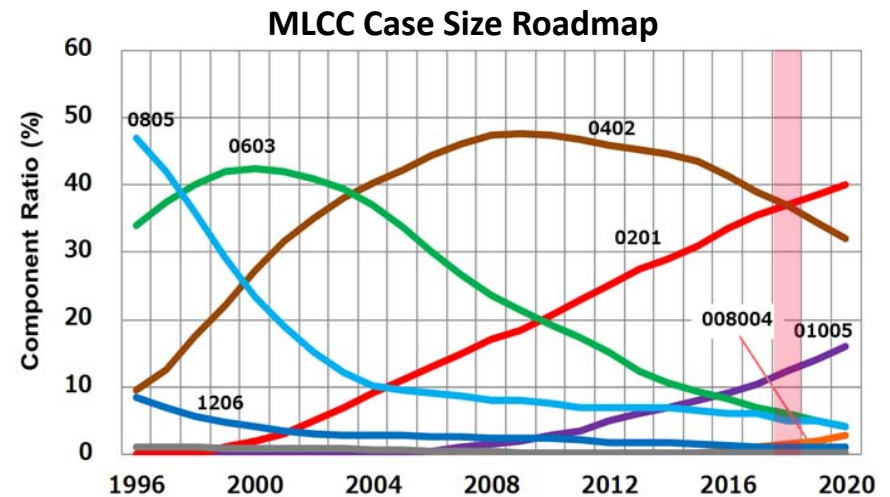




# Causal Factors

## Supplier Decisions to Cease Production

- Several larger suppliers have elected to end of life (EOL) less profitable, commodity products
- Capacity and resources are being redirected to smaller, more economical case sizes and market segments promising more reasonable returns

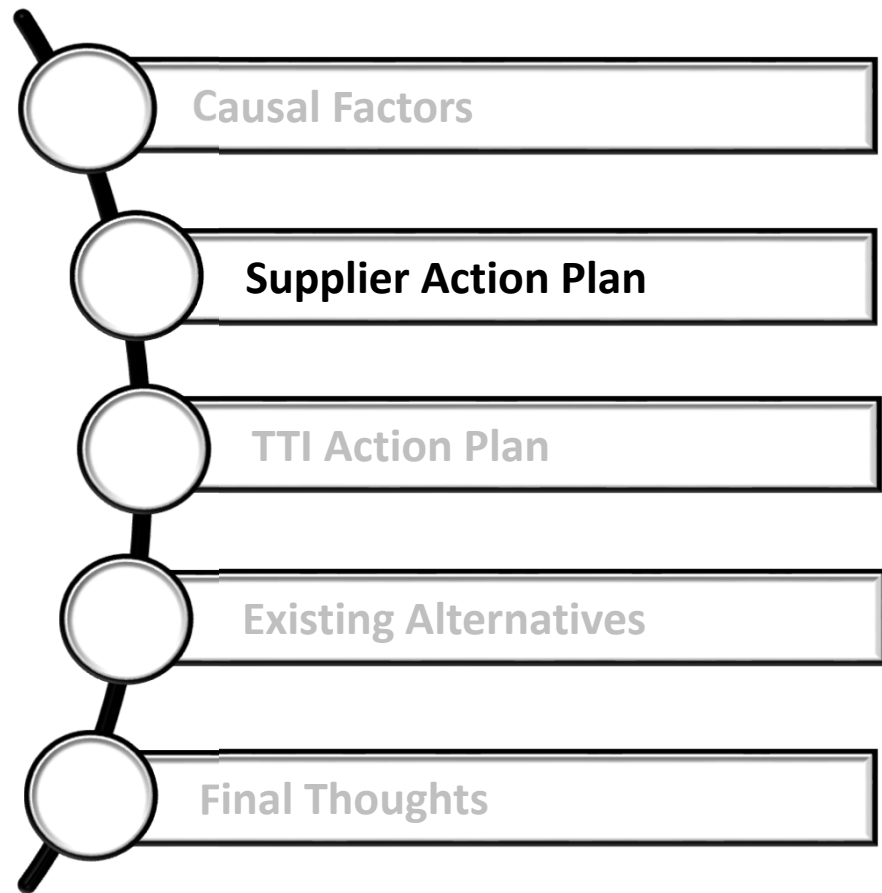
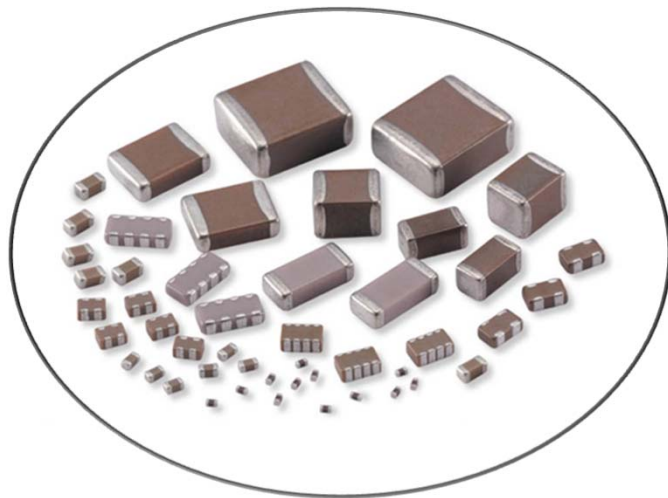


**Global Supplier Migration from Larger Case Low Capacitance to Smaller Case Size High Capacitance**

	~1nF	~100nF	~220nF	~470nF	1μF	2.2μF	4.7μF	10μF	22μF	47μF	100μF	220/330μF
Size(inch):	~102	~104	224	474	105	225	475	106	226	476	107	227,337
1005	Green	Green										
0201	Green	Green	Green	Green	Green							
0402	Green	Red	Green	Green	Green	Green	Green					
0603	Red	Red	Red	Red	Green	Green	Green	Green	Green			
0805	Red	Red	Red	Red	Red	Red	Green	Green	Green	Green		
1206	Red	Red	Red	Red	Red	Red	Red	Red	Green	Green	Green	Green
>=1210	Red	Red	Red	Red	Red	Red	Red	Red	Red	Green	Green	Green



# MLCC Market Update







## Supplier Action Plans

### Effect on Distribution

- Product Allocation and Limiting of New Orders
  - Distribution is allowed to purchase in levels equivalent to 2016/17 volumes
  - Not able to handle the upside of new customers or increased demand
- Increasing Manufacturing Capacity
  - 30% capacity will not satisfy current demand
  - Capital equipment lead times running 12-24 months
- Increasing Distributor Buy Prices
  - Increasing pricing on new business
  - Not extending debit renewals
  - Re-pricing open backlog and contract pricing
- Expiring Special Costs
  - MPP volume pricing increasing or being removed
  - Affecting existing orders



## Supplier Action Plans

### Constrained Suppliers on TTI's Linecard

As of July 1, 2018



Commercial and automotive ceramic capacitors  
Select values in 0201 through 2220 case sizes  
Low CV and high CV in all dielectrics



Commercial, automotive and specialty (Flexterm, high temp, high volt, fail safe)  
Series Cxxxx, all values in 0201 through 2225 case sizes  
Low CV and high CV



Commercial and automotive  
Low CV and high CV  
GR\*. GC\* and ZR\* series monolithic ceramic capacitors  
Limited values affected in 0201 and 0402  
Most values 0603 and greater  
All dielectrics



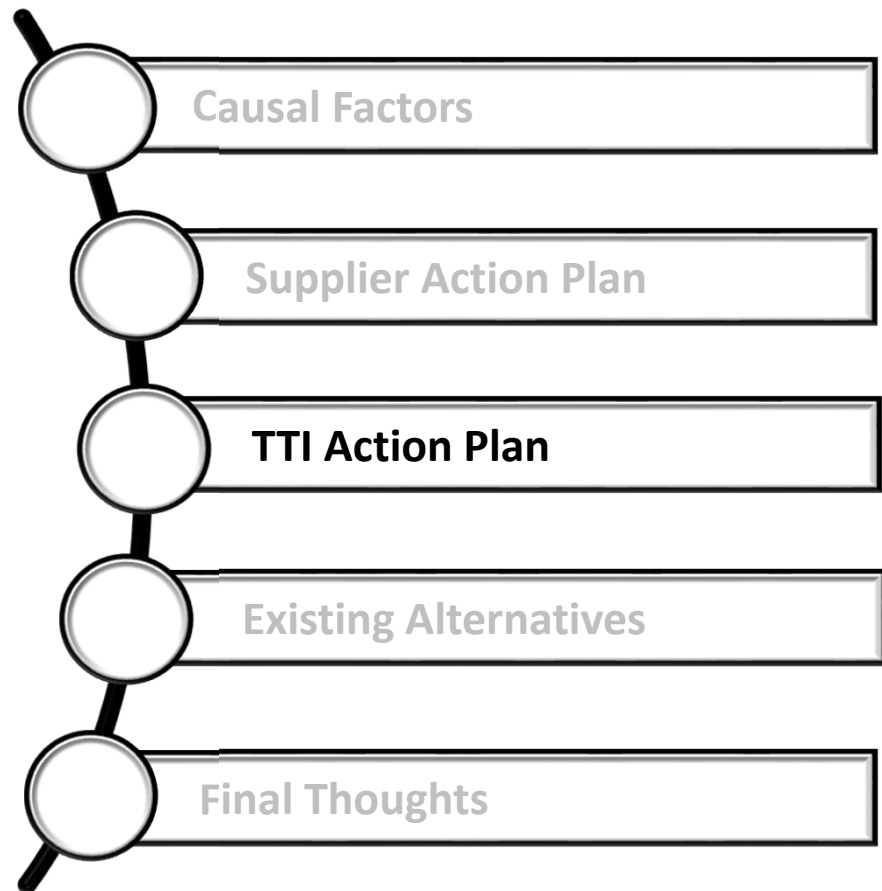
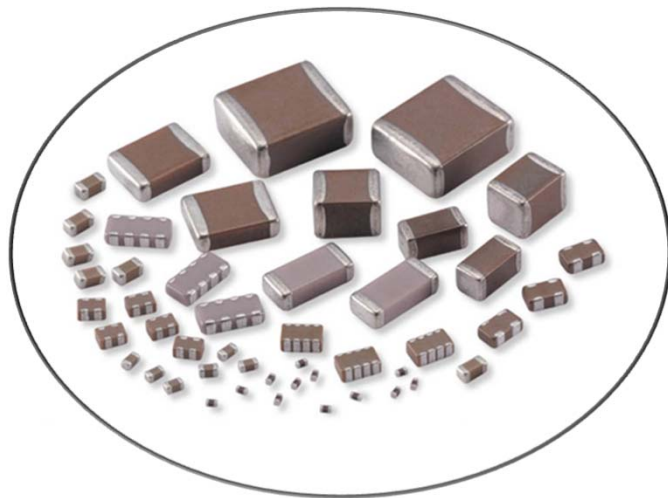
Commercial and automotive ceramic capacitors  
Series Cxxxx and CGA  
Select values in 0201-2220 case sizes  
Low CV and igh CV in all dielectrics



Commercial ceramic capacitors  
Series CCxxxx  
Select values in 0201-2220 case sizes  
Low CV and high CV in all dielectrics



# MLCC Market Update





## TTI Action Plan

### TTI Allocation is Currently Based on 2016/17 Receipts

- Increased On-hand and On-order Inventory Levels
  - Began increasing purchasing volumes from all suppliers in 3Q16
  - 2H'16 began purchasing alternative part numbers for back-up
  - Current backlog exceeds \$100M compared to \$20M in May 2016
  
- Created a special allocation product team lead by industry and product experts to manage and assist our sales teams, suppliers and customers
  
- Began allocating constrained product and declining orders from new customers
  - Supporting the customers who have supported us
  - Fairly dividing based on customer historical usage



# Causal Factors

## Potential Gaps in Supply – Comparative Data

TTI North America’s percentage of MLCC sales by case size and value.

TTI North America – Percentage of Units Shipped 2017 and 1H 2018												
	~1nF	~100nF	~220nF	~470nF	1µF	2.2µF	4.7µF	10µF	22µF	47µF	100µF	220/330µF
Size(inch):	~102	~104	224	474	105	225	475	106	226	476	107	227,337
1005	0	0	0	0	0	0	0	0	0	0	0	0
0201	0.29%	3.68%	0.31%	0.04%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
0402	3.60%	19.17%	0.94%	0.61%	4.37%	0.68%	0.47%	0.17%	0.00%	0.00%	0.00%	0.00%
0603	3.80%	18.96%	1.34%	0.48%	3.11%	0.97%	0.73%	1.30%	0.33%	0.00%	0.00%	0.00%
0805	0.83%	6.78%	0.93%	0.57%	2.82%	0.58%	1.37%	5.31%	0.53%	0.22%	0.00%	0.00%
1206	0.19%	1.61%	0.23%	0.60%	0.83%	0.49%	0.68%	1.50%	0.40%	0.18%	0.20%	0.00%
>=1210	0.02%	0.09%	0.12%	0.09%	0.77%	0.65%	0.63%	1.01%	0.50%	0.24%	0.18%	0.00%

### Highlighted Square Code:

- Green = Capacitance ratings and case sizes where additional capacity is being added.
- Yellow = Reduced capacity levels by major MLCC suppliers but lesser supply chain impact due to percentages of overall business levels.
- Red = Reduced capacity levels by major MLCC suppliers AND high supply chain impact due to percentage of overall business levels
  - TTI Suppliers to consider for these affected values:

0402 .1µF  
 0603 .1µF  
 0805 .1µF



### Near Term



### Long Term





## TTI Action Plan

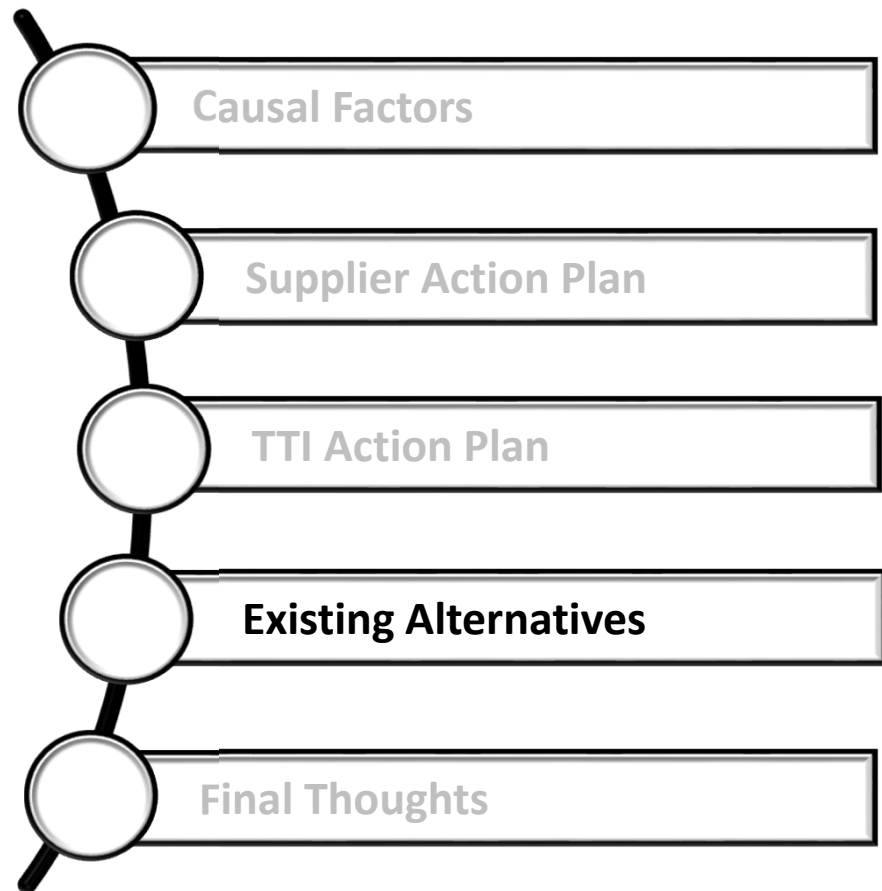
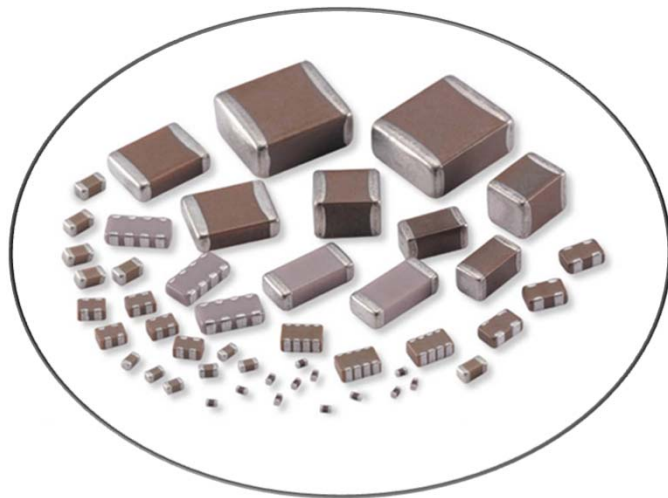
### TTI Allocation is Currently Based on 2016/17 Receipts

- Created New Reports and Cross Reference Tools to Share with Customers
  - Provide best insight of potential supply issues
  - Provide alternates for 95% of allocated product lines
  
- TTI has #1 Market Share in these Products
  - Largest customer to the manufacturer
  
- We are in this for long-term growth and partnership, not short term gain

*TTI remains committed to assured supply of highly constrained and allocated products to our existing customers. It is our objective to ensure our existing customers continue to have access at previous year consumption levels.*



# MLCC Market Update





# Assess Your Options

## Is Your Design Affected by the MLCC Shortage?

Be prepared for possible price and lead-time increases

Y

Can you accept an **Alternate Supplier** or a **Product Upgrade**?

Y

Qualify Alternate Suppliers Immediately.

Evaluate Upgrades:

- Can you use a higher voltage part?
- Can you use a tighter tolerance part?
- Is AECQ200 a requirement or an option?
- Is a Flexible termination product required?

N

Can you accept a **Smaller Package**?

Y

Determine if your pad layout will accommodate 0402 or smaller

N

Can you **Re-Design**?

Y

- First option – smaller pads
- Second option – alternative technology

N

Strategically align with a strong distribution partner, don't inflate your requirements

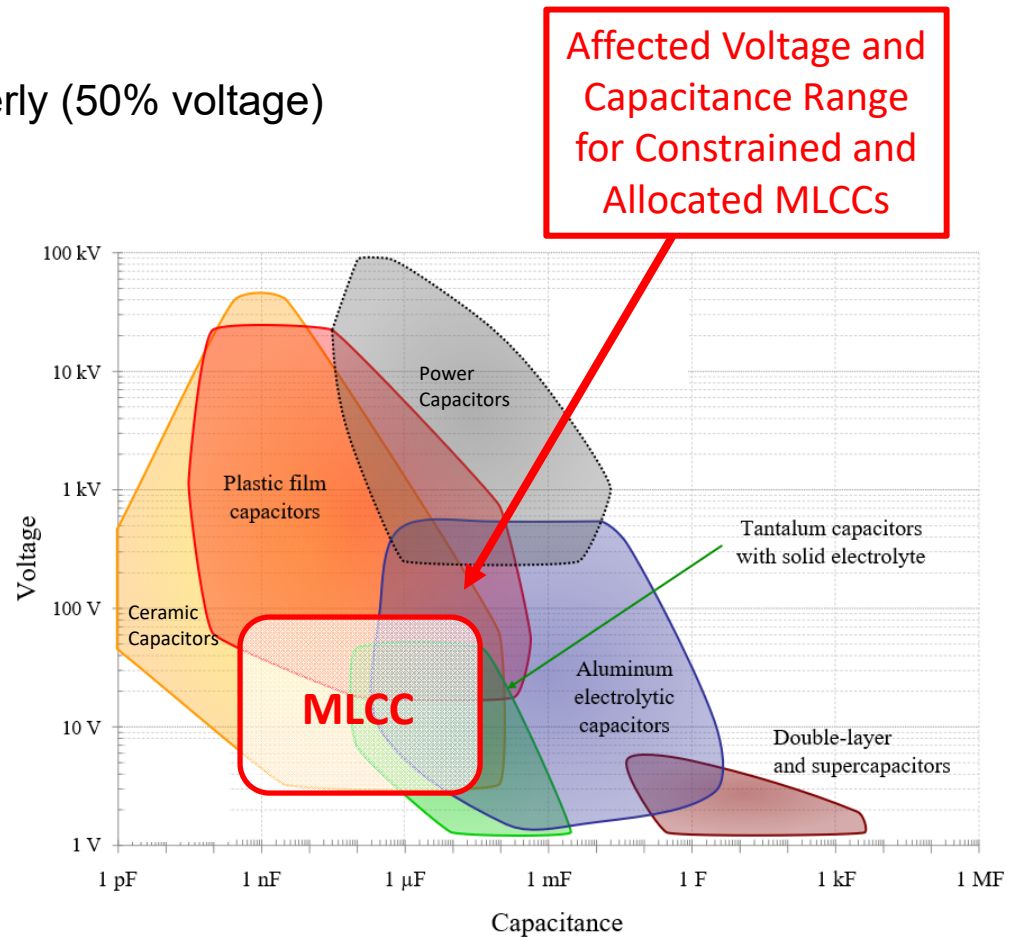




# What are Your Alternatives

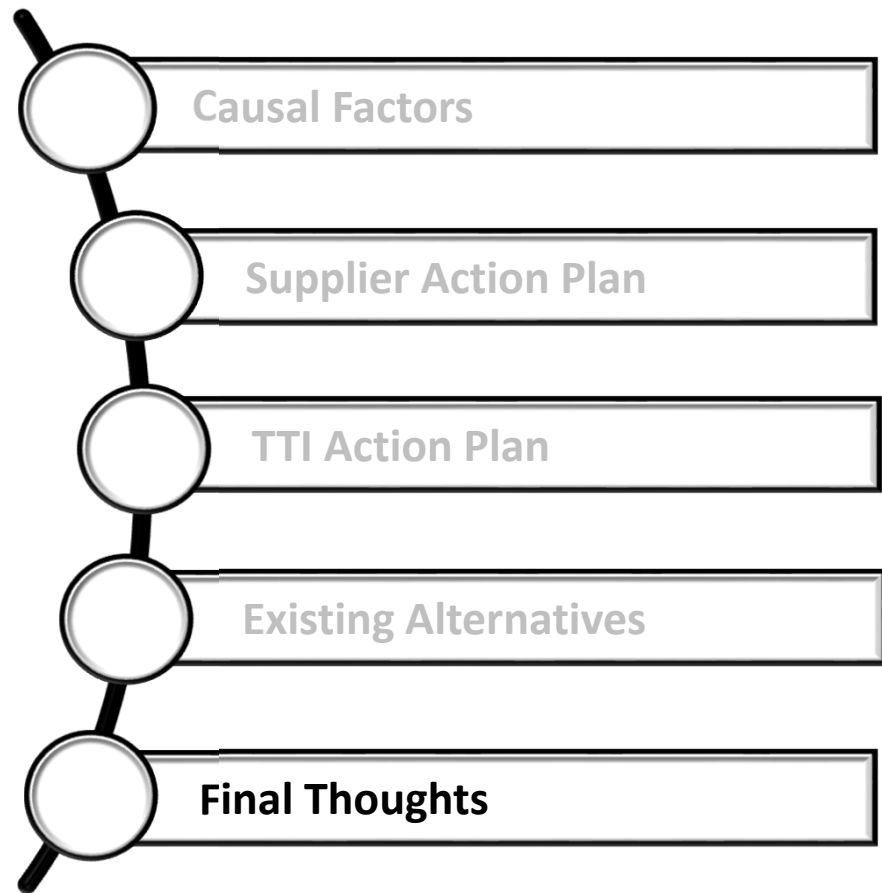
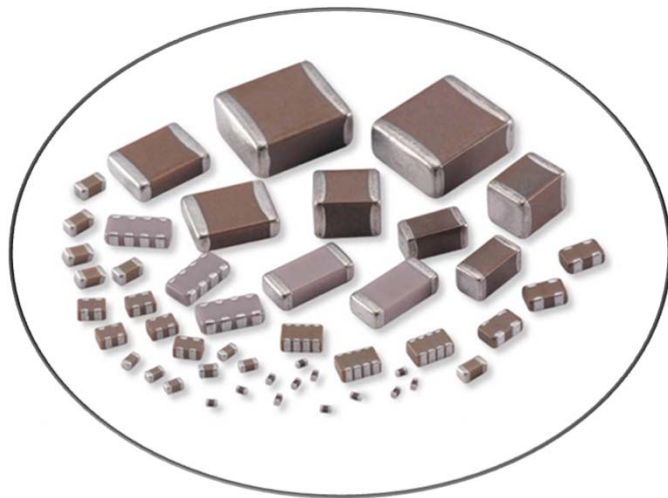
## Alternative Capacitor Technologies

- Tantalum (MnO<sub>2</sub>)
  - Cost effective when de-rated properly (50% voltage)
  - A-case generally fits 1206 pads
- Hybrid Polymer Tantalum
  - Low ESR
  - No ignition
  - High capacitance
  - (10%-20% V de-rating)
- Aluminum Polymer
  - Very low ESR
  - Good for low voltage applications
- Film
  - Good for higher voltages
  - Robust with long life
- SMT Aluminum Electrolytic
  - Good for bulk decoupling and higher voltages





# MLCC Market Update





## Final Thoughts

- TTI is #1 Distributor of MLCC products in North America and Globally
  - TTI is very important to each supplier
  - We are getting our unfair share, unfortunately sometimes that is not enough – please explore your options with your TTI sales team
  
- Generate Awareness
  - Inform people within your organization
  - Share the market conditions with your end customers
  
- Work with TTI on Solutions
  - Your success is our success



TTI, Inc.

The Specialist in Electronic  
Component Distribution

Thank You

1.800.CALL.TTI

[www.ttiinc.com](http://www.ttiinc.com)

